National Guideline Alliance

Version 1.0

Cerebral palsy: diagnosis and management in children and young people

Appendix J - Evidence Tables

NICE Guideline

Evidence tables

30th June 2016

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Commissioned by the National Institute for Health and Care Excellence

Disclaimer
Healthcare professionals are expected to take NICE clinical guidelines fully into account when exercising their clinical judgement. However, the guidance does not override the responsibility of healthcare professionals to make decisions appropriate to the circumstances of each patient, in consultation with the patient and/or their guardian or carer.

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Appendix I: Evidence tables

I.1 Risk factors

<table>
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<tr>
<td>Full citation

Ahlin,K., Himmelmann,K., Hagberg,G., Kacerovsky,M., Cobo,T., Wennerholm,U.B., Jacobsson,B., Non-infectious risk factors for different types of cerebral palsy in term-born babies: a population-based, case-control study, BJOG: An International Journal of Obstetrics and Gynaecology, 120, 724-731, 2013

Ref Id

322508

Country/ies where the study was carried out</td>
<td>Cases

356

Diagnostic criteria

Definition by Mutch et al

Controls

618 matched controls

Inclusion criteria
-Registered cases of CP during the birth year period 1983-1994
-Children were of at least 4 years of age at time of diagnosis
-Children living in the study area on a specific census date

Exclusion criteria
-Cases: Children with postnatal causes of cerebral palsy (n=21), spinal malformation (n=1), and ataxic cerebral palsy (n=25)

Statistical method</td>
<td>Factors
• Neonatal encephalopathy</td>
<td>Adjusted odds ratio
<table>
<tr><th>Risk factor</th><th>All spastic and dyskinetic CP (Adjusted odds ratio (95%CI))</th><th>Spastic CP (Adjusted odds ratio(95%CI))</th><th>Dyskinetic CP (Adjusted odds ratio (95%CI))</th><th>Spastic diplegia and tetraplegia (Adjusted odds ratio (95%CI))</th><th>Spastic hemiplegia (Adjusted odds ratio (95%CI))</th></tr>
<tr><td>Neonatal encephalopathy</td><td>OR 69.22 (9.4-511.9), P<0.0001</td><td>OR 22.21 (2.8-174.1), P=0.003</td><td>-</td><td>OR 19.72 (2.27-171.17), P=0.0069</td><td>-</td></tr>
</table>
</td>
<td>Limitations
Based on NICE manual checklist for prognostic studies (2012)

• Retrospective study
• risk factors from univariate analysis with P<0.1 for CP were included in the stepwise multiple regression analysis

Indirectness
Does the study match the review protocol in terms of:
Population: yes
Outcome: yes
Indirectness: some, diplegia and tetraplegia groups for multivariate analysis are not separated as in the review protocol</td>
</tr>
</table>

Study details	Participants	Factors	Results	Comments
Sweden, Czech Republic, Norway **Study type** Case-control study **Study dates** 1983-1994 **Consecutive recruitment** Not reported **Funding** -Göteborg Medical Society -Swedish government grants for researchers in the public sector -The Swedish Medical Society -The R&D unit in Södra Älvsborg -Linnea and Josef Carlsson's Foundation	-Baseline dichotomous outcome variable comparisons were assessed using Fisher's exact test -Continuous variables were presented as means and standard deviations (SD) -Between group differences were assessed using Student's t-test or Mann-Whitney U-test -Odds ratio (OR) and 95% confidence intervals (CI) were calculated for dichotomous variables -All significance tests were two-tailed and P<0.05 was considered statistically significant -All risk factors from univariate analyses attaining P<0.1 for cerebral palsy were included in a stepwise multiple logistic regression analysis -Variables with no events in the control group (even if statistically significant in univariate analysis) were not included in the multiple regression analysis **Demographics**			**Indirectness** **Other information**
Full citation Alshaikh, B., Yee, W., Lodha, A.,	**Cases** 332	**Factors**	**Adjusted odds ratio** <u>Risk of cerebral palsy (adjusted):</u> OR 0.63 (95% confidence interval 0.24-1.64), P=0.34	**Limitations** Based on NICE manual checklist for

Study details	Participants	Factors	Results	Comments
Henderson, E., Yusuf, K., Sauve, R., Coagulase-negative staphylococcus sepsis in preterm infants and long-term neurodevelopmental outcome, Journal of Perinatology, 34, 125-9, 2014 **Ref Id** 347027 **Country/ies where the study was carried out** Canada **Study type** Retrospective cohort study **Study dates** 1995 to 2008 **Consecutive recruitment** No **Funding** Not reported	**Diagnostic criteria** Defined as Levine 1980 **Controls** **Inclusion criteria** -all preterm infants born at <29 weeks gestational age -had neurodevelopment assessment at 30 to 42 months CA **Exclusion criteria** **Statistical method** -For comparisons of continuous variables in infants exposed and unexposed to coagulase-negative Staphylococcus (CoNS) sepsis, two-sample t-test or Mann-Whitney test were used -Chi-squared test was used to compare discrete variables unless expected cell frequency was <5 and then Fisher's exact test was used -Associations between CoNS sepsis and presence of neurodevelopment outcomes (CP, cognitive delay, deafness, blindness and total major disability) was examined using multivariate logistic regression with backward selection -Association of CoNS with deafness and blindness were adjusted for gestational age only due to small event numbers -For CP, the analysis was adjusted for gestational age, chorioanmionitis,	• Neonatal sepsis (CoNS)	(adjusted for gestational age, severe IVH, chorioamnionitis and postnatal steroids)	prognostic studies (2012): • Loss to follow up in CoNS group was 16 (13.2%) and 35 (13.4%) in the no CoNS group, but reason for loss to follow up was not reported and unclear if this was due to key characteristics of the population **Indirectness** Does the study match the review protocol in terms of: population: yes outcome: yes indirectness: none **Other information**

Study details	Participants	Factors	Results	Comments
	severe intraventricular haemorrhage (severe IVH), and use of postnatal steroids and were only included in the multivariate analysis if the univariate model had a P value of <0.20, or if its inclusion resulted in change of 15% or more in the estimate of the main effect of CoNS sepsis exposure -Outcomes were expressed as odds ratios with their 95% confidence intervals, and statistical significance was considered if P value was <0.05 (two sided test results) **Demographics** **Neonatal characteristics (no CoNS group (n=227)/CoNS group (n=105))** Gestational age (mean week ±SD): 26.3 (1.4)/25.9 (1.7), P=0.04 Birth weigh (mean g ±SD): 900 (197)/834 (211), P=0.01 Male (n): 116/63, P=0.13 Small for gestational age (n): 13/14, P=0.02 Apgar score at 5 min (median, IQR): 8 (6, 8)/7 (6,8), P=0.03 Cord pH (mean±SD): 7.30 (0.09)/7.28 (0.09), P=0.02 **Maternal characteristics (no CoNS group/CoNS group)** Maternal age (mean ±SD): 29.2 (5.9)/29.4 (5.4), P=0.79 Multiple births (n): 46/31, P=0.06 Chorioamnionitis (n): 60/19, P=0.08			
Full citation	**Cases**	**Factors**	**Adjusted odds ratio**	**Limitations**

Study details	Participants	Factors	Results	Comments
Alshaikh, B., Yusuf, K., Sauve, R., Neurodevelopmental outcomes of very low birth weight infants with neonatal sepsis: systematic review and meta-analysis, Journal of Perinatology, 33, 558-64, 2013 **Ref Id** 339259 **Country/ies where the study was carried out** Canada **Study type** Systematic review and meta-analysis **Study dates** Search update June 2012 **Consecutive recruitment** No **Funding**	**Diagnostic criteria** **Controls** **Inclusion criteria** -studies on very low birth weight infants (<1500g) -studies involving infants with neonatal culture-proven sepsis (Sepsis accompanied by the presence of an organism in the blood during the admission period in the neonatal intensive care unit -Long-term follow-up for a minimum of 12 months -A priori definition of moderate to severe neurodevelopment impairment (NDI) that included at least one of the following CP: cognitive delay, (cognitive score 2 SD less than mean on standardised psychological testing), vision loss or deafness - **Exclusion criteria** -review articles **Statistical method** -Estimates for odds ratio and 95% confidence interval, and percentage weight contributed to the overall meta-analysis from each study were calculated -For each outcome of interest, effect estimates were pooled assuming a random effect given that the data were	• Neurodevelopmental infection • Risk of cerebral palsy	From 17 studies included in the meta-analysis Neuro-developmental outcome using random effect model: OR: 2.09 (95% confidence interval 1.65-2.65) I squared: 36.9%, P=0.064 From 11 studies included in the meta-analysis, Risk of cerebral palsy using random effect model: Pooled odds ratio: 2.09 (95% confidence interval 1.78-2.45) I-squared= 0 %, P=0.853	NICE checklist for systematic reviews (2012): 1. The review addresses an appropriate and clearly focused question that is relevant to the guideline review question-yes 2. The review collects the type of studies you consider relevant to the guideline review question-yes 3. The literature search is sufficiently rigorous to identify all the relevant studies-yes 4. Study quality is assessed and reported-no 5. An adequate description of the methodology used is included, and the methods used are appropriate to the question-yes **Indirectness** Does the study match the review protocol in terms of: Population: yes Outcome: yes Indirectness: some, diplegia and tetraplegia groups for

<table>
<tr><th>Study details</th><th>Participants</th><th>Factors</th><th>Results</th><th>Comments</th></tr>
<tr><td>Not reported</td><td>retrieved from the literature and expected to have variable size effect
-Heterogeneity across observed studies was assessed using I2, with a P value of <0.1 for statistical significance
-Potential evidence was assessed for publication bias using the Begg's funnel plot and Egger test for asymmetry
-Sensitivity and subgroup analyses were planned using the following criteria: 1. studies with at least 80% infants who had follow-up;; 2. only neonates born in the post surfactant era given that long term outcome of VLBW infants improved significantly after introducing surfactant; 3. Analysis of studies reporting long-term outcome for infants with coagulase negative staphylococcus infection given that it is the most common type of infection in VLBW infants; 4. comparison between the components of neurodevelopment outcome

Demographics</td><td></td><td></td><td>multivariate analysis are not separated as in the review protocol

Other information
The systematic review included studies that were observational
No blinding of studies or not specified in individual included studies
Excluded studies list was not provided by authors</td></tr>
<tr><td>Full citation

Beaino, G., Khoshnood, B., Kaminski, M., Pierrat, V., Marret, S., Matis, J., Ledesert, B., Thiriez, G., Fresson, J.,</td><td>Cases

2357 infants eligible for follow-up

Diagnostic criteria

Definition of CP proposed by the SCPE.

Controls

Inclusion criteria</td><td>Factors

• gestational age
• multiple pregnancy

Outcome</td><td>Adjusted odds ratio
<table><tr><td>risk factor</td><td>adjusted OR (95% CI)</td></tr><tr><td>gestational age</td><td>1.00 (0.89-1.12)</td></tr></table></td><td>Limitations
Based on NICE manual checklist for prognostic studies (2012)

• attrition bias = at 5 years follow-up</td></tr>
</table>

Study details	Participants	Factors	Results	Comments
Roze, J. C., Zupan-Simunek, V., Arnaud, C., Burguet, A., Larroque, B., Breart, G., Ancel, P. Y., Epipage Study Group, Predictors of cerebral palsy in very preterm infants: the EPIPAGE prospective population-based cohort study, Developmental Medicine & Child Neurology, 52, e119-25, 2010 **Ref Id** 336128 **Country/ies where the study was carried out** France **Study type** prospective cohort study **Study dates** 1997 **Consecutive recruitment**	All infants born between 22-32 weeks of gestation in nine regions of France in 1997. **Exclusion criteria** • death before discharge • two regions exercise the option of following at random only one out of every two infants born at 32 weeks to reduce their workload (allowed by study protocol) • death before 5 years of age **Statistical method** Association were analysed using univariable and multivariable logistic regression. Logistic model included both obstetric (GA, infant gender, small for GA, multiple pregnancy, PROM, maternal hypertension) and neonatal factors (respiratory distress syndrome, necrotizing enterocolitis, maternal-fetal infection, BPD, acute anemia, postnatal corticosteroid use). Statistical analyses were performed using STATA/SE version 10. **Demographics** 159 infants were diagnosed with CP at 5 years of age. the study group comprised 942 males and 870 females with a mean	cerebral palsy at 5 years of age	multiple pregnancy (yes vs no) 0.67 (0.43-1.03) small for gestational age 0.81 (0.34-1.92)	information on CP was available for 77% of the study population and authors reported that gestational age was higher in non-responders compared to responders. **Indirectness** Does the study match the review protocol in terms of Population: some (children 22-32 GA only included) Outcome: Yes Indirectness: some **Other information**

<table>
<tr><th>Study details</th><th>Participants</th><th>Factors</th><th>Results</th><th>Comments</th></tr>
<tr><td>yes

Funding
the study was supported by a contract with INSERM (national institute of health and medical research), Merck-Sharp and Dohme-Chibret, the Foundation de la Recherché Medicale, and a grant from the French department of health.</td><td>gestational age of 30 weeks and a mean birth weight of 1367g.</td><td></td><td></td><td></td></tr>
<tr><td>Full citation

Bonellie,S.R., Currie,D., Chalmers,J., Comparison of risk factors for cerebral palsy in twins and singletons, Developmental Medicine and</td><td>Cases

646 included in analysis

Diagnostic criteria

Scottish Morbidity Record series (SMR2)

Controls

-</td><td>Factors
Gestational age (the paper reports 'adjusted OR' but doesn't give specific information on covariates in the model).</td><td>Adjusted odds ratio<table><tr><td>GA, wks</td><td>Singletons aOR (96%CI)</td><td>Twins aOR (96%CI)</td></tr><tr><td>24-27</td><td>93.56 (64.26-136.2)</td><td>49.25 (20.37-119.1)</td></tr><tr><td>28-31</td><td>64.45 (51.65-80.41)</td><td>13.62 (6.21-30.06)</td></tr><tr><td>32-36</td><td>7.69 (6.21-9.51)</td><td>2.72 (1.29-5.73)</td></tr></table></td><td>Limitations
From NICE manual 2012 checklist for prognostic studies:
- gestational age effect size was adjusted for birth weight which is considered to be strictly linked to gestational age. Therefore the effect</td></tr>
</table>

Study details	Participants	Factors	Results	Comments
Child Neurology, 47, 587-591, 2005 **Ref Id** 322511 **Country/ies where the study was carried out** United Kingdom **Study type** retrospective cohort **Study dates** data from 1984 - 1990 **Consecutive recruitment** yes **Funding** not stated.	**Inclusion criteria** singletons and twins born 1984-1990 and registered in the Scottish Register of Children with a Motor Deficit of Central Origin. **Exclusion criteria** • CP acquired post-neonatally • children with a specific syndrome (e.g. Rett syndrome) of which CP is a recognised manifestation • those diagnosed before 2 years of age where the diagnosis had not been confirmed subsequently • children whose mothers were not resident in Scotland at the time of birth • CP diagnosis obtained from a death certificate **Statistical method** Rates of CP and odds ratios for different factors were calculated for singletons and for twins separately. Logistic regression models were fitted to the data to compare risk factors for twins and singletons. **Demographics**		37+ | reference 1.00 | reference 1.00 for both singletons and twins the rate of CP is considerably higher among infants born at earlier gestational ages compared to those born nearer to term.	size for GA can results overadjusted. - covariates not specified in the paper **Indirectness** Does the paper match the review protocol with regards to population: yes outcomes: yes Indirectness: none **Other information**

<table>
<tr><th>Study details</th><th>Participants</th><th>Factors</th><th>Results</th><th>Comments</th></tr>
<tr><td></td><td>Data were from the years 1984 to 1990 and comprised 442662 live singleton births and 9248 live twin births from 4749 twin pregnancies.
586 children with CP were singletons; 57 from twin pregnancies, and 3 from triplet pregnancies.
CP prevalence for 1000 neonatal survivors:
singletons = 1.23 (95%CI 1.22-1.44)
twins = 6.39 (95% CI 4.97-8.22)</td><td></td><td></td><td></td></tr>
<tr><td>Full citation

Dammann,O., Dammann,C.E., Allred,E.N., Veelken,N., Fetal growth restriction is not associated with a reduced risk for bilateral spastic cerebral palsy in very-low-birthweight infants, Early Human Development, 64, 79-89, 2001

Ref Id

322517</td><td>Cases

324 followed up at 6 years

Diagnostic criteria

see demographics

Controls

Inclusion criteria
Liveborn infants between July 1984 and June 1986 with birthweight ≤1500 g.

Exclusion criteria

• death before or after discharge
• missing data at 6 years</td><td>Factors
Growth restriction</td><td>Adjusted odds ratio
<table><tr><td></td><td>aOR and 95% CI for bilateral spastic CP</td></tr><tr><td>Total sample (N=317)</td><td>0.2 (0.03-0.96)</td></tr><tr><td>Subgroup 24-31 weeks GA (n=227 SGA only)</td><td>1.2 (0.2-6.4)</td></tr><tr><td>Subgroup 28-31 weeks GA (n=160 SGA and AGA present)</td><td>1.2 (0.2-6.4)</td></tr><tr><td>matched sample (n=136)</td><td>2.2 (0.3-15)</td></tr></table></td><td>Limitations
Based on NICE manual 2012 checklist for prognostic studies:

• majority of important confounders not included in the model

Indirectness

Other information</td></tr>
</table>

Study details	Participants	Factors	Results	Comments
Country/ies where the study was carried out Germany **Study type** prospective review **Study dates** July 1983 - June 1986 **Consecutive recruitment** **Funding**	**Statistical method** Those variables that occurred more or less often among growth restricted that appropriately grown infants and also among children with bilateral spastic cerebral palsy (BSCP) than controls were selected as possible confounders. A selection criterion of p<0.03 instead of <0.05 was used. Logistic regression models were created to calculate crude and adjusted OR and 96% CI. To evaluate the effects of various sampling strategies, analyses were performed in • the total sample (BW≤1500 g) • subsample of 24-31 weeks of gestational age (this can be considered a simulation of sampling all infants below 1500 g and below 32 weeks) • subsample of 28-31 weeks were both AGA and SGA infants were present at each gestational age • a matched sample with three randomly chosen controls per case matched on gestational age Adjustment for: gestational age, foreign background, caesarean section, sepsis and PROM. **Demographics** Diagnosis of CP based on definition by Bax et al. on a modified version of Touwen's neurological examination.			

Study details	Participants	Factors	Results	Comments
	Children were further divided into those who had BSCP (diplegia or tetraplegia), hemiplegia, dystonia, or choreoathetotic CP. However, the only comparison made was between those who had BSCP and those who had no CP.			
Full citation Han,T.R., Bang,M.S., Lim,J.Y., Yoon,B.H., Kim,I.W., Risk factors of cerebral palsy in preterm infants, American Journal of Physical Medicine and Rehabilitation, 81, 297-303, 2002 **Ref Id** 86179 **Country/ies where the study was carried out** South Korea	**Cases** 437 **Diagnostic criteria** CP - see demographics **Controls** - **Inclusion criteria** Preterm babies born <36 weeks of gestational age . **Exclusion criteria** No specific criteria reported. **Statistical method** Multivariate analysis using multiple logistic regression model was applied.	**Factors** • Hypoxic ischemic events or birth asphyxia • Neonatal sepsis	**Adjusted odds ratio** • HIE aOR = 1.003 (0.98-1.02) • Neonatal sepsis aOR = 1.012 (0.97-1.04) Calculated by technical team at NGA.	**Limitations** no major bias detected. **Indirectness** **Other information**

Study details	Participants	Factors	Results	Comments
Study type prospective cohort **Study dates** january 1993-Dec 1994 with follow-up of 41mo (av.) **Consecutive recruitment** yes **Funding** Not stated.	**Demographics** • 11 patients lost at follow-up • boys:girls = 1.12 (231 boys; 206 girls) • gestational age at birth = 33.5 ±2.2 wk • 14.2 % of the infants had very low birth weight <1500 g • among these, 5 had extremely low birth weight <1000 g • 21 patients had CP defined as: a definite abnormality in the neurodevelopmental assessment; a persistent abnormality in muscle tone; spasticity of at least 1 limb; reflex abnormality.			

Study details	Participants	Factors	Results	Comments
Full citation Himpens,E., Oostra,A., Franki,I., Vansteelandt,S., Vanhaesebrouck, P., den Broeck,C.V., Predictability of cerebral palsy in a high-risk NICU population, Early Human Development, 86, 413-417, 2010 **Ref Id** 312562 **Country/ies where the study was carried out** Belgium **Study type** prospective cohort	**Cases** 984 **Diagnostic criteria** SCPE difinition **Controls** - **Inclusion criteria** Children referred from NICU with a GA less than 30 wks and at-risk children with a GA ≥30 wks with brain lesions and/or typical NICU-related short and long term complications. **Exclusion criteria** No specific exclusion criteria reported apart from not meeting the inclusion criteria. **Statistical method** All statistical analyses were performed with SPSS 15. Univariate and multivariate logistic regressions were	**Factors** • gestational age • multiple gestation • perinatal asphyxia	**Adjusted odds ratio** • multiple pregnancy aOR = 1.3 (0.8-2.1) • Perinatal asphyxia aOR = 2.4 (1.3-4.6); for non-spastic CP (reference category = spastic CP) aOR = 3.6(1.2-10.9) • Gestational age aOR = 1.1 (0.9-1.1) p=0.05; adjusted OR for non-spastic CP (reference category = spastic CP) aOR = 1.1 (1-1.2); adjusted OR for unilateral CP (reference category = bilateral CP) aOR = 1.2 (1-1.4)	**Limitations** No major limitations noted. **Indirectness** **Other information**

Study details	Participants	Factors	Results	Comments
Study dates 1995-2005 **Consecutive recruitment** yes **Funding** not reported.	performed. Variables were retained if significantly associated with CP at 5% significant level, but GA, gender and multiple gestations were included in the model regardless of their significance because they are generally accepted to be of influence. **Demographics** • 162 developed CP at follow-up • median age first diagnosis of CP = 12 months of corrected age			
Full citation Laptook, A. R., O'Shea, T. M., Shankaran, S., Bhaskar, B., Nichd Neonatal Network, Adverse neurodevelopmental outcomes	**Cases** 1473 **Diagnostic criteria** Defined as by Vohr et al 2000 **Controls**	**Factors** • Late onset sepsis	**Adjusted odds ratio** <u>Multivariate association with CP:</u> Late onset sepsis: OR 1.2 (95%CI 1.1-1.3) P <0.05 for independent associations (adjusted for prenatal variables, birth weight, gender, multiple births, pneumothorax, late onset sepsis, ventilation)	**Limitations** Based on NICE manual checklist for prognostic studies (2012): • population was not stratified

Study details	Participants	Factors	Results	Comments
among extremely low birth weight infants with a normal head ultrasound: prevalence and antecedents, Pediatrics, 115, 673-80, 2005 **Ref Id** 339473 **Country/ies where the study was carried out** USA, multicentre **Study type** Cohort study **Study dates** January 1 1995 to 31 December 1999 **Consecutive recruitment** No **Funding** Not reported	**Inclusion criteria** -Patients with: Birth weight <1000g -Cared for in a network centre -mean age and range for early and late head ultrasound were 6 ±5 SD (range 0-28) and 47±25 (range 5-127) days respectively -Had both early and late head ultrasound (normal head ultrasound was defined as absence of abnormal intraventricular or periventricular echo density or echo lucency and a normal size of the ventricular system) -Survived to hospital discharge -Discharge time close to or at 36 weeks post menstrual age **Exclusion criteria** -Presence of congenital infections and major malformations **Statistical method** -Bivariate association with primary outcomes (CP, MDI <70 and either CP or MDI <70) were analysed using X2 tests for categorical variables or t tests for continuous variables. A P value of <0.10 was considered statistically significant for multivariate analyses -Multivariate analysis was analysed with logistic regression models using a time-oriented approach for stepwise selection of variables into a logistic model			according to protocol **Indirectness** Does the study match the protocol in terms of: population: was not stratified according to protocol, not sure of type of motor disorder, or distribution of motor problem, or severity of functional disability outcome: yes indirectness:some **Other information**

Study details	Participants	Factors	Results	Comments
	-Variables included in the multivariate model included those variables that were statistically significant at a level of 0.05 in the univariate model. The multivariate analysis was adjusted for network centre as a control variable -The regression models were expressed as odds ratio with 95% confidence intervals -Further analyses were performed to examine potential role of confounders for the association of pneumothorax and cerebral palsy -Continuous outcomes were expressed as means and standard deviations (±); categorical outcomes were expressed as proportions **Demographics** Characteristics of ELBW infants who were in the neonatal network (1995-1999), survived to discharge, and did not have documented cranial ultrasound abnormalities (n=1473) 2 head ultrasounds available: yes Evaluated in follow-up:yes Birth weight (g): 792±134 Gestational age (weeks): 26.3±1.9 Surfactant use (n): 77 High frequency ventilation (n): 19 Pneumothorax: 4.9 Patent ductus arteriosus: 30 Necrotising enterocolitis: 8.4 Late onset sepsis: 37 02 at 36 weeks: 40 Postnatal steroids: 44 Parenteral nutrition (d): 30±18 Ventilation duration (d): 22±21			

<table>
<tr><th>Study details</th><th>Participants</th><th>Factors</th><th>Results</th><th>Comments</th></tr>
<tr><td></td><td></td><td></td><td></td><td></td></tr>
<tr>
<td>Full citation

Livinec, F., Ancel, P. Y., Marret, S., Arnaud, C., Fresson, J., Pierrat, V., Roze, J. C., Escande, B., Thiriez, G., Larroque, B., Kaminski, M., Epipage, Group, Prenatal risk factors for cerebral palsy in very preterm singletons and twins, Obstetrics & Gynecology, 105, 1341-7, 2005

Ref Id

339484

Country/ies where the study was carried out

France

Study type

Multicenter prospective cohort

Study dates</td>
<td>Cases

1339 singletons and 529 twins

Diagnostic criteria

European CP network definition.

Controls

Inclusion criteria
All children born between 22 and 32 weeks recruited in maternity units.

Exclusion criteria

• death before being discharged from maternity unit
• death before second birthday
• parents' refusal to participate
• no data on neurological status
• CP caused by external causes such as physical abuse.

Statistical method
The links between CP and pregnancy complications were studied alone (crude ORs) and then after adjustment for:

• in singletons the model included = pregnancy complications, gender, GA, prenatal steroids</td>
<td>Factors
Haemorrhagic events.

Outcome:
- cerebral palsy at 2 years of age</td>
<td>Adjusted odds ratio
<table>
<tr><td></td><td>Singletons</td><td>Twins</td></tr>
<tr><td></td><td>adjusted OR (95% CI)</td><td>adjusted OR (95% CI)</td></tr>
<tr><td>Haemmorhage</td><td>7/157 (4.3%)
OR = 1.1 (0.4-2.9)</td><td>2/23 (7.7%)
OR = 0.6 (0.1-3.7)</td></tr>
</table>
</td>
<td>Limitations
Based on NICE manual prognostic studies checklist (2012)

Attrition bias = 17% of children were not examined at 2 years. Authors report that non-examined children had a slighter higher GA' given the way in which data were collected at 2 years of age and the number of doctors involved, it is possible that some cases were misdiagnosed'

Indirectness
Does the study match the review protocol in terms of:
Population: some (only 22-32 GA included)
Outcome: Yes
Indirectness: some

Other information</td>
</tr>
</table>

Study details	Participants	Factors	Results	Comments
1997 **Consecutive recruitment** yes **Funding** the study was supported by a contract with INSERM (national institute of health and medical research), Merck-Sharp and Dohme-Chibret, the Foundation de la Recherché Medicale, and a grant from the French department of health.	• in twins the model included = pregnancy complication, type of placentation, in utero vital status of the co-twin, gender, GA, prenatal steroids Statistical analyses were performed by using SAS 8 and Stata 7.0. **Demographics** Of the children assessed, 113 singletons (8%) and 48 twins (9%) had CP.			
Full citation Miller, J. E., Pedersen, L. H., Streja, E., Bech, B. H., Yeargin-Allsopp, M., Van Naarden Braun, K., Schendel, D. E., Christensen, D., Uldall, P., Olsen, J., Maternal infections during	**Cases** 440564 **Diagnostic criteria** see Demographics **Controls** - **Inclusion criteria** all liveborn singletons born in Denmark between Jan 1997 and Dec 2003 who	**Factors** • Maternal infections: children were categorised as exposed to hospital reported maternal infections during pregnancy if the mother was recorded in the register with an	**Adjusted odds ratio** Any hospital reported maternal infection • preterm delivery: aHR = 1.4 (0.9-2.2) • term delivery: aHR = 1.2 (0.9-1.8)	**Limitations** Based on NICE manual checklist for prognostic studies: • Loss at 1 year follow up not reported. • validated congenital CP' not specified

Study details	Participants	Factors	Results	Comments
pregnancy and cerebral palsy: A population-based cohort study, Paediatric and Perinatal Epidemiology, 27, 542-552, 2013 **Ref Id** 336658 **Country/ies where the study was carried out** Denmark **Study type** prospective cohort **Study dates** participants identified 1997-2003 **Consecutive recruitment** **Funding** Supported by a grant from the National Center on Birth Defects and Developmental Disabilities, Centers for Disease Control	were alive at birth and resided in Denmark up to Dec 2008. **Exclusion criteria** No specific exclusion criteria reported, apart from having met the inclusion criteria. **Statistical method** All children included in the analysis survived to 1 year of age and were followed until a reported diagnosis of CP in the CP Registry, death, or December 2008, whichever occurred first. Hazard ratios (HR) and 95% confidence intervals were estimated by Cox proportional hazard models with person-years as the time-to-event variable. Factors associated with an increased risk for CP as well as for infection were considered potential confounders. Adjustment for: maternal age, smoking, parental income, calendar year **Demographics** Follow-up from 1 year of life until 2008. • 840 diagnosed with CP of whom 86% had spastic CP = children's CP status was ascertained from the Danish CP Registry; cohort member were identified as having validated congenital CP if alive	ICD-10 code for a defined infection between the start of pregnancy and the date of birth of the child.		• majority of important confounders not included in the model **Indirectness** **Other information**

Study details	Participants	Factors	Results	Comments
and Prevention (Atlanta, Georgia), and the University of Aarhus, Denmark.	after the 1st year of life and included in the registry.			
Full citation Mitha, A., Foix-L'Helias, L., Arnaud, C., Marret, S., Vieux, R., Aujard, Y., Thiriez, G., Larroque, B., Cambonie, G., Burguet, A., Boileau, P., Roze, J. C., Kaminski, M., Truffert, P., Ancel, P. Y., Epipage Study Group, Neonatal infection and 5-year neurodevelopmental outcome of very preterm infants, Pediatrics, 132, e372-80, 2013 **Ref Id** 339511	**Cases** 2665 born at 22-32 weeks of gestational age **Diagnostic criteria** Early onset sepsis/late onset sepsis **Controls** **Inclusion criteria** -children followed up from birth to 5 years of age -all live births between 22 and 32 completed weeks of gestation in all maternity units of 9 French regions from January 1 1997 to December 31 1997 (N=2665) -infants discharged from hospital alive (n=2374) -follow-up consisted of very preterm babies (n=2302), of which 2277 survived for follow-up at 5 years **Exclusion criteria**	**Factors** • Early onset sepsis (EOS) • Late onset sepsis (LOS)	**Adjusted odds ratio** <u>Association of cerebral palsy and EOS or LOS (multivariate analysis):</u> <u>Cerebral palsy and EOS:</u> No EOS: reference, 1.00 EOS: OR 1.55 (95% confidence interval 0.90-2.67), P=0.12 (adjusted for antenatal corticosteroid therapy, PROM, spontaneous preterm labour, gender, GA, SGA) <u>Cerebral palsy and LOS:</u> No LOS: reference, 1.00 LOS: OR 1.45 (95% confidence interval 0.95-2.20), P=0.08 (adjusted for antenatal corticosteroid therapy, PROM, spontaneous preterm labour, type of pregnancy, gender, GA, SGA and duration of central venous catheter use) <u>Association of cerebral palsy and neonatal infection (uninfected versus infected)</u> Uninfected: reference, 1.00 EOS alone (without associated LOS): OR 1.70 (95% confidence interval 0.84-3.45) LOS alone (without associated EOS): OR 1.71 (95% confidence interval 1.14-2.56) Associated EOS and LOS: OR 2.33 (95% confidence interval 1.02-5.33) P=0.03 (adjusted for antenatal corticosteroid therapy, PROM, spontaneous preterm labour, gender, GA, SGA)	**Limitations** Based on NICE manual checklist for prognostic studies (2012) • No limitations identified **Indirectness** Does the study match the review protocol in terms of: population: yes outcome: yes indirectness: none **Other information**

Study details	Participants	Factors	Results	Comments
Country/ies where the study was carried out France (9 regions) **Study type** Prospective cohort study **Study dates** 1997 **Consecutive recruitment** Yes **Funding** INSERM-National Institute of Health and Medical Research	-death of children in delivery room (n=127) -missing information about neonatal infection (n=109) -neonatal death during hospitalisation (n=291) -death of infants before the age of 5 years at follow-up (n=25) **Statistical method** -association between maternal and neonatal characteristics were assessed, as well as neonatal infections and neurological problems including cerebral palsy -early onset sepsis (EOS) and late onset sepsis (LOS) were assessed in infants (uninfected, EOS alone, LOS alone, both EOS and LOS together) -logistic regression analysis was used to assess infections and neurological outcomes -logistic regression model for cerebral palsy and neonatal infections was adjusted for confounding factors selected in the univariate analysis including preterm rupture of membranes (PROM), spontaneous preterm labour, gender, gestational age, and small for gestational age, antenatal corticosteroid therapy -analyses were expressed as odds ratios with 95% confidence intervals -Weights were used to take into account the differences in proportion of children born at 32 weeks included in the different regions -all statistical tests were 2-tailed, and a P value of <0.05 was considered statistically significant			

Study details	Participants	Factors	Results	Comments
	Demographics Characteristics of survivors seen at follow-up (5 years) (infants with known cerebral palsy) EOS (n): 131/1769 LOS (n): 557/1769 Gestational age (wks): 23-28 (n): 436/1769 29-30 (n): 467/1769 31-32 (n): 866/1769 Cranial ultrasound abnormalities Major or moderate (n): 340/1750 Minor (n): 275/1750 None (n): 1135/1750 Antenatal corticosteroid therapy (n): 1305/1739 Gender of child Male (n): 907/1769 Female (n): 862/1769 Small for gestational age (n): 138/1769			
Full citation Nasef,N., Shabaan,A.E., Schurr,P., Iaboni,D., Choudhury,J., Church,P., Dunn,M.S., Effect	**Cases** 274 **Diagnostic criteria** **Controls** **Inclusion criteria**	**Factors** • Clinical chorioamnionitis • Histological chorioamnionitis	**Adjusted odds ratio** Odds ratio for CP and clinical and histological chorioamnionitis (adjusted for mode of delivery and presence of premature rupture of membranes, PROM) Clinical chorioamnionitis and CP (n=2/33): OR 1.3 (95% confidence interval 0.2-7.9), P=0.72 Histological chorioamnionitis and CP (n=2/95): OR 0.4 (95% confidence interval 0.08-2.1), P=0.3 No chorioamnionitis and CP (n)=9/146	**Limitations** Based on NICE manual checklist for prognostic studies (2012): • Loss to follow-up in clinical

Study details	Participants	Factors	Results	Comments
of clinical and histological chorioamnionitis on the outcome of preterm infants, American Journal of Perinatology, 30, 59-68, 2013 **Ref Id** 322259 **Country/ies where the study was carried out** Canada **Study type** Retrospective cohort study **Study dates** January 2007-December 2008 **Consecutive recruitment** No **Funding** Not reported	-preterm infants born at <30 weeks gestation who were admitted to the neonatal intensive care unit of Sunnybrook health sciences centre between January 2007 and December 2008 -Clinical chorioamnionitis group -Histological chorioamnionitis group -No chorioamnionitis group **Exclusion criteria** **Statistical method** -Analysis of variance was used to assess differences between groups with Tukey test for continuous variables, and Chi-squared test with Fisher exact test for categorical variables -Odds ratio and 95% confidence intervals were calculated to assess magnitude of differences -Spearman test was used to assess correlation between developmental outcome and risk factors -Kaplan-Meier survival analysis was used to compare probability of survival between studied groups over time -Values were expressed as means and standard deviations or absolute numbers and percentages -Formal power analysis or sample size estimation was not calculated -P values of <0.05 were considered statistically significant **Demographics**			chorioamnionitis group=10 (30%) • Loss to follow-up in histological chorioamnionitis group=34 (36%) • Loss to follow-up in no chorioamnionitis group=50 (34%) **Indirectness** Does the study match the review protocol in terms of: population:yes outcome:yes indirectness:none **Other information**

Study details	Participants	Factors	Results	Comments
	Characteristics of preterm babies according to group (clinical chorioamnionitis, histological chorioamnionitis or no chorioamnionitis) Gestational age (wk, mean, SD) Clinical chorioamnionitis: 27.3 (1.3) Histological chorioamnionitis:27.0 (1.7) No chorioamnionitis:27.1 (1.7) Birth weight (g, mean, SD): Clinical chorioamnionitis:988 (226) Histological chorioamnionitis:976 (273) No chorioamnionitis:927 (275) Male (n): Clinical chorioamnionitis:15 Histological chorioamnionitis: 54 No chorioamnionitis: 83 PROM (n): Clinical chorioamnionitis: 21* Histological chorioamnionitis: 45* No chorioamnionitis: 25 (*P<0.05 by ANOVA or chi-squared test compared with no chorioamnionitis group) Mode of delivery (n) Vaginal (n): Clinical chorioamnionitis:14 Histological chorioamnionitis:51 No chorioamnionitis:27 Forceps (n): Clinical chorioamnionitis: 0 Histological chorioamnionitis:2 No chorioamnionitis: 0 Vacuum (n): Clinical chorioamnionitis: 0 Histological chorioamnionitis: 0 No chorioamnionitis:1 Cesarean section (no preterm labour) (n): Clinical chorioamnionitis: 0 Histological chorioamnionitis:5 No chorioamnionitis:59 Cesarean section (preterm labour) (n):			

<table>
<tr><th>Study details</th><th>Participants</th><th>Factors</th><th>Results</th><th>Comments</th></tr>
<tr><td></td><td>Clinical chorioamnionitis:19
Histological chorioamnionitis:37
No chorioamnionitis:59</td><td></td><td></td><td></td></tr>
<tr><td>Full citation

Natarajan, G., Shankaran, S., Laptook, A. R., Pappas, A., Bann, C. M., McDonald, S. A., Das, A., Higgins, R. D., Hintz, S. R., Vohr, B. R., Extended Hypothermia Subcommittee of the Eunice Kennedy Shriver National Institute of Child, Health, Human Development Neonatal Research, Network, Apgar scores at 10 min and outcomes at 6-7 years following hypoxic-ischaemic encephalopathy, Archives of</td><td>Cases

174 of 208 RCT participants

Diagnostic criteria

Defined by Surveillance of CP in Europe

Controls

Inclusion criteria
Trial inclusion criteria:
-gestational age≥36 weeks
-age at admission <6 hours
-Fulfilment of biochemical and clinical criteria such as severe acidosis in cord blood or postnatal blood gases or history of an acute perinatal event and need for resuscitation
-Infants with moderate or severe encephalopathy or seizures
Analysis:
-children with history of perinatal hypoxic-ischaemic encephalopathy

Exclusion criteria</td><td>Factors

• Association between 10 min Apgar scores and CP</td><td>Adjusted odds ratio
Outcomes:
All children (N=174): death/CP
Survivors to 6-7 years (N=109): CP

Association between each point increase in 10 min adjusted Apgar scores and outcomes
<table><tr><td>Outcome</td><td>10 min Apgar score, adjusted OR (95%CI)</td></tr><tr><td>Death or CP in all children (N=174)</td><td>0.64 (0.52-0.77), P=<0.001</td></tr></table></td><td>Limitations
Based on NICE manual checklist for prognostic studies (2012):

• Only 174 of 208 participants had data on 10 min Apgar scores, and data on primary outcome (90 hypothermia and 84 controls). Those excluded (n=34) differed in Apgar scores, cord pH and receipt of resuscitative interventions</td></tr>
</table>

Study details	Participants	Factors	Results		Comments
Disease in Childhood Fetal & Neonatal Edition, 98, F473-9, 2013 **Ref Id** 339524 **Country/ies where the study was carried out** USA **Study type** Observational analysis of RCT **Study dates** Analysis published in 2013 **Consecutive recruitment** No **Funding** -National Institutes of Health -Eunice Kennedy Shriver National Institute of Child Health and Human Development (NICHD)	-Infants with major congenital anomalies -Severe growth restriction or moribund condition **Statistical method** -Characteristics of children with follow-up data were compared with those who were lost to follow-up or had missing data using X^2 and t tests -Mixed effects logistic regression models conducted to determine association between Apgar scores and 6-7 year outcomes to yield OR and 95% CIs after controlling from treatment group (hypothermia vs conventional care), birth weight, gestational age, gender and outworn status -Models were conducted for primary outcomes (death/disability) and secondary outcomes separately -Children with Apgar score (10min) 0-3 X2 and t tests were used to compare perinatal neonatal variables (pre randomisation) between subgroups of children who died or had disability with those who survived without disability -Interaction between cooling and Apgar score was tested after controlling for confounding factors an risk-adjusted probabilities for the primary outcome for cooled and control infants by Apgar scores were calculated. P value <0.05 was considered significant **Demographics**		CP in survivors to 6-7 years (N=109)	0.69 (0.53-0.89), p=<0.01	Indirectness: Does the study match the review protocol in terms of: population: yes outcome: yes Indirectness:none **Indirectness** **Other information**

Study details	Participants	Factors	Results	Comments
Full citation Pappas, A., Kendrick, D. E., Shankaran, S., Stoll, B. J., Bell, E. F., Laptook, A. R., Walsh, M. C., Das, A., Hale, E. C., Newman, N. S., Higgins, R. D., Eunice Kennedy Shriver National Institute of Child, Health, Human Development Neonatal Research, Network, Chorioamnionitis and early childhood outcomes among extremely low-gestational-age neonates, JAMA Pediatrics, 168, 137-47, 2014 **Ref Id** 339551 **Country/ies where the study was carried out** USA **Study type**	**Cases** 2390 **Diagnostic criteria** CP defined as by Vohr et al., 2012 **Controls** **Inclusion criteria** -extremely preterm neonates with and without exposure to histological or clinical chorioamnionitis -preterm infants <27 weeks gestational age born between January 1 2006 and December 31 2008 with placental histopathology data and follow-up to 18-22 months corrected age **Exclusion criteria** -infants with congenital or chromosomal anomalies **Statistical method** -infants with or without exposure to chorioamnionitis were classified as histological or clinical and were compared with maternal and neonatal baseline characteristics and outcomes -outcomes were measured in three exposure groups: no choroiamnionitis, histological choroiamnionitis, and clinical chorioamnionitis -multivariate logistic regression analysis were used to assess death and neurodevelopmental impairment (primary outcomes), and were adjusted	**Factors** • Histological chorioamnionitis • Clinical chorioamnionitis	**Adjusted odds ratio** <u>Association (adjusted) of cerebral palsy and histological and/or clinical chorioamnoinitis including gestational age</u> Histological chorioamnionitis alone versus none: OR 0.80 (95% confidence interval 0.42-1.53) Histological plus clinical chorioamnionitis versus none: OR 1.39 (95% confidence interval 0.67-2.87) Histological alone versus histological plus clinical chorioamnoinitis: OR 0.58 (95% confidence interval 0.29-1.16)	**Limitations** Based on NICE manual checklist for prognostic studies (2012) • No limitations identified **Indirectness** Does the study match the review protocol in terms of: population: yes outcome: yes indirectness: none **Other information**

Study details	Participants	Factors	Results	Comments
Prospective cohort (retrospective analysis) **Study dates** January 1 2006 to December 31 2008 **Consecutive recruitment** No **Funding** -The National Institutes of Health -Eunice Kennedy Shriver National Institute of Child Health and Human Development -National Centre for Research Resources -National Centre for Advancing Translational Sciences	for maternal age, multiple birth, parity, antenatal steroids, maternal hypertension, antepartum haemorrhage, gender, GA, SGA status, insurance, race and centre) -categorical outcomes were expressed as odds ratios and 95% confidence intervals **Demographics** Maternal and neonatal characteristics among neonates with placental pathology data Sample size=2390 Maternal: Age (y, mean, SD): 27.2 (6.42) Race/ethnicity (%): Black: 39.5 White: 35.7 Hispanic: 19.8 Other: 5.0 Parity (%): 0 or 1: 38.6 2 or 3: 46.0 >3: 15.4 Hypertension (%): Chronic: 8.3 Pregnancy-induced: 9.8 None: 81.9 Prepartum haemorrhage (%): 22.9 PPROM>18h (%): 25.7 Duration of PPROM (y, mean, SD): 34.4 (103.2) Antenatal antibiotics (%): 66.9 Antenatal steroids (%): 75.4 Multiple birth (%):25.9 Insurance (%): Medicaid:46.9 Private:39.5 Self/uninsured/other: 13.6			

Study details	Participants	Factors	Results	Comments
	Neonatal Birth weight (g) (%): 401-500: 12.9 501-750: 54.1 751-1000: 33.1 GA (week, mean, SD): 24.3 (1.35) Male (%): 51.4 SGA at birth (%): 5.8			
Full citation Petrini,J.R., Dias,T., McCormick,M.C., Massolo,M.L., Green,N.S., Escobar,G.J., Increased risk of adverse neurological development for late preterm infants, Journal of Pediatrics, 154, 169-176, 2009 **Ref Id** 321792 **Country/ies where the study was carried out**	**Cases** 141321 **Diagnostic criteria** Based on ICD-9 CM code **Controls** **Inclusion criteria** -born alive at 1 of the 12 KPMCP birth facilities between January 1 2000 and Jone 30 2004 -survived birth hospitalisation -Gestational age at birth of at least 30 weeks -Remain a member of the Kaiser Foundation Health plan for at least one day after discharge from the birth hospitalisation	**Factors** • Gestational age at birth (weeks)	**Adjusted odds ratio** Hazard ratios for CP by gestational age (adjusted for maternal race/ethnicity, infant gender, multiple gestation, small for gestational age, large for gestational age) 30-33 weeks: HR 7.87 (95% confidence interval 5.38-11.51) 34-36 weeks: HR 3.39 (95% confidence interval 2.54-4.52) 37-41 weeks: Reference 1.00 ≥42 weeks: HR 0.90 (95% confidence interval 0.34-2.43)	**Limitations** Based on NICE manual checklist for prognostic studies (2012): • The analysis included survivors to age 3 years only • Majority of babies in the study were of heavier weight **Indirectness** Does the study match the review protocol in terms of: population: yes

Study details	Participants	Factors	Results	Comments
USA **Study type** Retrospective cohort study **Study dates** 2000-2005 **Consecutive recruitment** No **Funding** -March of Dimes -Kaiser Permanente Medical Group -Kaiser Foundation Hospitals Inc.	**Exclusion criteria** -death of infant during hospitalisation -missing gender information from records -wrong birth weight recorded -Follow-up time <1 day **Statistical method** -For multivariate analyses, gestational age ranges were used (30-33 weeks, 34-36 weeks,37-41 weeks and 42+ weeks) -Distribution between groups of duration of clinical follow-up were calculated using the Pearson X2 value -Cox proportional hazards were calculated and controlled for varying lengths of follow-up by birth weight (<2500g) or very low birth weight (<1500g) -The model was adjusted for relevant maternal and infant characteristics available (maternal race/ethnicity, gender, plurality and size for gestational age status) -Ratios were expressed as hazard ratios with 95% confidence intervals **Demographics** <u>Maternal race/ethnicity (total, n)</u> Hispanic: 34557 Black: 10332 Asian:25723 White:58664 Other:12045 <u>Maternal age, years (total, n):</u> <20:8413			outcome: yes indirectness: none **Other information**

Study details	Participants	Factors	Results	Comments
	20-29:64788 30-39:62421 ≥40:5422 Multiple gestation (total, n): Yes:3790 No:137531 Infant gender (total, n): Male:72277 Female:69044 Birthweight (g) (total, n): <1500:531 <2500:7434 ≥2500:133887			
Full citation Shatrov, J. G., Birch, S. C., Lam, L. T., Quinlivan, J. A., McIntyre, S., Mendz, G. L., Chorioamnionitis and cerebral palsy: a meta-analysis, Obstetrics & Gynecology, 116, 387-92, 2010 **Ref Id** 336881 **Country/ies where the study was carried out** n/a **Study type**	**Cases** 15 studies considered for data extraction. **Diagnostic criteria** see inclusion criteria **Controls** n/a **Inclusion criteria** • appropriate exposure and outcome measures as defined (see factors section) • case-control or cohort study design • risk ratio or OR with 95% CI provided or able to be calculated from the data presented in the study	**Factors** The types of exposure were separated into clinical and histological chorioamnionitis. the infectious agents were viral, bacterial, or protozoan. • clinical choriomanionitis was defined by the criteria of maternal fever with uterine tenderness, malodorous amniotic fluid, maternal of fetal tachycardia, or maternal leucocytosis, or established markers of infection.	**Adjusted odds ratio** Clinical chorioamnionitis and CP • n studies= 12 OR = 2.41 (1.52-3.84); I-squared = 70.5%; P<0.001 Histological chorioamnionitis and CP • n studies=8 OR = 1.83 (1.17-2.89); I-squared = 28.8%; P<0.198	**Limitations** none **Indirectness** **Other information**

Study details	Participants	Factors	Results	Comments
Meta-analysis **Study dates** see inclusion criteria **Consecutive recruitment** n/a **Funding** supported by a Cerebral Palsy Institute grant to Drs. Mendz and Quinlivan, and by RUSC research scholarship to Jobe G. Shatrov and Samuel S. M. Birch.	• published in the years 2000-2009 • the key outcome was a diagnosis of CP in accordance with established criteria (1) **Exclusion criteria** • redundancy in data reported • exposure, outcomes or both failed to meet the required inclusion criteria **Statistical method** The methodology conformed to meta-analysis of observational studies in epidemiology (MOSE) criteria. All extracted articles underwent preliminary independent analysis by two authors to identify the studies that had primary data investigating a relevant exposure and outcome. • Meta-analyses were performed with STATA v10.0 statistical software and conducted for the relationship between clinical chorioamnionitis of histological chorioamnionitis and cerebral palsy. • to determine the suitability of studies to be pooled for the MA, a test of heterogeneity of estimated effects was	• histological chorioamnionitis was defined as pathological findings on placental histology and culture.		

Study details	Participants	Factors	Results	Comments
	conducted to test for the equity of parameter estimate. • According to the argument by bailey (6), should the research question be whether the exposure has an effect, on average, on the outcome, then a random effect model is an appropriate model to be used. • The general inverse variance method was used for the calculation of the pooled effect size and the corresponding 95% CI. **Demographics** • OR ranged from 0.9 to 5.8 • 12 studies used a case-control design.			
Full citation Soraisham,A.S., Trevenen,C., Wood,S., Singhal,N., Sauve,R., Histological chorioamnionitis and neurodevelopmental outcome in preterm infants, Journal of	**Cases** 384 **Diagnostic criteria** see demographics **Controls** **Inclusion criteria** all surviving infants with birth gestational age <29 weeks, born between 2000 and 2006 and who had a	**Factors** • HCA, defined as the presence of polymorphonuclear leukocyte infiltration in the placental membranes and chorionic plate.	**Adjusted odds ratio** Histological chorioamnionitis vs no HCA • aOR = 2.45 (1.11-5.40) p=0.02	**Limitations** based on NICE manual checklist for prognostic studies: - majority of important confounders not included in the model **Indirectness** **Other information**

Study details	Participants	Factors	Results	Comments
Perinatology, 33, 70-75, 2013 **Ref Id** 317061 **Country/ies where the study was carried out** Canada **Study type** retrosp cohort with prosp follow-up **Study dates** 1 Jan 2000 - 31 Dec 2006 **Consecutive recruitment** **Funding** not reported.	developmental assessment at 30-42 months corrected age. **Exclusion criteria** • infants with major congenital or chromosomal anomalies • children without placental examinations • children without neurodevelopmental assessment at 30-42 months of corrected age **Statistical method** The association between HCA and the presence of neurodevelopmental outcomes (including CP) was examined using generalised estimating equations with a binomial distribution and a logit link to account for correlations in multiple births. OR and 95% CI were computed for the outcome. Adjustment for: gestational age, maternal hypertension, PROM >24 hs , multiple pregnancy **Demographics** Of the 384 included infants, 197 (51%) were born to mothers with evidence of histological chorioamnionitis (HCA). The follow-up assessment consisted of a medical and developmental history, as well as complete physical and neurological examination on every child			

Study details	Participants	Factors	Results	Comments
	at 4, 8, 12, 18 and 36 months corrected age. Cerebral palsy was diagnosed if the child had non-progressive motor impairment characterised by abnormal muscle tone in at least one extremity, and decreased range of control of movements.			
Full citation Stoll, B. J., Hansen, N. I., Adams-Chapman, I., Fanaroff, A. A., Hintz, S. R., Vohr, B., Higgins, R. D., National Institute of Child, Health, Human Development Neonatal Research, Network, Neurodevelopmental and growth impairment among extremely low-birth-weight infants with neonatal infection, JAMA, 292, 2357-65, 2004 **Ref Id** 347367	**Cases** 7892 **Diagnostic criteria** **Controls** **Inclusion criteria** -very low birth weight infants (weighing 401-1500g) at birth -surviving infants who weighed 1000g were asked to return for a comprehensive visit at 10 to 22 months of corrected gestational age **Exclusion criteria** -infants with major congenital malformations/syndromes -infants with ventricular shunts **Statistical method** -logistic regression models were adjusted for confounding factors including infection group, study centre, gestational age, birth weight, gender, race/ethnicity, rupture of membranes more than 24 hours before delivery, mode of delivery, multiple birth,	**Factors** • Sepsis alone	**Adjusted odds ratio** Association (adjusted) of cerebral palsy and sepsis alone group versus uninfected group (multivariate analysis) Number of infants=1825/5740 OR 1.4 (95% confidence interval 1.1-1.8), P<0.01	**Limitations** Based on NICE manual checklist for prognostic studies (2012): • No limitations identified **Indirectness** Does the study match the review protocol in terms of: population: yes outcome: yes indirectness: none **Other information**

Study details	Participants	Factors	Results	Comments
Country/ies where the study was carried out USA **Study type** Prospective cohort study **Study dates** January 1 1993 to August 31 2001 **Consecutive recruitment** No **Funding** -National Institutes of Health	antenatal antibiotic and steroid use, postnatal surfactant and steroid use, RDS, BPD, PDA, IVH grade 3 or 4, PVL and maternal age at time of delivery -associations in the multivariate analyses were expressed as odds ratios and 95% confidence intervals -Wald X^2 tests were used to determine statistical significance between infection or pathogen groups, with P<0.05 considered as statistically significant **Demographics** Maternal and neonatal characteristics of study population by sepsis alone group (n=1922) and uninfected group (n=2161) Maternal (sepsis group; uninfected group) (n/N): Age≤19 years: 339/1920; 340/2161 ROM >24 hrs: 430/1874; 495/2121 Neonatal (sepsis group/uninfected group) (n/N): Birth weight (g): 401-500: 47/1922; 8/2161 501-750: 918/1922; 491/2161 751-1000: 957/1922; 1662/2161 Gestational age (wk, n): <25: 526/1922; 182/2160 25-28: 1277/1922; 1479/2160 29-32: 114/1922; 468/2160 ≥33: 5/1922; 31/2160 SGA at birth: 260/1922; 521/2160 Male: 923/1922; 878/2161			

<table>
<tr><th>Study details</th><th>Participants</th><th>Factors</th><th>Results</th><th>Comments</th></tr>
<tr><td></td><td></td><td></td><td></td><td></td></tr>
<tr>
<td>Full citation

Streja, E., Miller, J. E., Bech, B. H., Greene, N., Pedersen, L. H., Yeargin-Allsopp, M., Van Naarden Braun, K., Schendel, D. E., Christensen, D., Uldall, P., Olsen, J., Congenital cerebral palsy and prenatal exposure to self-reported maternal infections, fever, or smoking, American Journal of Obstetrics & Gynecology, 209, 332.e1-332.e10, 2013

Ref Id

339639

Country/ies where the study was carried out

Denmark

Study type</td>
<td>Cases

81066 singletons

Diagnostic criteria

diagnosis of CP - see outcomes

Controls

Inclusion criteria
Singletons born 1996-2003.
Women included if they participated in both of the two interviews during pregnancy.

Exclusion criteria

• non-singleton children
• children who died
• children who emigrated prior to 1st birthday
• children who were not in the Danish Medical Birth registry

Statistical method
Hazard ratios and 95% CI were estimated by cox proportional hazard regression models.
Adjusted HRs included: maternal age, alcohol consumption, binge drinking,</td>
<td>Factors

• all infections
• vaginal infections
• urinary infections

Infections were self-reported by the mothers.

Outcomes
Cerebral palsy and spastic cerebral palsy. Children were identified as having validated CP if they were alive after 1st year of life and included in the Danish cerebral Palsy registry.</td>
<td>Adjusted odds ratio

<table>
<tr><td></td><td>All CP aHR (95% CI)</td><td>Spastic CP aHR (95% CI)</td></tr>
<tr><td>All infections</td><td>n=119/139
0.98 (0.68-1.41)</td><td>n=103/121
1.00 (0.67-1.48)</td></tr>
<tr><td>Vaginal Infections</td><td>n=130/139
1.52 (1.04-2.24)</td><td>n=112/121
1.73 (1.16-2.60)</td></tr>
<tr><td>Urinary Infections</td><td>n=127/139
0.74 (0.40-1.38)</td><td>110/121
0.79 (0.41-1.50)</td></tr>
</table>
Stratified analysis by GA

• in children born at term vaginal infections = aHR 1.70 (1.08-2.67) for sCP
• in children born preterm = aHR 1.59 (0.51-4.94) for sCP</td>
<td>Limitations
Based on NICE manual checklist for prognostic studies (2012)

• data on infections were self-reported and limited to those addressed in the interviews and could not therefore differentiate between different types of infections
• only women who completed both interviews were included in the analysis
• adjust only for confounders related to social status and health behaviours</td>
</tr>
</table>

<table>
<tr><th>Study details</th><th>Participants</th><th>Factors</th><th>Results</th><th>Comments</th></tr>
<tr><td>prospective cohort study

Study dates

Children born 1996-2003 and followed up til 2008.

Consecutive recruitment

Funding
Supported by a grant from the National Centre on Birth Defects and Developmental disabilities, Centers for Disease Control and Prevention.</td><td>combined SES, season of birth, number per household, birth year, and smoking. Confounders were selected for adjustment a priori based on literature review.
Analyses by stratification on gestational age were performed.
All analyses carried out in SAS version 9.2.

Demographics
81066 singletons were included in the analyses.
Children were followed up for a maximum of 11.4 years.
A total of 139 children were identified as having CP, of which 121 has spastic CP (sCP).</td><td></td><td></td><td>(no data on delivery, complications etc).

Indirectness
Does the study match the review protocol in terms of:
Population: some (only singletons included)
Outcome: Yes
Indirectness: some

Other information</td></tr>
<tr><td>Full citation

Sukhov, A., Wu, Y., Xing, G., Smith, L. H., Gilbert, W. M., Risk factors associated with cerebral palsy in preterm infants, Journal of Maternal-Fetal & Neonatal</td><td>Cases

6,154,357

Diagnostic criteria

ICD codes

Controls

Inclusion criteria
Preterm births from January 1991 to December 2001</td><td>Factors

• mild to severe birth asphyxia
• gestational age in 4 categories</td><td>Adjusted odds ratio

<table><tr><td></td><td>adjusted OR (96% CI)</td></tr><tr><td>Mild to severe birth asphyxia</td><td>5.98 (5.28-6.58)</td></tr><tr><td>gestational age at birth</td><td></td></tr><tr><td><28wks</td><td>18.21 (16.70-19.86)</td></tr></table></td><td>Limitations
Based on NICE manual checklist for prognostic studies:

• Gestational age effect size was adjusted for birth weight which is considered to be strictly linked to</td></tr>
</table>

Study details	Participants	Factors	Results	Comments
Medicine, 25, 53-7, 2012 **Ref Id** 339221 **Country/ies where the study was carried out** California (US) **Study type** retrospective cohort **Study dates** 1 Jan 1991 - Dec 31 2001 **Consecutive recruitment** **Funding** Supported by a NIH grant.	• genetic syndromes and birth defects were included in the analysis **Exclusion criteria** infants with CP due to • near drowning, • auto accidents, • other accidents and • child abuse **Statistical method** Infants were grouped according to gestational age, maternal and infant diagnoses, demographics, and gender. The data were analysed by determining OR and 95% CI for CP. Adjustment for: maternal age, parity, maternal education, payer-source, race/ethnicity, timing of initiation of prenatal care, number of prenatal visits, GA, BW, and obstetric and neonatal comorbidities **Demographics** data for all study participants were collected from three state databases: • the OSHPD Patients Discharge Database		28-31 wk: 8.83 (8.04-9.70) 32-36 wk: 2.20 (0.2-1.3) 37+ wk: reference aOR= 1.00	gestational age. Therefore the effect size for GA can results overadjusted. • 'adjusted for obstetric and neonatal comorbidities' but doesn't specify which ones **Indirectness** **Other information**

Study details	Participants	Factors	Results	Comments
	• the Linked Vital Statistics Birth File • the California DDS which collects information from 21 non-profit regional centers			
Full citation Wang, L. W., Lin, Y. C., Wang, S. T., Yeh, T. F., Huang, C. C., Hypoxic/ischemic and infectious events have cumulative effects on the risk of cerebral palsy in very-low-birth-weight preterm infants, Neonatology, 106, 209-15, 2014 **Ref Id** 347405 **Country/ies where the study was carried out** Taiwan **Study type**	**Cases** 4355 **Diagnostic criteria** see demographics **Controls** **Inclusion criteria** N=5,807 very low birth weight (<1500 g) and preterm babies (<30 weeks) admitted to the NICU of 18 tertiary care centres in Taiwan. 4355 had 24-months follow-up. **Exclusion criteria** • death before discharge • chromosome abnormalities • congenital brain abnormalities **Statistical method** Potential predictors in univariate analyses were fitted into a multivariate	**Factors** • neonatal sepsis	**Adjusted odds ratio** Neonatal sepsis • aOR = 1.22 (0.59-2.62) p=0.71	**Limitations** Based on NICE manual checklist for prognostic studies: • majority of important confounders not included in the model **Indirectness** **Other information**

Study details	Participants	Factors	Results	Comments
prospective cohort **Study dates** January 1995 to December 2005 **Consecutive recruitment** **Funding** Supported by grants from Taiwan National Health Research Institute and Chi Mei medical centre.	logistic regression model, with computed OR and 95% CI. Adjustment for GA, birth weight, gender, and retinopathy of prematurity >stage III **Demographics** Motor developmental outcomes were assessed using neurologic examinations and the psychomotor development index of the bailey scales at corrected age 24 months. CP was diagnosed and stratified into diparesis, hemiparesis, and quadriparesis using an algorithm-based classification. • 457 (10.5%) had CP • of the CP group, 51, 39 and 10% had quadriparesis, diparesis and hemiparesis respectively • gestational age, weeks: CP group = 26.9 ±2.1; no CP group = 27.8 ±1.9 • multiple births: CP group = 110; no CP group = 537			
Full citation Wu,C.S., Pedersen,L.H.,	**Cases** 588936 singletons for the final analysis	**Factors** Maternal infection during pregnancy (mothers were classified as having	**Adjusted odds ratio**	**Limitations** based on NICE checklist for cohort

<table>
<tr><th>Study details</th><th>Participants</th><th>Factors</th><th>Results</th><th>Comments</th></tr>
<tr>
<td>Miller,J.E., Sun,Y., Streja,E., Uldall,P., Olsen,J., Risk of cerebral palsy and childhood epilepsy related to infections before or during pregnancy, PLoS ONE [Electronic Resource], 8, e57552-, 2013

Ref Id

321930

Country/ies where the study was carried out

Denmark

Study type

prospective cohort

Study dates

January 1, 1982 to December 31, 2004.

Consecutive recruitment

yes

Funding
The study was supported by the</td>
<td>Diagnostic criteria

ICD - 8

Controls

Inclusion criteria
First live-born singletons born in Denmark between Jan 1982 and Dec 2004 from the Danish medical Birth Register.

Exclusion criteria

• children who were adopted (n=4320)
• children who could not be linked to their mothers (n=1)
• children who had missing data on gestational age (n=4132)
• children who had missing values on maternal education (n=9936)
• children who had missing values on maternal marital status (n=23)
• children who had missing values on maternal income (n=1454)
• children who had missing values on paternal income (n=15818)

Statistical method</td>
<td>infection during pregnancy if they had at least one hospital-recorded infection during pregnancy).
Infections were classified as

• infections of the genitourinary system
• other infections

Outcomes

• cerebral palsy</td>
<td>
<table>
<tr><th></th><th>Total</th><th>Cases</th><th>Crude HR</th><th>Adjusted HR</th></tr>
<tr><td>Cerebral palsy</td><td></td><td></td><td></td><td></td></tr>
<tr><td>No infections (ref)</td><td>565343</td><td>2607</td><td>1.00</td><td>1.00</td></tr>
<tr><td>Infections of the genitourinary system</td><td>14037</td><td>105</td><td>1.74</td><td>1.61 (1.32-1.96)</td></tr>
<tr><td>Any other infections</td><td>9556</td><td>53</td><td>1.22</td><td>1.13 (0.86-1.49)</td></tr>
</table>
Children of mothers with infections of the genitourinary system or any other infections during pregnancy were compared to the reference group of children of mothers without infections during pregnancy.
</td>
<td>studies (limitations only reported):

• selection bias: low
• performance bias: low
• attrition bias:
• detection bias:

Indirectness
Does the study match the review protocol in terms of:
Population: Yes
Outcome: Yes
Indirectness: None

Other information</td>
</tr>
</table>

Study details	Participants	Factors	Results	Comments
Danish medical Research council (FSS). The founders had no role in the study design, data collection and analysis, decision to publish, or preparation of the manuscript.	Cox proportional hazards models were used to estimate hazard ratios (HRs) with 95% CI for CP. Multivariate analyses included the pre-specified covariates of maternal age, gender, maternal education, and maternal marital status at birth, birth year, and family income at birth, and maternal infection BEFORE pregancy. The statistical analysis were done using Stata version 11. **Demographics** Participants were identified from the Danish medical Birth Register. N = 588936 first born singletons • Born to mothers who had genitourinary infection during pregnancy = 14037 (2.38%) • Born to mothers who had any other infection during pregnancy = 9556 (1.62%) • Born to mothers without any hospital-recorded infections during pregnancy = 565343 (96.99%)			

<table>
<tr><th>Study details</th><th>Participants</th><th>Factors</th><th>Results</th><th>Comments</th></tr>
<tr>
<td>Full citation

Bear, J. J., Wu, Y. W., Maternal infections during pregnancy and cerebral palsy in the child, Pediatric Neurology, 57, 74-79, 2016

Ref Id

444797

Country/ies where the study was carried out

USA

Study type

Retrospective cohort

Study dates

1991-2001

Consecutive recruitment

Funding
Project funded by the Cerebral Palsy International Research Foundaation, the Cerebral Palsy</td>
<td>Cases

prenatal infection=381,056; CP=8,473

Diagnostic criteria

See other comments*

Controls

N/A

Inclusion criteria
Not reported

Exclusion criteria
Children with postnatal causes including child abuse (n=272), motor vehicle and other vehicle injuries (n=213), and near drowning (n=72).

Statistical method
Firstly, univariate relative risk (RR) and 95% confidence intervals for each infection category, and stratified results by timing of diagnosis and by gestational age. Secondly, demographic characteristics were compared in different patients groups using X^2 analyses. Finally, multivariate logistic regression was performed in order to estimate the odds ratios (ORs) of maternal infection for cerebral palsy after adjusting for known risk factors for cerebral palsy: maternal age, race, education, ans socioeconomic status; maternal hospital diagnosis of obesity and infant gender.</td>
<td>Factors
Chorioamnionitis; "other" GU (venereal diseases; pyelonephritis; cystitis; inflammatory disease of female pelvic organs; infections of GU tract in pregnancy), and respiratory infections (Acute respiratory infections; other diseases of the upper respiratory infection, other diseases of the respiratory tract; pneumonia and influenza)</td>
<td>Adjusted odds ratio
<table>
<tr><td>Chorioamnionitis</td><td>RR</td><td>95%CI</td></tr>
<tr><td>Prenatal hospitalization</td><td>2.3</td><td>0.6-9.2</td></tr>
<tr><td>Preterm</td><td>0.9</td><td>0.1-6.2</td></tr>
<tr><td>Term</td><td>NA</td><td>-</td></tr>
<tr><td>Birth hospitalization</td><td>4.1</td><td>3.8-4.4</td></tr>
<tr><td>Preterm</td><td>4.1</td><td>3.7-4.5</td></tr>
<tr><td>Term</td><td>2.0</td><td>1.7-2.4</td></tr>
<tr><td>Any hospitalization</td><td>4.1</td><td>3.8-4.4</td></tr>
<tr><td>Preterm</td><td>4.0</td><td>3.7-4.5</td></tr>
<tr><td>term</td><td>2.0</td><td>1.7-2.3</td></tr>
</table>
RR= relative risk; CI= confidence interval
NA= not calculated because there were not enough cases of cerebral palsy
<table>
<tr><td>Other genituorinary infection</td><td>RR</td><td>95%CI</td></tr>
<tr><td>Prenatal hospitalization</td><td>1.4</td><td>1.2-1.7</td></tr>
<tr><td>Preterm</td><td>1.2</td><td>1.0-1.5</td></tr>
<tr><td>Term</td><td>1.0</td><td>0.7-1.3</td></tr>
</table>
</td>
<td>Limitations
No major bias detected

Indirectness
Does this paper match the review protocol with regards to: population: yes outcomes: yes indirectness: none

Other information
*cerebral palsy was defined as a nonprogressive lesion or disorder in the brain occurring during intrauterine life or the perinatal period and characterised by paralysis, spasticity, or abnormal control of movement or posture that is manifest before the age 2-3 years, and other significant motor dysfunction appearing before age 18 years.</td>
</tr>
</table>

<table>
<tr><th>Study details</th><th>Participants</th><th>Factors</th><th>Results</th><th>Comments</th></tr>
<tr>
<td>Alliance Research Foundation, and the National Institutes of Health</td>
<td>
Demographics
<table>
<tr><th></th><th>Prenatal infection</th><th>CP</th></tr>
<tr><td><18 y/o</td><td>6.0</td><td>5.0</td></tr>
<tr><td>18-34 y/o</td><td>80.4</td><td>77.3</td></tr>
<tr><td>≥35 y/o</td><td>13.7</td><td>17.8</td></tr>
<tr><td>Low SES</td><td>52.2</td><td>51.3</td></tr>
<tr><td>middle/high SES</td><td>47.8</td><td>48.7</td></tr>
<tr><td>Education up until high school</td><td>65.4</td><td>64.8</td></tr>
<tr><td>College education</td><td>34.7</td><td>35.2</td></tr>
<tr><td>Hispanic race</td><td>47.6</td><td>46.8</td></tr>
<tr><td>White race</td><td>30.2</td><td>35.0</td></tr>
<tr><td>Other race</td><td>22.2</td><td>18.2</td></tr>
</table>
y/o years old; SES = socioeconomic status; CP= cerebral palsy
</td>
<td></td>
<td>
<table>
<tr><td>Birth hospitalization</td><td>1.9</td><td>1.7-2.4</td></tr>
<tr><td>Preterm</td><td>1.7</td><td>1.5-2.0</td></tr>
<tr><td>Term</td><td>1.4</td><td>1.2-1.7</td></tr>
<tr><td>Any hospitalization</td><td>1.7</td><td>1.6-1.9</td></tr>
<tr><td>Preterm</td><td>1.6</td><td>1.4-1.8</td></tr>
<tr><td>term</td><td>1.3</td><td>1.1-1.5</td></tr>
</table>
RR= relative risk; CI= confidence interval
<table>
<tr><td>Respiratory infection</td><td>RR</td><td>95%CI</td></tr>
<tr><td>Prenatal hospitalization</td><td>2.0</td><td>1.5-2.7</td></tr>
<tr><td>Preterm</td><td>1.5</td><td>1.0-2.3</td></tr>
<tr><td>Term</td><td>1.8</td><td>1.2-2.7</td></tr>
<tr><td>Birth hospitalization</td><td>2.8</td><td>2.2-3.6</td></tr>
<tr><td>Preterm</td><td>1.8</td><td>1.3-2.6</td></tr>
<tr><td>Term</td><td>2.2</td><td>1.5-3.3</td></tr>
<tr><td>Any hospitalization</td><td>2.4</td><td>2.0-2.9</td></tr>
<tr><td>Preterm</td><td>1.7</td><td>1.3-2.2</td></tr>
<tr><td>term</td><td>2.0</td><td>1.5-2.6</td></tr>
</table>
RR= relative risk; CI= confidence interval
</td>
<td></td>
</tr>
</table>

I.2 Causes of cerebral palsy

Bibliographic details	Number of Participant & Participant Characteristics	Results	Reviewer comment
Authors McIntyre, S., Blair, E., Badawi, N., Keogh, J., Nelson, K. B. **Year of publication** 2013 **Country of publication** Australia **Ref Id** 339502 **Sub-type** Prospective cohort study	**Cohort population** • A total of 782 cases of cerebral palsy were initially identified. 288 were excluded (12 registered after participant selection, 29 medical records not located and 247 multiple births and singletons under 35 weeks of gestational age). A total number of 486 were included in the study. • Data was gathered from the Western Australia Cerebral Palsy Register • Participants were born between 1980 and 1985 • Study participants were categorised in five different groups: a total of 154 (31.2%) presented with spastic hemiplegia, 94 (19%) had diplegia, 116 (23.5%) had quadriplegia, 75 (15.2%) presented with dyskinesia (dystonia or atheosis) and 55 (11.1%) had ataxia or isolated hypotonia.	**Results** • A total of 60 cases of the sample had Neonatal Encephalopathy. Of those, 15 (9.7%) presented with hemiplegia, 5 (5.3%) had Diplegia, 25 (21.6%) had quadriplegia, 8 (10.7%) dyskinesia and a total of 7 (12.7%) presented with ataxia or hypotonia • A total of 103 cases presented with Hypoxic- Ischemic Encephalopathy. Of those, 11 (7.1%) had hemiplegia, 19 (20.2%) had diplegia, 39 (33.6%) presented with quadriplegia, 28 (37.3%) had dyskinesia and 6 (10.9%) of the total number had ataxia or hypotonia.	**Funding** not reported. **Quality Items** MODERATE (based on the tool developed and published by Munn et al. 2014) • Population limited to after 35 weeks GA **Other information**

Bibliographic details	Number of Participant & Participant Characteristics	Results	Reviewer comment
	Inclusion Criteria • Singletons born at or after 35 weeks of gestation • All registrants of the Western Australia Cerebral Palsy Register between January 1, 1980 and December 25,1995 **Exclusion Criteria** • Cerebral palsy acquired post-neonatally **Demographics - Total** 486 **Cases** 486 **Statistical method** • Odds ratios for each outcome with each risk factor were estimated by unconditional logistic regression using SAS 9.2 and SPSS 19. Statistical significance was accepted at p<.05		

Bibliographic details	Number of Participant & Participant Characteristics	Results	Reviewer comment
	• The original study has a a control group and a case group **Diagnostic criteria** • Cerebral palsy was defined as a disorder of movement, posture, or both affecting activities of daily living resulting in non-progressive lesions or abnormalities of the developing brain. • Moderate or severe neonatal encephalopathy was defined as any admission to special or intensive care for 2 days or more with seizures, abnormal consciousness or abnormal tone. **Reference Test** • Encephalopathy, no encephalopathy, hypoxicischemic encephalopathy • Data by distribution and type of CP		
Authors	**Cohort population**	**Results**	**Funding**

Bibliographic details	Number of Participant & Participant Characteristics	Results	Reviewer comment
Garne, E., Dolk, H., Krageloh-Mann, I., Holst Ravn, S., Cans, C. **Year of publication** 2008 **Country of publication** Netherlands **Ref Id** 335363 **Sub-type** Population-based study	• Data from 11 CP registries contributing to the European Cerebral Palsy Database (SCPE), for children born between 1976 and 1996. • 4584 children with cerebral palsy • 5% were premature, born at <28 weeks gestational age • Children were categorised in the following variables: congenital anomaly, brain malformation and chromosomal anomaly. **Inclusion Criteria** • Children were included in the registry at the age of at least 4 years, but children dying between 2 and 4 years old were included in they had clear signs of cerebral palsy • Only cases coded with congenital hydrocephalus were included (in the ICD coding system, there are codes for both congenital and acquired hydrocephalus) • All cases coded 1 = yes for at least one of the following: congenital anomaly,	• 12% of the total cohort (n=4584) was found to have cerebral malformation. • 72% (n=394/547) of children with congenital malformation had a cerebral malformation. Of these, 25.8% (n=102) presented with microcephaly, 18.7% (n=74) presented with hydrocephaly, 18.2% (n=72) had reduction reformity of brain, 8.6% (n=34) had cerebral cyst, 3.2% (n=13) presented with corpus callosum anomalies, 16.2% (n=64) had other specified brain malformations and 7.6% (n=30) presented with unspecified brain malformations. • In total, 3% (n=12) of the children with CP and cerebral malformation had a GA < 28 weeks, 2% (n=9) had a GA between 28 and 31 weeks, 14% (n=54) had a GA between 32 and 36 weeks and 71% (n=279) had a GA ≥ 37 weeks • 9% of the children with a cerebral malformation had spastic unilateral CP; 8% had bilateral spasticity; 14% had ataxia; 6% had dyskinesia.	Study supported by the European Comission Funds **Quality Items** HIGH The quality of the evidence has been assessed by using the tool developed and published by Munn et al. 2014. The criteria address the following issues: · Ensuring a representative sample · Ensuring appropriate recruitment · Ensuring an adequate sample size · Ensuring appropriate description and reporting of study subjects and setting · Ensuring data coverage of the identified sample is adequate · Ensuring the condition was measured reliably and objectively · Ensuring appropriate statistical analysis · Ensuring confounding factors/subgroups/differences are identified and counted for

Bibliographic details	Number of Participant & Participant Characteristics	Results	Reviewer comment
	congenital brain anomaly and chromosomal anomaly. **Exclusion Criteria** Cases with ICD codes or written text for congenital infections (without malformations), metabolic, neonatal events, other diseases and no or uncertain information. **Demographics - Total** 394 **Cases** 394 **Statistical method** Prevalence rates were given per 1000 or 10000 livebirths. Chi square test was used for comparison of proportions. **Diagnostic criteria** • congenital brain malformation was defined as an antenatal developmental abnormality of the brain including developmental abnormality due to the infectious agents and excluding postnatal developmental anomaly		**Other information** • The total number of children with non-cerebral malformations was 97 • Prevalence of malformations was compared to published data on livebirths from a European database of congenital malformations (EUROCAT)

Bibliographic details	Number of Participant & Participant Characteristics	Results	Reviewer comment
	(acquired hydrocephaly and microcephaly) • Definition of cerebral palsy based on phenomenology not on etiology in order to account for different levels of diagnostic facilities and knowledge in different time periods and different countries **Reference Test** Congenital brain malformations (microcephaly, hydrocephaly)		
Authors Cans, C., McManus, V., Crowley, M., Guillem, P., Platt, M. J., Johnson, A., Arnaud, C. **Year of publication** 2004 **Country of publication** France **Ref Id** 410018	**Cohort population** • Children with post-neonatal cerebral palsy born 1976-90 were identified from a European database and seven registers were included (Surveillance of Cerebral Palsy in Europe collaboration) (SCPE) • There were 347 cases of cerebral palsy elegible for the study of which 206 (59.4%) were male. The post-neonatal cases with an age of onset above 24 months (n=53), and the cases not born in the area (n=20) were both excluded from further analysis. The remaining 252 cases were included for analysis. Among	**Results** • Overall, 50% (n=125) of children were attributed to an infection as the aetiology of the cerebral palsy. In total, 19.2% (n=48) of the cases had a meningitis/encephalitis type of which the infectious agents responsible were: herpes virus in 16 % (n=8) , haemophilus influenzae in 14.2% (n=7), pneumococcus in 10.4% (n = 5), meningococcus in 6.2% (n=3), E coli in 4.1% (n=2), other virus in 8.3% (n=4), proteus in 2% (n=1), streptococcus in 2% (n=1) and 35.4% (n=17) of the cases were had an unknown etiology. • In total, 12% (n=30) of the cases presented a head injury as the aetiology of the cerebral palsy. Of these, 2.8% (n=7) had a road traffic accident, 4% (n= 10) have had other traumatic head injury and 5.2% (n=13) had a non-accidental injury. • Of the total cases included, 20% (n= 50) had a vascular episode. Of these, 8% (n=20) had a post-heart surgery, 3.6% (n=9) has a post-other surgery, 2% (n=5) presented associated with congenital heart disease and 6.4% (n=16) had other (cerebrovascular accident). Among the other infections there were cases of brochiolitis, endocarditis, septicaemia, and other not well defined infections (viral, febrile convulsion, acute epiglottis) • Based on 91 post-neonatal cerebral palsy cases, there was no statistically significant evidence of a lower average gestational age for cerebral palsy cases of pot-neonatal origin (P=0.39). The proportion of preterms among the post-neonatal	**Funding** Work supported by European Comission funds **Quality Items** MODERATE (based on the tool developed and published by Munn et al. 2014) • Reporting bias:Data not reported by GA • Post-neonatal origin cerebral palsy only

Bibliographic details	Number of Participant & Participant Characteristics	Results	Reviewer comment
Sub-type Retrospective cohort study	these 252 cases, 77% had their onset during the first year after birth (range 67.6% to 84.6% in the different centres). • There were more males (59.4% or 206/347) than females • The age of onset of cerebral palsy was known for 94% (325/347) of cases; it ranged from 1 to 132 months with a mean value of 16 months. • The aetiology was known for 99% of the cases (250/252) **Inclusion Criteria** Post-neonatal cerebral palsy cases occurred between the 28th day after birth and the 25th month old **Exclusion Criteria** • Post-neonatal cases with an age of onset above 24 months • Cases not born in the area • Cases in which an insult occurred after the first week of life **Demographics - Total**	group was 8.8% compared with 46.1% among the non-post-neonatal cerebral palsy cases.	**Other information**

Bibliographic details	Number of Participant & Participant Characteristics	Results	Reviewer comment
	252 **Cases** 252 **Statistical method** • Logistic regression was used to investigate possible between-centre rate differences, and trends over time. • Fisher's exact test was used when necessary • ANOVA procedure for comparing the age of onset within different subgroups **Diagnostic criteria** • Post-neonatal cerebral palsy cases were identified by a recognised putative event occurring after the 28th day after birth • Morbidity information was coded using the ICD-10 taxonomy **Reference Test** Infection, head injuries, acquired traumatic injury, miscellaneous		

Bibliographic details	Number of Participant & Participant Characteristics	Results	Reviewer comment
Authors Bax,M., Tydeman,C., Flodmark,O. **Year of publication** 2006 **Country of publication** United Kingdom **Ref Id** 220884 **Sub-type** Population-based study	**Cohort population** • 585 children born between 1996 and 1999 were identified as eligible to participate in the study and 431 of these children were included and assessed • 81.4% (n=351) children had a brain MRI scan assessed for the study. The ages at which the scan was taken ranged between 1 to 87 months, with a mean age of 38 months • 61.9% (n=266) of the children were male • Of the included children, 26.2% (n=113) presented with hemiplegia, 34.4% (n=148) had diplegia, 18.6% (n=80) spastic quadriplegia, 14.4%(n=62) dyskinesia, 3.9%(n=17) ataxia and 2.6%(n=11) presented with other type of cerebral palsy • At the time of original examination, the children ranged in age from 12 to 91 months, with a mean age of 46 months (9 children were seen at <23 months). Where children were assessed before the age of 3 years, a request was made to reassess at a later date and to confirm the diagnosis of cerebral palsy and note any changes in presentation.	**Results** • Of the total number of women, 39.5% (158/400) reported an infection during the pregnancy. Of these, 19.2% (n=76) reported a urinary tract infection. • 54.5% (n=235) of children were born at term, 10.9% (n=47) of children were born preterm (<28 weeks), 16% (n=69) were born between 28 and 31 weeks, and 18.3% (n=79) were born between 32 and 36 weeks of gestation. • White-matter damage of immaturity (WMDI, including PVL) accounted for 42.5% (n=181) of the included children. Of these, 71.3% (n=87) of children presented with diplegia, 34.1% (n=31) with hemiplegia, and 35.1% (n=20) with quadriplegia. • Basal ganglia and thalamic damage accounted for 12.8% (n=55) of the included children. It was mainly associated with dystonic CP, which accounted for 75.6% (n=34) of the basal ganglia group. This type of damage was seen in children with spastic quadriplegia (n=7) and diplegia (n=4). There were no children with hemiplegia. • 7.4% (n=31) of the included children presented with focal infarcts, of those, 27.5% (n=8) children had hemiplegia. • 9.1% (n= 32) children were found to have malformations (lissencephaly, polymicrogyria, schizencephaly, and cortical dysplasia). These were most common in the hemiplegia group (n=12). 6 of the malformations were thought to be a result of specific in utero infections, such as cytomegalovirus. • 7.1% (n=25) of children had findings on the scans that did not fit into the aforementioned groups. They were found across all clinical cerebral palsy subtypes. • Normal MRI findings were present in 11.7% (n=50) of the children	**Funding** Ongoing funding for this study is provided by the Castang Foundation, having been initiated by the Little Foundation **Quality Items** HIGH (based on the tool developed by Munn et al. 2014). **Other information** Many of the included cases also have clinical findings not related to motor disorder, and failure to include this in any definition and classification of CP has recently been emphasised. 28% of the children had epilepsy: the rate was highest (50%) among the quadriplegia group and lowest (16%) in children with diplegia. Communication problems were present in 58% of the total group- highest in the dyskinesia and quadriplegia groups and lowest in the diplegia and hemiplegia groups.

Bibliographic details	Number of Participant & Participant Characteristics	Results	Reviewer comment
	• An interview questionnaire with the parents provided information about family history and prenatal, pregnancy and birth informations • Hospital obstetric notes were sought to verify birth data given by parents and to collect extra information on the birth and neonatal period **Inclusion Criteria** Children after the age of 2 years or more **Exclusion Criteria** See inclusion criteria and demographic characteristics. **Demographics - Total** 431 **Cases** 431 **Statistical method** • X^2 tests were used to asses the statistical significance of associations between categorical variables		

Bibliographic details	Number of Participant & Participant Characteristics	Results	Reviewer comment
	• SPSS software, version 14.0 was used to analyse data **Diagnostic criteria** • Cerebral palsy was defined as a group of non-progressive motor disorders of movement and posture due to a defect of lesion of the developing brain. • CP was assessed by lead clinicians with experience in the matter. When possible, these clinicians examined the study children within their centers. • Cranial MRI - a standardised scoring system was specifically developed for this study. **Reference Test** Maternal infections, white-matter damage including PVL, basal ganglia lesions, malformations, focal infarcts, miscellaneous lesions.		
Authors O'Callaghan, M. E., MacLennan, A. H., Gibson, C.	**Cohort population** • 587 individuals were included in the analysis • A total of 191 (33.4%) children presented with	**Results** • Birth before 32 weeks of gestational age was a major risk factor for cerebral palsy when compared with all other gestational ages for 29.3% (n=170) of children and	**Funding** Funded by the Australian National Health and Medical Research Council and the Cerebral Palsy foundation.

Bibliographic details	Number of Participant & Participant Characteristics	Results	Reviewer comment
S., McMichael, G. L., Haan, E. A., Broadbent, J. L., Goldwater, P. N., Dekker, G. A., Australian Collaborative Cerebral Palsy Research, Group **Year of publication** 2011 **Country of publication** Australia **Ref Id** 339538 **Sub-type** Retrospective cohort study	hemiplegia, 149 (26%) had diplegia, 145 (25.3%) had quadriplegia and 70 (12.2%) presented other cerebral palsy types • Children and young people between 5 and 18 years old • Data were taken from state perinatal data sets or by maternal questionnaire **Inclusion Criteria** • Children aged between 5 and 18 years old • Born in Australia • Caucasian background **Exclusion Criteria** • Individuals with missing variables were excluded from tests examining that variable **Demographics - Total** 587 individuals **Cases** 587 individuals	also when compared with first-term born neonates, with a total number of cases of 34.1% (n=170) children • 20.2% (n=83) of the children born at 32 to 36 weeks were also at increased risk of cerebral palsy compared with term neonates and a total of 14.3%(n=83) were at increased risk of cerebral palsy when compared with all other gestational ages. MATERNAL INFECTIONS: • Overall, 39.9% (n=243) of cases reported having had any type of maternal infection during pregnancy. • 2.9%(n=17) of women reported having had a herpes between the 0 and 20 week of gestational age, by 2% (n=12) of women in between their 21 and 40 week, by 1.2% (n=7) of women within 1 weeks after birth • 2.2% (n=13) of women reported having had fever between the 0 and 20 week of GA, 3.4% (n=20) of women reported fever between the 21 and 40 week of gestational age, and 1% (n=6) of women reported the presence of fever within 1 week after birth • The presence of cytomegalovirus, Ross River virus, chicken pox, staphylococcus, streptococcus, cystitis, wound infections and urinary track infections was reported by 2.7% (n=16) of women in between the 0 and 20 week of gestational age , by 5.6% (n=33)of women between the 21 and 40 week of gestational age and by 3.4% (n=20) of the women. • Labor and delivery complicated by infection was reported by 4.9% (n=29) of the women. • Gastrointestinal infections were reported by 2.4% (n=14) in between their 0 and 20 GA, by 3.7% (n=22) of women in between their 21 and 40 week and by 0.3% (n=2) of women within 1 week after birth. • Upper respiratory tract and gastrointestinal infections were reported by 10.1% (n=59) of the women in between their 0-20 weeks of GA, by 9.4 (n=55) of women in between their 21 and 40 weeks of GA and by 1.2% (n=7) of women within 1 weeks after birth.	**Quality Items** MODERATE (based on the tool developed and published by Munn et al. 2014) • Recall bias: Use of maternal questionnaire to identify infections (and other variables related to the cerebral palsy outcome) • Data not reported by either gestational age, or cerebral palsy severity/motor distribution. • Selection bias: population only recruited in Australia and only individuals with Caucasian background were included **Other information**

Bibliographic details	Number of Participant & Participant Characteristics	Results	Reviewer comment
	Statistical method • X^2 test and PASW 17.0.2; p<.05 was considered significant. • Where cell counts were less than five, Fisher exact test was used • Note that the original study compared individuals with cerebral palsy with individuals with no cerebral palsy **Diagnostic criteria** • Maternal health questionnaire • Perinatal data • Cerebral palsy diagnosis data were retrieved by linkage to cerebral palsy registers in each state and by contacting specialist clinicians where a link could not be made **Reference Test** Maternal infection during pregnancy: any, upper respiratory infections, gastrointestinal, herpes, fever, other infections (including cytomegalovirus, Ross River virus, chicken pox, staphylococcus, streptococcus,		

Bibliographic details	Number of Participant & Participant Characteristics	Results	Reviewer comment
	cystitis, wound infections and UTI), labour an delivery complicated by infection, urinany tract infection (data reported by timing infection).		
Authors Ipek, B., Ecevit, C., Ipek, I., Kocabas, O., Kavakli, T., Ozturk, A. **Year of publication** 2007 **Country of publication** Turkey **Ref Id** 336488 **Sub-type** Retrospective cohort study	**Cohort population** • 371 cases of cerebral palsy • 22.6% of children were premature • 38.8% (n=144) of the cases were female • Age ranged between 7 and 216 months (average 96.50 ± 40.09 months) • Selected cases were followed up between January 1984 and December 2004 **Inclusion Criteria** Not reported **Exclusion Criteria** Not reported **Demographics - Total** **Cases** **Statistical method** Statistical package for Social Sciences 10.0 was used for statistical analysis. Group parametric (mean)	**Results** • Prematurity was present in 22.6 (n=84) of cases • CNS infections was present in 6.5% (n=24) of cases • Kernicterus was present in 4.6% (n=17) of the women	**Funding** Not reported **Quality Items** LOW (based on the tool developed and published by Munn et al. 2014) • Hospital based population • Unclear how cerebral palsy diagnosis was made • Lack of details in reporting how caused of cerebral palsy were ascertained • Data not reported by either gestational age, or cerebral palsy severity/motor distribution **Other information**

Bibliographic details	Number of Participant & Participant Characteristics	Results	Reviewer comment
	comparisons were tested by one-way analysis of variance (ANOVA) and independent-samples t test. Tukey HSD test was used to test the hypothesis regarding sampling distribution. Values of $p < 0.05$ were considered as significant. **Diagnostic criteria** • Cerebral palsy defined as a nonprogressive neuropathological condition which is characterised by abnormal control of posture or motion. It develops secondary to a central nervous system lesion, injury or malformation. • Diagnostic imaging findings involved either computed tomography (CT) or magnetic resonance imaging (MRI). All cases having normal CT evaluations also underwent MRI because of the probability of the insensivity of CT in detecting abnormality of this type. Cases involving unremarkable CT avaluation and not followed up with MRI were excluded. **Reference Test** Kernicterous		

<table>
<tr><th>Bibliographic details</th><th>Number of Participant & Participant Characteristics</th><th>Results</th><th>Reviewer comment</th></tr>
<tr>
<td>

Authors

Reid, S.M., Dagia, C.D., Ditchfield, M.R., Carlin, J.B., Reddihough, D.S.

Year of publication

2014

Country of publication

Australia

Ref Id

316891

Consecutive recruitment

Sub-type

Population-based study

</td>
<td>

Cohort population

Publications from 1995 to 2012 reporting imaging findings in population cohorts were selected through a literature search. Studies from 5 different sites were included:

- Sweden N = 289; data from a lon-running CP registry covering a well defined area of western Sweden
- Quebec N = 213; data extracted from the Quebec CP registry
- Victoria N = 563; data from the Victorian CP register
- California N = 78
- Germany N = 56

Inclusion Criteria

- Data included from articles originating from industrialised nations in which a population sample was used
- Studies included based on MRI findings, and on CT findings when CT accounted for less than half of the total number of scans assessed.

Exclusion Criteria

</td>
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Results

MALFORMATIONS	Total						
weighted mean % (95%CI)	10.9 (9.0 – 12.7)						
Gestational age	< 28 w	28 - 31 w	32 – 36 w	> 37 w			
weighted mean % (95%CI)	6.9 (4.1 – 9.6)	13.2 (10.4 – 16.0)					
CP subtype	**Spastic hemiplegia**	**Spastic diplegia**	**Spastic quadriplegia**	**Bilateral spasticity**	**All spasticity**	**Ataxia**	**Dyskinesia**
weighted mean % (95%CI)	13.2 (9.9 – 16.5)	5.2 (2.1 – 8.2)	15.7 (10.7 – 20.7)	10.4 (7.8 – 13.0)	11.4 (9.1 – 13.6)	18.0 (4.8 – 31.2)	3.9 (0.0 – 10.6)
GMFCS level	**I/II**	**III**	**IV**	**V**			
weighted mean % (95%CI)	8.2 (5.9 – 10.6)	6.6 (1.7 – 11.4)	12.2 (6.7 – 17.7)	18.2 (12.2 – 24.2)			

WHITE MATTER DAMAGE	Total
% range	19.2 - 45.3

</td>
<td>

Funding

funded by the William Henry and Vera Ellen Houston Memorial Trust Fund and the CP Alliance.

Quality Items

HIGH (based on the tool developed by Munn et al. 2014)

Other information

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</table>

<table>
<tr><th>Bibliographic details</th><th>Number of Participant & Participant Characteristics</th><th>Results</th><th>Reviewer comment</th></tr>
<tr>
<td></td>
<td>

Data were excluded if fewer than 100 scans were assessed
If less than half the population sample were imaged
When possible, children with CP associated with a postneonatal injury were excluded.

Demographics - Total

Cases

Statistical method

For each study, the proportions of each imaging pattern were tabulated, with their 95% CI, for all CP cases and for subgroups based on term or preterm birth, CP subtype, and GMFCS level.
The heterogeneity of the estimates for each imaging pattern was assessed using the I^2 statistic.
Data were synthesised using weighted means only if heterogeneity was low.
Analysis was performed using STATA 12.0 software.

</td>
<td>
<table>
<tr><td>CP subtype</td><td>Spastic hemiplegia</td><td>Spastic diplegia</td><td>Spastic quadriplegia</td><td>Bilateral spasticity</td><td>All spasticity</td><td>Ataxia</td><td>Dy</td></tr>
<tr><td>% range</td><td>18.3 - 47.4</td><td>30.6 - 50.9</td><td>20.3 - 27.6</td><td>23.5 – 66.1</td><td>21.5 - 46.6</td><td>24%</td><td>6.7</td></tr>
<tr><td>GMFCS level</td><td>I/II</td><td>III</td><td>IV</td><td>V</td><td></td></tr>
<tr><td>% range</td><td>22.2 – 49.7</td><td>16.7 – 43.7</td><td>12.8 – 45.9</td><td>7.7 – 29.3</td><td></td></tr>
</table>
</td>
<td></td>
</tr>
</table>

Bibliographic details	Number of Participant & Participant Characteristics	Results	Reviewer comment
	Controls **Diagnostic criteria** WHITE MATTER INJURY • Victoria: Signal abnormality and⁄or volume loss in the periventricular and⁄or deep white matter. Ventricular dilatation, scalloping of the ventricles, and cysts may also be present • Quebec: Abnormality/volume loss in the periventricular and/or deep white matter • California: Periventricular white matter lesions, intraventricular haemorrhage, periventricular venous infarction • Germany: Periventricular areas of signal hyperintensity on T2-weighted images (diffuse and mild signal increase wasnot taken into account) • Sweden: White matter lesions MALFORMATIONS • Victoria: Abnormal formation of the brain, including cortical dysplasia, polymicrogyria, lissencephaly, pachygyria, heterotopia,		

Bibliographic details	Number of Participant & Participant Characteristics	Results	Reviewer comment
	schizencephaly, cerebellar hypop lasia or dysgenesis, holoprosencephaly, hydranencephaly, hydrocephalus, and agenesis of the corpus callosum. This category also includes the sequelae of intrauterine infection, which may manifest as dystrophic, predominantly periventricular, calcification with or without focal white matter destruction, microcephaly, and cerebellar hypoplasia • Quebec: Included cortical dysplasia, polymicrogyria, lissencephaly, pachygyria, heterotopias, schizencephaly , cerebellar hypoplasia or dysgenesis, holoprosencephaly, hydranencephaly, hydrocephalus, and agenesis of the corpus callosum. Infection defined as dystrophic, predominantly periventricular, calcifications with or without focal white matter destruction, and cerebral hypoplasia in conjunction with a known positive serology • California: Included polymicrogyria, schizencephaly, large heterotopia associated with callosal agenesis and multiple interhemispheric		

Bibliographic details	Number of Participant & Participant Characteristics	Results	Reviewer comment
	cysts, congenital hydrocephalus, agenesis of the corpus callosum with absent septum pellucidum, and diffuse calcifications attributed to congenital cytomegaloviral infection • Germany: Included polymicrogyria, schizencephaly, lissencephaly, Arnold–Chiari malformation, genetic myelin defect • Sweden: Maldevelopments **Reference Test** • white matter injury • malformations		

I.3 Clinical and developmental manifestations of cerebral palsy

Bibliographic details	Participants	Tests	Methods	Outcomes and results	Comments
Full citation Adde,L., Rygg,M.,	**Sample size** Total: n = 74 Of these:	**Tests** Index test:	**Methods** **Details** Infants had General	**Results** Risk groups:	**Limitations NICE manual Appendix I: Methodology**

<table>
<tr><th>Bibliographic details</th><th>Participants</th><th>Tests</th><th>Methods</th><th>Outcomes and results</th><th>Comments</th></tr>
<tr>
<td>Lossius,K., Oberg,G.K., Stoen,R., General movement assessment: predicting cerebral palsy in clinical practise, Early Human Development, 83, 13-18, 2007

Ref Id

322507

Country/ies where the study was carried out

Norway

Study type

Prospective cohort study

Aim of the study
To demonstrate to what extent general movement assessment (GMA) predicted CP.</td>
<td>Term : n = 42
Preterm: n = 32

Characteristics
<u>Gender:</u>
Boys: n = 33
Girls: n = 41

<u>Age at assessment</u>: all assessments were carried between 10 to 18 weeks post-term.
<u>Corrected age at neurological outcome</u>: 23 months (range 9 - 31 months) if based on medical information or 26 months (range 9 - 34 months) if based on parent's report.

<u>In Preterm group (n = 32):</u>
Median gestational age = 30.5 weeks (range 24 - 36 weeks)
median birth weight = 1367 g (range 540 - 3800 g)

<u>High risk</u> (see methods for high risk classification)
In preterm group, 40% (n = 17) were classified as high risk.
In term group, 25% (n = 8) were classified as high risk.

Inclusion Criteria
High risk infants (term and preterm) were included from the NICU and low-risk preterm infants were included from the maternity ward. In addition, 9 high risk infants were included from four other hospitals in Norway. High risk infants</td>
<td>General Movement Assessment using video recordings at 10 to 18 weeks post-term.
High risk classification (criteria detailed in methods).
<u>Reference (Gold Standard):</u>
Neurological outcome at 2 years assessed by multi-disciplinary team involving:consultant neonatologist, child physiotherapist, occupational therapist, specialist in neuropsychology and special education therapist. Neuroimaging results (MRI and CT scans) were available for all high risk infants and all very low birth weight</td>
<td>Movement Assessment (GMA) using video recordings performed at 10 - 18 weeks post-term in order to study the absence or presence of normal fidgety movements.
<u>GMA</u>
Recordings performed according to standard method for GM observation (Einspieler et al, 1997) at least 30 mins after feeding and lasted for several minutes during periods of active wakefulness. The infant was partially dressed (vest and nappy), lying supine. Recordings were repeated several times (1 to 5) to ensure quality of movements</td>
<td>High: n = 25 classified as high risk, including n = 17 preterm and n = 8 term with other risks (see method details)
Low: n = 49, of which n = 25 born preterm.

Index test: <u>Quality of fidgety movement</u> (GMA)

<table>
<tr><th>Quality of fidgety movements</th><th>CP</th><th>No CP</th><th>Uncertain</th><th>Total</th></tr>
<tr><td>Abnormal</td><td>10</td><td>1</td><td>2</td><td>13</td></tr>
<tr><td>Normal</td><td>0</td><td>60</td><td>1</td><td>61</td></tr>
</table>
Sensitivity: 100% (95% CI: 68.9 - 100)
Specificity: 98.3% (95% CI: 95 - 100)
Positive likelihood ratio: 61 (95% CI: 8.73 - 426)
Negative LR: not calculable (false negative = 0)
Positive predictive value (PPV): 90.91% (95% CI: 58.7 - 98.5)
NPV: 100% (95% CI: 93.98 - 100)

Index test: <u>Risk classification</u>

<table>
<tr><th>Risk classification</th><th>CP</th><th>No CP</th><th>Uncertain</th><th>Total</th></tr>
<tr><td>High risk</td><td>10</td><td>12</td><td>3</td><td>25</td></tr>
</table>
</td>
<td>checklist: prognostic studies

1.1 The study sample represents the population of interest with regard to key characteristics, sufficient to limit potential bias to the results: unclear (recruitment has not been adequately described)
1.2 Loss to follow-up is unrelated to key characteristics (that is, the study data adequately represent the sample), sufficient to limit potential bias: yes (in total, 4 families did not participate because they did not give consent to contact their family physician and/or the public health nurse)
1.3 The prognostic</td>
</tr>
</table>

Bibliographic details	Participants	Tests	Methods	Outcomes and results	Comments
Study dates Not reported. **Source of funding** Work supported by Research Council of Norway. Not reported if funds were provided.	were included based on medical history and cerebral ultrasound results. **Exclusion Criteria** Not reported.	babies had ultrasound scans. Motor and mental skills were assessed using validated tests (AIMS test at 9 and 15 months and Bayley score for motor and mental function at 24 months). Additionally, all parents filled out questionnaire about whether their child has CP or not.	could be accurately judged. Fidgety movements were defined according to Prechtl (1997) as circular movements of small amplitude, moderate speed and variable acceleration of neck, trunk and limbs in all directions. Fidgety movements were classified as abnormal if they were absent or abnormal in nature. <u>High risk classification:</u> Infants were classified into high-risk group if they had one or more well-known perinatal risk factors: • Perinatal stroke	Low risk | 0 | 49 | 0 | 49 Sensitivity: 100% (95% CI: 68.9 - 100) Specificity: 80.33% (95% CI: 68.2- 89.39) Positive likelihood ratio: 5.08 (95% CI: 3.06 - 8.44) Negative LR: not calculable (false negative = 0) Positive predictive value (PPV): 45.45% (95% CI: 24.4 - 67.8) NPV: 100% (95% CI: 92.7- 100) Note: 'Uncertain' is omitted from calculations. Of the 10 infants diagnosed with CP, 4 had Quadriplegia, 4 had right hemiplegia, 1 had left hemiplegia and 1 was unspecified CP.	**factor of interest is adequately measured in study participants, sufficient to limit potential bias:** yes (the Prechtl classification system for General Movement Assessment [GMA] was used and during observation, the setting was the same for all study participants) **1.4 The outcome of interest is adequately measured in study participants, sufficient to limit potential bias:** unclear (duration of follow-up was provided, the neurological outcome was assessed by a multidisciplinary team and the same consultant in neonatology did the clinical neurological examination for all children,

Bibliographic details	Participants	Tests	Methods	Outcomes and results	Comments
			• Perinatal asphyxia • Intra / peri-ventricular haemorrhage • Severe hypoglycaemia and E.coli sepsis • Birth weight (BW) < 1000 g and/or gestational age (GA) < 28 weeks • Bronchopulmonary dysplasia with supplementary o2 at discharge <u>Statistical analysis</u> Outcome data were compared with data collected from the GMA analysis. Confidence intervals for sensitivity and specificity were calculated.		however the diagnostic criteria for cerebral palsy was not described) **1.5 Important potential confounders are appropriately accounted for, limiting potential bias with respect to the prognostic factor of interest:** N/A **1.6 The statistical analysis is appropriate for the design of the study, limiting potential for the presentation of invalid results:** yes **Other information**

Bibliographic details	Participants	Tests	Methods	Outcomes and results	Comments
Full citation Allen,M.C., Alexander,G.R., Using gross motor milestones to identify very preterm infants at risk for cerebral palsy, Developmental Medicine and Child Neurology, 34, 226-232, 1992 **Ref Id** 315667 **Country/ies where the study was carried out** USA **Study type** Population-based study **Aim of the study** To evaluate the efficacy of 10 gross motor	**Sample size** n = 173 high risk preterm infants **Characteristics** **Inclusion Criteria** High risk preterm infants who had been discharged from the John Hopkins NICU with multiple perinatal and demographic risk factors and had been followed in a comprehensive developmental clinic. **Exclusion Criteria** Not stated.	**Tests** Index test: Developmental assessments (performed every 2 months) including a history of motor milestone attainment and a neurodevelopmental examination. Reference test: Motor outcome was determined at 18 to 24 month visit and CP was diagnosed on basis of a significantly abnormal neurological examination e.g. spasticity and/or variable tone and/or persistent primitive and pathological reflexes) and functional impairment.	**Methods** Setting John Hopkins Hospital NICU Details 10 gross motor milestones were analysed: • Roll over from supine to prone • sit with arm-support • sit without arm support • creep • crawl • come to a sitting position from prone to supine independently • pull to a stand from crawl or sit • cruise	**Results** Efficacy of motor delay determined by population norms to predict CP in white very preterm infants: **Sit without support:** Population norms Sensitivity: 93% Specificity: 71% PPV: 52% Race-specific norms (from cohort) Sensitivity: 93% Specificity: 75% PPV: 56% **Come to sit** Population norms Sensitivity: 87% Specificity: 67% PPV: 48% Race-specific norms (from cohort) Sensitivity: 87% Specificity: 67% PPV: 48% **Walk independently** Population norms Sensitivity: 100% Specificity: 75% PPV: 58% Race-specific norms (from cohort) Sensitivity: 100% Specificity: 75% PPV: 58%	**Limitations NICE manual Appendix I: Methodology checklist: prognostic studies** **1.1 The study sample represents the population of interest with regard to key characteristics, sufficient to limit potential bias to the results:** unclear (recruitment has not been described) **1.2 Loss to follow-up is unrelated to key characteristics (that is, the study data adequately represent the sample), sufficient to limit potential bias:** N/A **1.3 The prognostic factor of interest**

Bibliographic details	Participants	Tests	Methods	Outcomes and results	Comments
milestones in predicting cerebral palsy among 173 high risk infants. **Study dates** Not reported. **Source of funding**			• walk independently Relevant milestones will be reported in results. Criteria for delay was 1.25 times the mean age at attainment of the milestone in the full term population. The results from these 173 high risk infants were compared with total population and race-specific norms for white and non-white infants (as it was stated that "non-white infants have been observed to attain motor milestones earlier than white infants").	Efficacy of motor delay determined by population norms to predict CP in non-white very preterm infants: **Sit without support:** Population norms Sensitivity: 88% Specificity: 76% PPV: 38% Race-specific norms (from cohort) Sensitivity: 94% Specificity: 65% PPV: 31% **Come to sit** Population norms Sensitivity: 88% Specificity: 82% PPV: 45% Race-specific norms (from cohort) Sensitivity: 94% Specificity: 68% PPV: 33% **Walk independently** Population norms Sensitivity: 94% Specificity: 80% PPV: 44% Race-specific norms (from cohort) Sensitivity: 94% Specificity: 73% PPV: 37%	**is adequately measured in study participants, sufficient to limit potential bias:** yes (the same criteria for assessing motor milestones was applied for all participants) **1.4 The outcome of interest is adequately measured in study participants, sufficient to limit potential bias:** no (the criteria used for diagnosing the participants with cerebral palsy was specified in the text, however does not match with any pre-specified diagnostic criteria) **1.5 Important potential confounders are appropriately accounted for, limiting potential bias with respect to the prognostic**

<table>
<tr><th>Bibliographic details</th><th>Participants</th><th>Tests</th><th>Methods</th><th>Outcomes and results</th><th>Comments</th></tr>
<tr><td></td><td></td><td></td><td></td><td></td><td>factor of interest: unclear (but results were stratified by white preterm infants and non-white very preterm infants)
1.6 The statistical analysis is appropriate for the design of the study, limiting potential for the presentation of invalid results: No (controls have been extracted from a wider population and CI have not been provided)</td></tr>
<tr><td>Full citation

Allen,M.C., Alexander,G.R., Screening for cerebral palsy in preterm infants: delay criteria for motor milestone attainment, Journal of Perinatology,</td><td>Sample size
Total: n=173
All high risk preterm (<33 weeks gestation)

Characteristics
Birth weight, mean (SD): 1030grams (266)
Gestational age (SD): 27.8 weeks (2.2)
Gender, %male: 53%
Race, % non white: 65%
Intraventricular haemorrhage: None (54%), Grades 1 and 2 (30%), Grades 3 and 4 (16%)</td><td>Tests
Every clinic visit (~ 2- 4 months): history of attainment of 10 motor milestones (carried out in the manner of Capute et al)
18-24months from term: Motor outcome determined.</td><td>Methods
Details:
The 10 motor milestones assessed:

• Roll prone to supine
• Roll supine to prone</td><td>Results
31/173 Cerebral palsy (18%)
42/173 (24%) neuromotor dysfunction (mild neuromotor abnormalities with no or very mild functional impairment)
100/173 (58%) normal
Milestone attainment was done by chronological age with prematurity adjustment. N value for each milestone attained varies due to it being recall data.
<table><tr><td>Motor milestone</td><td>Efficacy measure</td><td>12.5% delay</td><td>25% delay</td><td>37.5% delay</td><td>50% dela</td></tr></table></td><td>Limitations NICE manual Appendix I: Methodology checklist: prognostic studies
1.1 The study sample represents the population of interest with regard to key characteristics,</td></tr>
</table>

Bibliographic details	Participants	Tests	Methods	Outcomes and results	Comments
14, 190-193, 1994 **Ref Id** 315668 **Country/ies where the study was carried out** USA **Study type** Case-control study **Aim of the study** To determine whether a delay criteria for attaining motor milestones in preterm babies is successful in screening for cerebral palsy. **Study dates** Not described. **Source of funding** Not described.	**Inclusion Criteria** High risk preterm infants (<33 weeks gestation) discharged from Johns Hopkins neonatal intensive care unit. Followed up at the Johns Hopkins Hospital/ Kennedy Kneger Institute for ≥ 18 months. **Exclusion Criteria** None described.	Cerebral palsy diagnosis: Both persistently abnormal neurologic examination findings (e.g. spasticity or variable tone and/or persistent primitive and pathologic reflexes) and functional impairment.	• Sit with support (tripod sitting) • Sit without support • Creep (with chest and abdomen on the floor) • Come to sit • Crawl (on hands and knees) • Pull to stand (from crawl or sitting) • Cruise (walking holding on to furniture) • Walk Delay in motor milestone attainment was based on the mean ages of 381 normal term births reaching the milestones. They were followed until they were 2 years old (Study by Capute et al.).	Roll prone to supine / Sensitivity / 77% / 70% / 67% / 63% Specificity / 68% / 70% / 80% / 85% Positive predictive value / 34% / 34% / 42% / 47% Roll supine to prone / Sensitivity / 81% / 71% / 71% / 64% Specificity / 73% / 81% / 86% / 91% Positive predictive value / 40% / 45% / 52% / 61% Sit with support / Sensitivity / 93% / 87% / 84% / 84% Specificity / 57% / 73% / 86% / 89% Positive predictive value / 33% / 41% / 58% / 62% Sit without support / Sensitivity / 100% / 90% / 84% / 77% Specificity / 60% / 74% / 85% / 94%	**sufficient to limit potential bias to the results:** unclear (recruitment has not been described) **1.2 Loss to follow-up is unrelated to key characteristics (that is, the study data adequately represent the sample), sufficient to limit potential bias:** N/A **1.3 The prognostic factor of interest is adequately measured in study participants, sufficient to limit potential bias:** yes (the same criteria for assessing motor milestones was applied for all participants) **1.4 The outcome of interest is adequately measured in study participants, sufficient to limit**

Bibliographic details	Participants	Tests	Methods	Outcomes and results						Comments
					Positive predictive value	36%	44%	55%	73%	**potential bias:** no (the crite ria used for diagnosing the participants with cerebral pasly was specified in the text, however does not match with any pre-specfied diagnostic criteria) **1.5 Important potential confounders are appropriately accounted for, limiting potential bias with respect to the prognostic factor of interest:** unclear **1.6 The statistical analysis is appropriate for the design of the study, limiting potential for the presentation of invalid results:** No (controls have been extracted from a wider population and CI have not been provided)
				Creep	Sensitivity	75%	71%	68%	61%	
					Specificity	88%	94%	95%	97%	
					Positive predictive value	62%	74%	79%	85%	
				Come to sit	Sensitivity	97%	87%	87%	87%	
					Specificity	55%	77%	83%	87%	
					Positive predictive value	33%	47%	54%	61%	
				Crawl	Sensitivity	93%	87%	84%	84%	
					Specificity	75%	85%	89%	95%	
					Positive predictive value	47%	57%	85%	79%	
				Pull to stand	Sensitivity	87%	87%	87%	87%	
					Specificity	70%	79%	88%	92%	

<table>
<tr><th>Bibliographic details</th><th>Participants</th><th>Tests</th><th>Methods</th><th>Outcomes and results</th><th>Comments</th></tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>
<table>
<tr><td></td><td>Positive predictive value</td><td>39%</td><td>48%</td><td>63%</td><td>71%</td></tr>
<tr><td>Cruise</td><td>Sensitivity</td><td>93%</td><td>90%</td><td>90%</td><td>84%</td></tr>
<tr><td></td><td>Specificity</td><td>65%</td><td>79%</td><td>91%</td><td>93%</td></tr>
<tr><td></td><td>Positive predictive value</td><td>37%</td><td>49%</td><td>70%</td><td>74%</td></tr>
<tr><td>Walk</td><td>Sensitivity</td><td>97%</td><td>97%</td><td>97%</td><td>97%</td></tr>
<tr><td></td><td>Specificity</td><td>67%</td><td>79%</td><td>81%</td><td>81%</td></tr>
<tr><td></td><td>Positive predictive value</td><td>39%</td><td>50%</td><td>53%</td><td>53%</td></tr>
</table>
</td>
<td>Other information
The same participants were used in the Allen and Alexander 1992, where they looked at correcting the age of milestone attainment for the degree of preterm birth and against race specific norms.</td>
</tr>
<tr>
<td>Full citation

Bouwstra, H., Dijk-Stigter, G. R., Grooten, H. M. J., Janssen-Plas, F. E. M., Koopmans, A. J., Mulder, C. D., van Belle, A., Hadders-Algra, M.,</td>
<td>Sample size
n = 455 3 month old infants

Characteristics
<u>Gender</u>
Female: n = 241
Male: n = 214

<u>Mean birth weight</u> (SD):
3452g (604g)</td>
<td>Tests
<u>Index test</u>:
Definitely abnormal general movements.

<u>Reference</u>:
Non-definite abnormal general movements.</td>
<td>Methods
<u>Setting</u>
6 well-baby clinics, which provide scheduled assessment of children's nutritional and medical needs, performed by public health</td>
<td>Results
<table>
<tr><td></td><td>CP</td><td>No CP</td></tr>
<tr><td>Definite abnormal GMs</td><td>2</td><td>15</td></tr>
<tr><td>non-definite abnormal GM</td><td>1</td><td>437</td></tr>
</table>
</td>
<td>Limitations NICE manual Appendix I: Methodology checklist: prognostic studies
1.1 The study sample represents the population of interest with</td>
</tr>
</table>

Bibliographic details	Participants	Tests	Methods	Outcomes and results	Comments
Predictive value of definitely abnormal general movements in the general population, Developmental Medicine and Child Neurology, 52, 456-461, 2010 **Ref Id** 336166 **Country/ies where the study was carried out** Netherlands (northern region) **Study type** Prospective cohort study **Aim of the study** To assess predictive values of definitely abnormal general movements at 3 months for serious	Mean gestational age in weeks (SD): 39.4 (1.96) Preterm: n = 32 Smoking during pregnancy: 86% Infant breastfed at least until 3 months: n = 236 **Inclusion Criteria** All infants who consecutively visited one of the 6 well-baby clinics at the age of 3 months. **Exclusion Criteria** Infants whose primary caregiver was not fluent in Dutch.		physicians and their assistants. Details Quality of general movements assessed by means of video recording of spontaneous motility in the supine position for at least 5 minutes at the corrected age of 3 months. Assessed by 2 physicians who were unaware of the infants history during the assessment. Quality of movements were classified according to Hadders-Algra et al, 2004 which grouped GM quality into 4 classes: 1. Normal optimal	Sensitivity = 67% (95% CI: 13 - 98%) Specificity = 97% (95% CI: 94 - 98%) Positive predictive value = 12% (95% CI: 2 - 38%) Negative predictive value = 100% (95% CI: 99 - 100%) LR+ = 20.1 (95% CI: 7.8 - 51.5) LR- = 0.34 (0.06 - 1.71)	**regard to key characteristics, sufficient to limit potential bias to the results:** yes **1.2 Loss to follow-up is unrelated to key characteristics (that is, the study data adequately represent the sample), sufficient to limit potential bias:** yes (there was no lost to follow-up) **1.3 The prognostic factor of interest is adequately measured in study participants, sufficient to limit potential bias:** yes (general movement quality was assessed by means of a video recording with a standardised procedure and was assessed by two independent researchers who were unaware of the infant's history

Bibliographic details	Participants	Tests	Methods	Outcomes and results	Comments
neurodevelopmental impairment in a representative sample of the general population. **Study dates** 2001 **Source of funding** None stated.			movements (abundant variation and complexity, fluent) 2. Normal suboptimal movements (sufficiently variable and complex, non-fluent) 3. Mildly abnormal movements (insufficiently variable and complex, non-fluent) 4. Definitely abnormal movements (variations and complexity virtually absent, non-fluent) Inter-observer reliability was good (kappa 0.82, 95% CI: 0.62 - 1.0). At the age of 3 yrs and 9 months, all children could be traced and assessed by		during the assessment) **1.4 The outcome of interest is adequately measured in study participants, sufficient to limit potential bias:** yes (the criteria of the international collaboration Surveillance of Cerebral Palsy in Europe were used) **1.5 Important potential confounders are appropriately accounted for, limiting potential bias with respect to the prognostic factor of interest:** unclear **1.6 The statistical analysis is appropriate for the design of the study, limiting potential for the presentation of invalid results:** yes

Bibliographic details	Participants	Tests	Methods	Outcomes and results	Comments
			the physicians. Interview and assessment at 3 yrs and 9 months were conducted according to the guidelines of well-baby clinics in the Netherlands, which includes standard screening of development according to van Weichen (The Van Wiechenonder zoek - De Baeck-Fassaert motor test, 2005). For diagnosis of Cerebral Palsy, the criteria of the international collaboration Surveillance of Cerebral Palsy in Europe were used. <u>Statistical analysis</u> Analysis focused on the relationship between a definitely		**Other information**

<table>
<tr><th>Bibliographic details</th><th>Participants</th><th>Tests</th><th>Methods</th><th>Outcomes and results</th><th>Comments</th></tr>
<tr><td></td><td></td><td></td><td>abnormal GM quality and major neurodevelopmental impairment at 4 years.

<u>Follow-up</u>
From 3 months to 3 yrs and 9 months.</td><td></td><td></td></tr>
<tr><td>Full citation

Brogna, C., Romeo, D. M., Cervesi, C., Scrofani, L., Romeo, M. G., Mercuri, E., Guzzetta, A., Prognostic value of the qualitative assessments of general movements in late-preterm infants, Early Human Development, 89, 1063-6, 2013

Ref Id

336179</td><td>Sample size
N=640 eligible
66 discarded due to not completing the 2 year assessment; 15 did not perform one GM assessment, 40 did not do the neurological assessment and 20 missed the Bayley assessment. None of these infants had USS abnormalities or transient flares and were said to have similar baseline characteristics to the included population (no data given).
N=574

Characteristics
<table><tr><td>Characteristic</td><td>34 weeks n=82</td><td>35 weeks n=271</td><td>36 weeks n=221</td><td>Total n=57</td></tr><tr><td>Birth weight</td><td>2161 +/- 458g</td><td>2277 +/-325g</td><td>2377 +/-555g</td><td>2299 451</td></tr></table></td><td>Tests
Cranial USS at 1 week post natal age and term equivalent age
Index: GM video recordings at 1 and 3 months post term age
Reference: Neurological and developmental scale assessment at 24 months post term age</td><td>Methods
GM assessment:

• Writhing movements (term age to 9 weeks)- normal, poor repertoire, chaotic or cramped synchronized
• Fidgety movements (approx 7 weeks to 20 weeks) - normal fidgety, abnormal fidgety, absent fidgety</td><td>Results
At two years of age:
n=494 (87%) normal (71 born SGA, 16 suffered RDS, and 9 sepsis)
n=54 (9%) mildly abnormal (5 born SGA, 15 RDS, 7 sepsis)
n=22 (4%) severely abnormal (all affected by CP, 4 SGA, 14 RDS, 4 sepsis)

Significant correlation between GMs and outcome for the writhing period (rs 0.68, p<0.001), fidgety period (rs 0.78, p<0.001).
In relation to the development of CP:
Assessment at 1 month (writhing period): 100% sensitivity, 86% specificity
Assessment at 3 months (fidgety period): 100% sensitivity, 97% specificity

Also reports relationship between USS findings and outcome.</td><td>Limitations NICE manual Appendix I: Methodology checklist: prognostic studies
1.1 The study sample represents the population of interest with regard to key characteristics, sufficient to limit potential bias to the results: yes
1.2 Loss to follow-up is unrelated to key characteristics (that is, the study data adequately</td></tr>
</table>

Bibliographic details	Participants	Tests	Methods	Outcomes and results	Comments
Country/ies where the study was carried out Italy **Study type** Prospective cohort study **Aim of the study** To determine the characteristics of GMs and their predictive value for neuroddevelopmental outcome in a cohort of infants born between 34-36 weeks gestation. **Study dates** January 2006-December 2010 **Source of funding** None described.	<table><tr><td>USS Normal VD, transient flare IVH I-II Persistent flare IVH Cystic PVL</td><td>49 (60%) 4 (5%) 25 (30%) 0 4 (5%)</td><td>218 (80%) 2 (1%) 43 (16%) 6 (2%) 2 (1%)</td><td>194 (88%) 13 (6%) 10 (4%) 2 (1%) 2 (1%)</td><td>461 (80% 19 (3 78 (12% 8 (2. 8 (2.</td></tr><tr><td>Outcome Normal Mildly abnormal Cerebral Palsy</td><td>68 (83%) 7 (8.5%) 7 (8.5%)</td><td>243 (90%) 21 (8%) 7 (2%)</td><td>187 (85%) 26 (12%) 8 (3%)</td><td>498 (87% 54 (9 22 (4</td></tr></table> **Inclusion Criteria** Infants born between 34-36 weeks at the Neonatal Unit of the University of Catania (Level II and Level III neonatal intensive care center admitting high risk patients. Gestational age calculated from USS at 14-16 weeks. **Exclusion Criteria** Presence of congenital anomalies Incomplete follow up program		Two assessors reviewed the videos rating the quality of the GMs (according to Prechtl's method). They were blinded to the infants clinical history. Neuromotor outcome/ presence of CP assessed at 24 months using a structured examination in conformity with an extension of Touwen's criteria. Those without signs of CP were then classed as normal, mildly abnormal or severely abnormal. 100 infants had two assessors review their videos. The inter observer correlation was 0.89. The remaining were reviewed		**represent the sample), sufficient to limit potential bias:** N/A **1.3 The prognostic factor of interest is adequately measured in study participants, sufficient to limit potential bias:** yes (cranial ultrasound was performed by an experienced neonatologist following a pre-set and standardised criteria and the general movements assessment protocol was also standardised). **1.4 The outcome of interest is adequately measured in study participants, sufficient to limit potential bias:** yes (presence and type of cerebral palsy were evaluated using a structured

Bibliographic details	Participants	Tests	Methods	Outcomes and results	Comments
			by one evaluator.		examination in conformity with an extension of Touwen's criteria) **1.5 Important potential confounders are appropriately accounted for, limiting potential bias with respect to the prognostic factor of interest:** N/A **1.6 The statistical analysis is appropriate for the design of the study, limiting potential for the presentation of invalid results:** no (patients with missing data were removed; CI were not provided) **Other information**
Full citation	**Sample size** N= 82 (50 boys and 32 girls) from a larger group of n=99, who participated in prospective studies	**Tests** Index test	**Methods** Video recordings	**Results** N=82 enrolled.	**Limitations NICE manual Appendix I:**

<table>
<tr><th>Bibliographic details</th><th>Participants</th><th>Tests</th><th>Methods</th><th>Outcomes and results</th><th>Comments</th></tr>
<tr>
<td>Bruggink, J. L., Einspieler, C., Butcher, P. R., Stremmelaar, E. F., Prechtl, H. F., Bos, A. F., Quantitative aspects of the early motor repertoire in preterm infants: do they predict minor neurological dysfunction at school age?, Early Human Development, 85, 25-36, 2009

Ref Id

336189

Country/ies where the study was carried out

Netherlands

Study type

Prospective cohort study

Aim of the study
To investigate whether quantitative</td>
<td>of the prognostic value of the quality of GMs for neurologic and developmental findings

Characteristics
<table>
<tr><th>Characteristic</th><th>Children who developed normally o</th><th></th><th>simple MND</th></tr>
<tr><td>Number</td><td>49</td><td>18</td><td>15</td></tr>
<tr><td>Gestational age, median (P25-75)</td><td>30.1 weeks (28.6-31.7)</td><td>28.9 weeks (27.8-31.0)</td><td>28.7 week (27.7- 30.0)</td></tr>
<tr><td>Birth weight, median (P25-75)</td><td>1160g (950-1343)</td><td>1165g (898-1333)</td><td>1220g (870- 1460)</td></tr>
<tr><td>Male, n</td><td>23 (47%)</td><td>12 (67%)</td><td>12 (8</td></tr>
<tr><td>IUGR (BW<P5, Dutch weight centiles), n</td><td>12 (24%)</td><td>4 (22%)</td><td>1 (7%</td></tr>
<tr><td>Prenatal corticosteroids, n</td><td>34 (71%)</td><td>11 (61%)</td><td>9 (60</td></tr>
</table></td>
<td>Quantitative aspects of the motor repertoire between 6 and 24 weeks post term assessed through video recordings.
<u>Reference test</u>
Touwen's neurological examination at 7-11 years of age.</td>
<td>carried out (approx 10 mins) at 6-8 weeks (n=60), 12-14 weeks (n=73) and 18-21 weeks (n=53)
Timing and frequency of recordings: varied for a few due to logistical/family reasons
Sites of recordings: outpatient clinic, home, during awake time between feeds, partly dressed in a supine position
214 recordings (median 3 per infant, median duration 9.01 minutes). 10 unable to be evaluated due to crying, sleepiness or hiccups.
Evaluated in order of post term age, off line by 3 investigators according to Einspieler et al</td>
<td>N=7 died during first few months after birth (mostly due to severe respiratory problems such as bronchopulmonary dysplasia)
N=3, conditions that could interfere with normal neurological development (blindness due to retinopathy of prematurity (n=2) and Duchenne muscular dystrophy (n=1)
N=5 could not be traced
N=2 families refused to participate
6 years of age: 15 children diagnosed with CP according to Hagbergs criteria.
7-11 years old: neurological examination according to Touwen carried out on the remaining 67 children.
Out of the remaining 67 children: n=13 simple MND, n=18 complex MND, n=36 normal.
<table>
<tr><th>Quality of fidgety movements</th><th>Quality of the concurrent motor repertoire at 11-16 weeks post-term</th><th>Absence or of an presence obligatory ATN posture</th><th>Normal/simple MND at school age</th><th>Complex MND at school age</th><th>Cerebral Palsy at school age</th><th>Total</th></tr>
<tr><td rowspan="4">Normal FMs</td><td rowspan="2">Smooth and variable</td><td>Absent</td><td>19</td><td>1</td><td>0</td><td>20</td></tr>
<tr><td>Present</td><td>1</td><td>0</td><td>0</td><td>1</td></tr>
<tr><td rowspan="2">Abnormal: monotonous, jerky</td><td>Absent</td><td>17</td><td>3</td><td>0</td><td>20</td></tr>
<tr><td>Present</td><td>2</td><td>5</td><td>1</td><td>8</td></tr>
</table></td>
<td>Methodology checklist: prognostic studies
1.1 The study sample represents the population of interest with regard to key characteristics, sufficient to limit potential bias to the results: no (sampling frame and recruitment has not been adequately described, inclusion and exclusion criteria has not been described)
1.2 Loss to follow-up is unrelated to key characteristics (that is, the study data adequately represent the sample), sufficient to limit potential bias: N/A
1.3 The prognostic factor of interest is adequately measured in study</td>
</tr>
</table>

Bibliographic details	Participants	Tests	Methods	Outcomes and results	Comments
aspects of the motor repertoire between 6 and 24 weeks post term also have predicitve value for neurological outcome at 7 to 11 years of age. **Study dates** September 1992 and October 1997. **Source of funding** Grant from the University of Groningen and the Graduate School for Behavioural and Cognitive Neurosciences (BCN).	<table><tr><td>Apgar score at 5, median</td><td>8 (8-9)</td><td>8 (5-8.3)*</td><td>6 (5-7</td></tr><tr><td>Umbilical pH, median (P25-75)</td><td>7.28 (7.25-7.31)</td><td>7.26 (7.21-7.33)</td><td>7.26 (7.21-7.33)</td></tr></table> * p<0.01, compared with infants who developed normally or simple MND **Inclusion Criteria** Preterm infants born between September 1992 and October 1997 and admitted to the Neonatal intensive care unit of the Beatrix Children's Hospital of the University Medical Center of Groningen. Infants were part of a larger study (n=99) on the prognostic value of the quality of GMs for neurological and developmental findings. <34 weeks gestational age at birth Written parental consent was obtained in the first week after birth **Exclusion Criteria** Chromosomal abnormalities Congenital malformations Infants who died before 6 weeks post term age		(10-15 mins per recording), 2 blinded to infant history and neurological status, one unblinded to infant history but unaware of neurological status at school age. Three quantitative aspects assessed: 1. Presence and normality of movement patterns (total 32 movements)They include: wiggling oscillating movements, saccadic movements, kicking, swipes, mutual manipulation (fiddling of fingers and clothing), reaching and touching, legs	<table><tr><td></td><td>and/or stiff</td><td></td><td></td><td></td><td></td><td></td></tr><tr><td>Abnormal FMs</td><td>Abnormal: monotonous, jerky and/or stiff</td><td>Absent</td><td>4</td><td>6</td><td>0</td><td>10</td></tr><tr><td></td><td></td><td>Present</td><td>0</td><td>1</td><td>0</td><td>1</td></tr><tr><td>Absent FMs</td><td>Abnormal: monotonous, jerky and/or stiff</td><td>Absent</td><td>0</td><td>1</td><td>6</td><td>7</td></tr><tr><td></td><td></td><td>Present</td><td>0</td><td>0</td><td>6</td><td>6</td></tr><tr><td></td><td></td><td>Total</td><td>43</td><td>17</td><td>13</td><td>73</td></tr></table> The following have been calculated from the data given in the paper: • Normal FMs, smooth and variable motor repertoire, the obligatory ATN to predict CP; sensitivity N/A, specificity 95.24% (95% CI 76.18%-99.88%), PPV 0% (95% CI 0-97.5%), NPV 100% (95% CI 83.16-100%) • Normal FMs, abnormal motor repertoire, the obligatory ATN to predict CP; sensitivity 100% (95% CI 2.5-100%), specificity 74.07% (95% CI 53.72%-88.89%), PPV 12.50% (95% CI 0.32-	**participants, sufficient to limit potential bias:** no (video recording was unequal across groups, 1 of the assessors was not blinded to the child's clinical history, the setting where the measurements were done was not the same for all study participants) **1.4 The outcome of interest is adequately measured in study participants, sufficient to limit potential bias:** no (15 children had already been diagnosed with CP according to Hagberg's criteria and 67 were assessed against Touwen's criteria) **1.5 Important potential confounders are appropriately accounted for, limiting potential bias with respect to the**

Bibliographic details	Participants	Tests	Methods	Outcomes and results	Comments
			lift and with hand-knee contact, trunk rotation, axial rolling, hand regard, visual exploration and social interactive behaviour. Foot to foot contact, hand to face contact and hand mouth contact have also been observedAbnormal: circular arm movements and abnormal segmental movements. **Normal-** when more normal than abnormal patterns were observed, **abnormal -** when more abnormal than normal patterns were observed 2. Presence and normality of various postural patterns: 9 different	52.65%), NPV 100% (95% CI 83.16-100%) • Abnormal FMs, abnormal motor repertoire, the obligatory ATN to predict CP; sensitivity N/A, specificity 90.91% (95% CI 58.72%-99.77%), PPV 0% (95% CI 0-97.50%), NPV 100% (95% CI 69.15-100%) • Absent FMs, abnormal motor repertoire, the obligatory ATN to predict CP; sensitivity 50% (95% CI 21.09-78.91%), specificity 100% (95% CI 2.5%-100%), PPV 100% (95% CI 54.07-100%), NPV 14.29% (95% CI 0.36-57.87%)	**prognostic factor of interest:** yes (multiple logistic regression analysis was performed) **1.6 The statistical analysis is appropriate for the design of the study, limiting potential for the presentation of invalid results:** no (there is missing data as some time intervals did not have patient data recorded) **Other information**

Bibliographic details	Participants	Tests	Methods	Outcomes and results	Comments
			postural patterns. Normal included variable hand and finger postures. Abnormal- predominantly flat posture extensor postures, predominant fisting, abnormal finger spreading and limited finger movement. Also recorded if asymmetric tonic neck posture (and checked if spontaneous flexion of the extended arm was/wasn't possible) 3. Age adequacy of the motor repertoire: age adequate(>6 movement patterns observed), reduced (5-6) or absent (<5). Scoring based on the		

Bibliographic details	Participants	Tests	Methods	Outcomes and results	Comments
			presence or absence of antigravity movements, movements of the arms and/or legs towards the midline and fiddling movements. Excluded movements usually present:smiles, mouth movements, tongue movements. Motor optimality score: 5-28 points based on the three aspects listed above. Interscorer reliability: 145 recordings randomly selected and reviewed by 3 observers. Disagreement in 16 (11%) movement patterns and 15 (105)		

Bibliographic details	Participants	Tests	Methods	Outcomes and results	Comments
			recordings of postures. 7-11 years old: neurological examination according to Touwen carried out. Following Hadders-Algra, 6 areas assessed; posture and muscle tone, reflexes, choreiform dyskinesia, coordination and balance, fine manipulative ability and rarely occurring dysfunctions, including an excess of associated movements. Classification: normal, simple MND (1-2 category dysfunctions) or complex MND (>2 category dysfunctions). Further analysis: clustered video		

<table>
<tr><th>Bibliographic details</th><th>Participants</th><th>Tests</th><th>Methods</th><th>Outcomes and results</th><th>Comments</th></tr>
<tr><td></td><td></td><td></td><td>recordings (6-10 weeks post term, 11-16 weeks post term, 17-24 weeks post term). If >1 recording for a child was done in a cluster, the one closest to the median age of the age period was used.

Multiple logistic regression was carried out.</td><td></td><td></td></tr>
<tr><td>Full citation

Bruggink,J.L., Einspieler,C., Butcher,P.R., Van Braeckel,K.N., Prechtl,H.F., Bos,A.F., The quality of the early motor repertoire in preterm infants predicts minor neurologic dysfunction at school age, Journal of</td><td>Sample size
N=82 - See Bruggink 2009 (336189)

Characteristics
See Bruggink 2009 (336189)

Inclusion Criteria
See Bruggink 2009 (336189)

Exclusion Criteria
See Bruggink 2009 (336189)</td><td>Tests
<u>Index test</u>
Quality of FMs (Fidgety movements) - normal, abnormal (exaggerated amplitude, speed and jerkiness) or absent (no FMs observed between 6-20 weeks).
When FMs present:</td><td>Methods
See Bruggink 2009 (336189)
Fidgety movements: small amplitude, moderate speed and variable acceleration and occur in the neck, trunk, and limbs in all directions. Awake infant- they are</td><td>Results
Neurologic findings at school age
<table>
<tr><th>Post term age, weeks</th><th>Quality of FMs</th><th>Normal/simple MND</th><th>Complex MND</th><th>Cerebral Palsy</th><th>Total</th></tr>
<tr><td>6 to 10</td><td>Normal</td><td>30</td><td>7</td><td>0</td><td>37</td></tr>
<tr><td></td><td>Abnormal</td><td>2</td><td>2</td><td>0</td><td>4</td></tr>
<tr><td></td><td>Absent</td><td>2</td><td>6</td><td>11</td><td>19</td></tr>
</table></td><td>Limitations Methodology checklist: prognostic studies
1.1 The study sample represents the population of interest with regard to key characteristics, sufficient to limit potential bias to the results: no (sampling frame and recruitment has not been</td></tr>
</table>

<table>
<tr><th>Bibliographic details</th><th>Participants</th><th>Tests</th><th>Methods</th><th>Outcomes and results</th><th>Comments</th></tr>
<tr>
<td>Pediatrics, 153, 32-39, 2008

Ref Id

315830

Country/ies where the study was carried out

Netherlands

Study type

Prospective cohort study

Aim of the study
To determine whether the predictive value of the quality of the early motor repertoire for the development of MND at school age.

Study dates
September 1992- October 1997</td>
<td></td>
<td>Temporal organisation scored: continual ++, intermittent +, sporadic +/-
Spatial organisation scored: proximal (more prominent in the trunk, neck, shoulders and hips), distal (more prominent in the wrists and ankles), or equally prominent in the proximal and distal parts of</td>
<td>continual except if fussing or crying.
Start from as early as 6 weeks, usually evident by 9 weeks and persist until 15-20 weeks.

Interobserver reliability for the quality of FMs: 0.87</td>
<td>
<table>
<tr><td></td><td>Total</td><td>34</td><td>15</td><td>11</td><td>60</td></tr>
<tr><td>11 to 16</td><td>Normal</td><td>39</td><td>9</td><td>1</td><td>49</td></tr>
<tr><td></td><td>Abnormal</td><td>4</td><td>7</td><td>0</td><td>11</td></tr>
<tr><td></td><td>Absent</td><td>0</td><td>1</td><td>12</td><td>13</td></tr>
<tr><td></td><td>Total</td><td>43</td><td>17</td><td>13</td><td>73</td></tr>
<tr><td>17 to 24</td><td>Normal</td><td>21</td><td>4</td><td>1</td><td>26</td></tr>
<tr><td></td><td>Abnormal</td><td>1</td><td>2</td><td>0</td><td>3</td></tr>
<tr><td></td><td>Absent</td><td>12</td><td>4</td><td>8</td><td>24</td></tr>
<tr><td></td><td>Total</td><td>34</td><td>10</td><td>9</td><td>53</td></tr>
</table>
Association between the combination of quality of FMs and the quality of the concurrent motor repertoire at 11 to 16 weeks post term and neurologic findings at school age:
<table>
<tr><td></td><td></td><td colspan="4">Neurologic findings at school age</td></tr>
<tr><td>Quality of FMs at 11 to 16</td><td>Quality of the concurrent motor</td><td>Normal/ simple MND</td><td>Complex MND</td><td>Cerebral Palsy</td><td>Total</td></tr>
</table>
</td>
<td>adequately described, inclusion and exclusion criteria has not been described)
1.2 Loss to follow-up is unrelated to key characteristics (that is, the study data adequately represent the sample), sufficient to limit potential bias: N/A
1.3 The prognostic factor of interest is adequately measured in study participants, sufficient to limit potential bias: no (video recording was unequal across groups, 1 of the assessors was not blinded to the child's clinical history, the setting where the measurements were done was not the same for all study participants)</td>
</tr>
</table>

<table>
<tr><th>Bibliographic details</th><th>Participants</th><th>Tests</th><th>Methods</th><th>Outcomes and results</th><th>Comments</th></tr>
<tr>
<td>Source of funding
See Bruggink 2009 (336189)</td>
<td></td>
<td>the body

<u>Reference test</u>
Touwen's neurological examination</td>
<td></td>
<td>
<table>
<tr><td>weeks post term</td><td>repertoire at 11 to 16 weeks post term</td><td></td><td></td><td></td><td></td></tr>
<tr><td>Normal</td><td>Smooth and variable</td><td>20</td><td>1</td><td>0</td><td>21</td></tr>
<tr><td></td><td>Abnormal: monotonous, jerky, and/or stiff</td><td>19</td><td>8</td><td>1</td><td>28</td></tr>
<tr><td>Abnormal</td><td>Abnormal: monotonous, jerky, and/or stiff</td><td>4</td><td>7</td><td>0</td><td>11</td></tr>
<tr><td>Absent</td><td>Abnormal: monotonous, jerky, and/or stiff</td><td>0</td><td>1</td><td>12</td><td>13</td></tr>
</table>
</td>
<td>1.4 The outcome of interest is adequately measured in study participants, sufficient to limit potential bias: no (15 children had already been diagnosed with CP according to Hagberg's criteria and 67 were assessed against Touwen's criteria)
1.5 Important potential confounders are appropriately accounted for, limiting potential bias with respect to the prognostic factor of interest: yes (multiple logistic regression analysis was performed)
1.6 The statistical analysis is appropriate for the design of the study, limiting potential for the presentation of invalid results: no (there is</td>
</tr>
</table>

<table>
<tr><th>Bibliographic details</th><th>Participants</th><th>Tests</th><th>Methods</th><th>Outcomes and results</th><th>Comments</th></tr>
<tr><td></td><td></td><td></td><td></td><td></td><td>missing data as so me time intervals did not have patient data recorded)

Other information
No term control group.
Note: the authors state that these results cannot be generalised and need to confirmed in other groups of infants (which is why no sensitivity/ specificity data was provided).</td></tr>
<tr><td>Full citation

Burger, M., Frieg, A., Louw, Q. A., General movements as a predictive tool of the neurological outcome in very low and extremely low birth weight infants - A South African perspective,</td><td>Sample size
n=115 preterm infants weighing (<1250g) who were admitted to level 2 neonatal wards or to the neonatal intensive care unit of TCH (Tygerberg Children's Hospital, Cape Town).

Characteristics<table><tr><td></td><td>N=115</td><td>Median</td><td>Ra</td></tr><tr><td>Gender (female/male)</td><td>67/48</td><td></td><td></td></tr></table></td><td>Tests
<u>Index test:</u>
General Movements Assessment
<u>Reference test:</u>
Neurodevelopment assessment (The Peabody Developmental Motor Scale (PMDS-2), second edition and the Alberta Infant Motor Scale (AIMS)</td><td>Methods
Successive sampling method was used.
General movements assessment: during the fidgety movements period according to specific methodological standards</td><td>Results
N=121 eligible
N=1 withdrawn due to a ventricular septum defect with consequential Congestive Heart Failure, extreme tiredness and inhibited spontaneous movement patterns during the fidgety movement evaluation.
N=1 lost to follow up (parents returned to Transkei)
N=4 died before 12 month assessment
Final sample n=115<table><tr><td>Quality of fidgety movements</td><td>Number of infants with an abnormal</td><td>Number of infants with a normal</td><td>Total number of infants</td></tr></table></td><td>Limitations
NICE manual
Appendix I: Methodology checklist: prognostic studies
1.1 The study sample represents the population of interest with regard to key characteristics, sufficient to limit</td></tr>
</table>

<table>
<tr><th>Bibliographic details</th><th>Participants</th><th>Tests</th><th>Methods</th><th>Outcomes and results</th><th>Comments</th></tr>
<tr>
<td>Early Human Development, 87, 303-308, 2011

Ref Id

336196

Country/ies where the study was carried out

South Africa

Study type

Prospective cohort study

Aim of the study
To determine whether the qualitative assessment of fidgety movements will predict the neurological outcome of very low bith weight and extremely low birth weight infants.

Study dates</td>
<td>
<table>
<tr><td>Ethnic group (coloured/black/white)</td><td>85/30/0</td><td></td><td></td></tr>
<tr><td>Birth weight (g, mean +/- SD)</td><td>1039.3 +/- 160.5</td><td></td><td>55
12</td></tr>
<tr><td>Gestational age (weeks, mean +/-SD)</td><td>30 +/-2.1</td><td></td><td>27</td></tr>
<tr><td>Apgar at 1 min (mean +/- SD)</td><td>6.9 +/- 2.3</td><td>8.0</td><td>0-1</td></tr>
<tr><td>Apgar at 5 min (mean +/- SD)</td><td>8.3 +/- 1.7</td><td>9.0</td><td>0-1</td></tr>
<tr><td>Apgar at 10 min (mean +/- SD)</td><td>9.1 +/- 1.4</td><td>10.0</td><td>1-1</td></tr>
</table>
Inclusion Criteria
N=115 Preterm infants weighing (<1250g) who were admitted to level 2 neonatal wards or to the neonatal intensive care unit of TCH (Tygerberg Children's Hospital, Cape Town).

Exclusion Criteria
Infants diagnosed with chromosomal defects or a known syndrome (e.g. Down syndrome or Foetal Alcohol syndrome)
Infants with birth malformations of the central nervous system e.g. myelomeningocele
Infants expose to and/or infected with HIV</td>
<td>and a complete neurological examination according to the procedure recommended by Amiel-Tison and Gosselin)</td>
<td>prescribed by Einspieler et al.
Light sensitive digital video camera used to record infants' spontaneous movement patterns at 12 weeks corrected age. Infant placed supine on an Airex mat on the floor, lightly dressed and comfortable (thin nappy and vest). Camera view: lateral frontal. 10-15 minutes recording during state 4 (active wakefulness, irregular breathing, spontaneous movement patterns and the absence of fussing or crying). 22-24 degrees centigrade room temperature. Blinds closed,</td>
<td>
<table>
<tr><td></td><td>motor outcome (CP) at 12 months</td><td>motor outcome at 12 months</td><td></td></tr>
<tr><td>Absent</td><td>8</td><td>0</td><td>8</td></tr>
<tr><td>Normal</td><td>1</td><td>101</td><td>102</td></tr>
<tr><td>Total</td><td>9</td><td>101</td><td>110</td></tr>
</table>
N=5 were classed as suspect and excluded from the analysis. Note the following 95% CI have been calculated from the figures, they were not published in the paper.
Sensitivity: 89% (95% CI 51.75-99.72)
Specificity: 100% (95% CI 96.41-100)
PPV: 100% (95% CI 63.06-100)
NPV: 99% (95% CI94.66-99.98)
p<0.01.

When suspect infants were combined with the infants who had a normal motor outcome:
Sensitivity: 89%
Specificity: 89%
PPV: 80%
NPV: 99%
p<0.01.

When the suspect infants were included with the infants who had an abnormal motor outcome:
Sensitivity: 71%
Specificity: 100%
PPV: 100%
NPV: 96%
p<0.01.</td>
<td>potential bias to the results: yes
1.2 Loss to follow-up is unrelated to key characteristics (that is, the study data adequately represent the sample), sufficient to limit potential bias: yes (4 died, 1 lost to follow up, 1 VSD)
1.3 The prognostic factor of interest is adequately measured in study participants, sufficient to limit potential bias: yes (the Peabody Developmental Motor Scale, second edition (PDMS-2), and the Alberta Infant Motor Scale (AIMS) were used by one of the researchers to asses the infants' fine and gross motor development at 12 months. An experienced</td>
</tr>
</table>

Bibliographic details	Participants	Tests	Methods	Outcomes and results	Comments
Recruitment: 1 January to 31 December 2004 **Source of funding** Harry Crossly Foundation for funding the transport costs of the participants involved in the study.			lights dimmed, minimum noise level. If the infant cried the recording would be stopped, then restarted once the baby was consoled. Blinded physiotherapist (did not know infants medical history), trained in basic and advanced gM Trust Training courses. Each recording was analysed and scored on the day of recording. **Normal movements:** continual circular movements of small amplitude, variable acceleration and moderate speed of the neck, trunk and limbs in all directions in the awake infant except		physician performed a complete neurological examination, according to the procedure recommended by Amiel-Tison examination. **1.4 The outcome of interest is adequately measured in study participants, sufficient to limit potential bias:** yes (but inter rater reliability was 0.88 (tested on a subgroup of 16) and definite diagnosis of CP was given at age 12) **1.5 Important potential confounders are appropriately accounted for, limiting potential bias with respect to the prognostic factor of interest:** N/A **1.6 The statistical analysis is appropriate for**

Bibliographic details	Participants	Tests	Methods	Outcomes and results	Comments
			during fussing and crying. **Fidgety abnormal movements:** absent or abnormal in nature (moderately or much exaggerated in degree of speed, amplitude and jerkiness). Inter rater reliability: Cohens kappa 0.88. Carried out on a sample of 16 (14%) by 5 certified observers (Blind). At 12 months: neurodevelopment assessment (The Peabody Developmental Motor Scale (PMDS-2), second edition and the Alberta Infant Motor Scale (AIMS)). Three groups:		**the design of the study, limiting potential for the presentation of invalid results:** yes **Other information** ?Is 12 months too early to make a definitive diagnosis of CP Not gestational age adjusted. Note: Authors describe the gestational age of the infants to be higher than other studies. This was due mainly to restricted finances in South Africa (strict admission criteria to NICU). If <1000g or <28 weeks they will not be admitted to NICU.

Bibliographic details	Participants	Tests	Methods	Outcomes and results	Comments
			Normal: no neurological signs/ upper motor signs, with scores of very superior, superior, above average, average and below average on the PMDS-2; combined with scores above the 5th percentile on the AIMS **Suspect:** delayed in meeting motor milestones with scores below average, poor or very poor on the PMDS-2 as well as scoring below the 5th percentile on the AIMS, but without neurological signs/upper motor signs **Abnormal:** delayed in meeting motor milestones, with scores below average, poor or very		

Bibliographic details	Participants	Tests	Methods	Outcomes and results	Comments
			poor on the PMDS2 or a score below the 5th percentile on the AIMS combined with neurological signs/ upper motor signs such as abnormal reflexes, tone or a form of CP. The abnormal group were then classified in accordance with the Gross Motor Function Classification System (GMFCS) for children with CP (level I-V)		
Full citation Chaudhari,S., Bhalerao,M., Chitale,A., Patil,B., Pandit,A., Hoge,M., Transient tone abnormalities in high risk infants and cognitive	**Sample size** n = 190 high risk infants n = 49 controls **Characteristics** <u>Birthweight (g)</u> <1500 = 33 (17%) 1500 - 1999 = 94 (49.50 2000 - 2499 = 26 (13.7) > 2500 = 37 (19.5)	**Tests** Infants were assessed for tone abnormalities at 3, 6, 9 and 12 months using the method described by Amiel-Tison (1986) and	**Methods** <u>Setting</u> Level II care Neonatal Unit of KEM Hospital, Pune. <u>Details</u> Evaluation of muscle tone is	**Results** Of the n = 190 high risk infants: Normal = 113, of which 16 were lost to follow-up TTA: 67, of which 5 were lost to follow-up CP: 10 infants Controls: n = 49, of which 6 were lost to follow-up Of the 10 infants diagnosed with CP: 4 had hypertonia and 6 had hypotonia at 6 and 12 months and were referred to rehabilitation centre.	**Limitations NICE manual Appendix I: Methodology checklist: prognostic studies** **1.1 The study sample represents the population of**

Bibliographic details	Participants	Tests	Methods	Outcomes and results	Comments
outcome at five years, Indian Pediatrics, 47, 931-935, 2010 **Ref Id** 315877 **Country/ies where the study was carried out** India **Study type** Prospective cohort study **Aim of the study** To identify transient tone abnormalities and determine its prevalence in 'high risk' infants and their cognitive outcome at 5 years. **Study dates** Starting October 1990.	<u>Gestational age, wk (%)</u> < 30 = 7 (3.7%) 31 - 32 = 21 (11) 33 - 34 = 51 (26.8) 35 - 36 = 40 (21) ≥ 37 = 71 (37.4) **Inclusion Criteria** Selection of high risk: • birthweight < 2000 g • Gestation less than 37 weeks • seizures • apnea • hypoxic ischemic encephalopathy - Sarnat stage II or III • Intraventricular haemorrhage > grade i • hyper bilirubinemia • respiratory distress Full term infants with a normal antenatal, natal and postnatal course born during the same period were enrolled as controls **Exclusion Criteria** Non reported.	corrected age was used in preterms. Based on this examination, infants were characterised into: • Hypertonia • Hypotonia • minor tone abnormalites like mild hypertonia or hypotonia in one extremity, mild adductor or abductor spasm at the hip joint, mild hypertonia of the neck extensors. if there were no abnormalities at 6 and 12 months, the group was called normal high risk (HR). If tone abnormalities present but disappeared at 12 months, they were grouped as transient tone abnormalities	based on the study of spontaneous posture, passive tone and active tone. Passive tone is measured by popliteal, adductor and dorsiflexor angles in the lower extremity and scarf sign in the upper extremity. Active tone comprises of spontaneous movements and movements provoked by maneuvers such as pull to sit and pull to stand. The study children were recalled at 5 years of age and an IQ test was done by a trained psychologist using Kulkshetra's adaption of Standford Binet		**interest with regard to key characteristics, sufficient to limit potential bias to the results:** yes **1.2 Loss to follow-up is unrelated to key characteristics (that is, the study data adequately represent the sample), sufficient to limit potential bias:** unclear (the lost of follow up was only specified for 18 families and it was unrelated to the study characteristics. However, in the flowchart of study participants is stated that they lost follow up in a total of 27 participants) **1.3 The prognostic factor of interest is adequately measured in study participants, sufficient to limit potential**

Bibliographic details	Participants	Tests	Methods	Outcomes and results	Comments
Source of funding None.		(TTA). Those infants who persisted to have tone abnormalities at 6 and 12 months were diagnosed as CP.	Intelligence scale. An IQ ≥ 85 was considered normal. A preschool inventory described by Ayres, Bobath (Smith, 1983) was also used which consisted of 7 areas of development: gross motor, fine motor, perception, intersensory integration, preschool skills, activities of daily living and language development. Statistical analysis ANOVA was used to compare means. Follow-up The study children were recalled at 5 years of age .		**bias:** yes (infants were assessed for tone abnormalities at 3, 6, 9 and12 months using the method described by Amiel-Tison) **1.4 The outcome of interest is adequately measured in study participants, sufficient to limit potential bias:** unclear (the diagnostic criteria for cerebral palsy was not defined) **1.5 Important potential confounders are appropriately accounted for, limiting potential bias with respect to the prognostic factor of interest:** N/A **1.6 The statistical analysis is appropriate for the design of the study, limiting potential for the presentation of invalid results:** yes

<table>
<tr><th>Bibliographic details</th><th>Participants</th><th>Tests</th><th>Methods</th><th>Outcomes and results</th><th>Comments</th></tr>
<tr><td></td><td></td><td></td><td></td><td></td><td>Other information</td></tr>
<tr>
<td>Full citation

Ferrari, F., Cioni, G., Einspieler, C., Roversi, M. F., Bos, A. F., Paolicelli, P. B., Ranzi, A., Prechtl, H. F. R., Cramped synchronized general movements in preterm infants as an early marker for cerebral palsy, Archives of Pediatrics and Adolescent Medicine, 156, 460-467, 2002

Ref Id

336353

Country/ies where the</td>
<td>Sample size
N=93 infants enrolled at the University of Modena and the University of Pisa
N=84 included in final sample (9 were excluded due to missing data).

Note: some infants had taken part in previous studies (checked- these are not included in this review, so no risk of double counting).

Characteristics
<table>
<tr><td>Characteristics</td><td>Infants</td></tr>
<tr><td>Postmenstrual age at birth, mean +/- SD, wks</td><td>30.2 +/-2.7</td></tr>
<tr><td>Birth weight, mean +/-SD, g</td><td>1410.14 +/- 456.71</td></tr>
<tr><td>Outborn</td><td>14</td></tr>
<tr><td>Inborn</td><td>86</td></tr>
<tr><td>Gender (M/F)</td><td>50/50</td></tr>
</table>
</td>
<td>Tests
<u>Index test:</u>
General movement assessment; Cramped synchronized character Neurological examination USS
<u>Reference test:</u>
Neurological outcome (Griffiths Scale) at 2-3 years</td>
<td>Methods
3-5 weekly videos of the infants from birth until hospital discharge (5-10 recordings per infant). Neurological assessment (according to Dubowitz and Dubowitz and Prechtl) was also videoed. 4 Key age periods: preterm (up to 37 weeks post menstrual age), term age (38-42 weeks post menstrual age), 43-46 weeks and 47-60 weeks. Quality of the GMs recorded in Pisa were reviewed in</td>
<td>Results
At 2-3 years of age:
N=40 healthy infants
N=44 spastic type cerebral palsy (diplegia n=22, tetraplegia n=14, hemiplegia n=8)
Grade 1 motor impairment n=15
Grade 2 n=5
Grade 3 n=5
Grade 4 n=9
Grade 5 n=10
No minor neurological disorder observed apart from 1 mild hearing defect.
Fidgety movements and neurological outcome in 84 high risk preterm infants:
<table>
<tr><td rowspan="2">Movement</td><td>Neurological outcome No. of subjects</td><td></td></tr>
<tr><td>Cerebral Palsy</td><td>Normal</td></tr>
<tr><td>Normal Fidgety movements</td><td>0</td><td>36</td></tr>
<tr><td>Abnormal fidgety movements</td><td>1</td><td>3</td></tr>
</table>
</td>
<td>Limitations NICE manual Appendix I: Methodology checklist: prognostic studies
1.1 The study sample represents the population of interest with regard to key characteristics, sufficient to limit potential bias to the results: yes
1.2 Loss to follow-up is unrelated to key characteristics (that is, the study data adequately represent the sample), sufficient to limit potential bias: N/A
1.3 The prognostic</td>
</tr>
</table>

<table>
<tr><th>Bibliographic details</th><th>Participants</th><th>Tests</th><th>Methods</th><th>Outcomes and results</th><th>Comments</th></tr>
<tr>
<td>study was carried out

Italy

Study type

Prospective cohort study

Aim of the study
To determine whether specific abnormalities (i.e. cramped synchronized general movements) can predict cerebral palsy and the severity of later motor impairment in preterm infants affected by brain lesions.

Study dates
Not described.

Source of funding
Supported in part by the Italian Ministry of Health</td>
<td>
<table>
<tr><td>Preeclamptic toxemia</td><td>7</td></tr>
<tr><td>Multiple pregnancies</td><td>6</td></tr>
<tr><td>Acute fetal distress</td><td>13</td></tr>
<tr><td>Appropriate size for gestational age</td><td>76</td></tr>
<tr><td>Severe respiratory distress syndrome</td><td>42</td></tr>
<tr><td>Severe infection</td><td>33</td></tr>
<tr><td>Seizures</td><td>17</td></tr>
<tr><td>Patent ductus arteriosus</td><td>30</td></tr>
<tr><td>Bronchopulmonary dysplasia</td><td>13</td></tr>
<tr><td>Retinopathy of prematurity (grades 2-5)</td><td>17</td></tr>
</table>
Serial US with 5-7.5 MHz 34 cystic and 34 non cystic abnormalities of the white matter. 16 infants had intraventricular haemorrhages grades 3 and 3+ (according to Volpe). US abnormalities were reviewed blindly.

Inclusion Criteria
Mother's last menstrual date reliably known
Gestational age <37 completed weeks
US abnormalities highly suggestive of brain parenchymal insult
</td>
<td></td>
<td>Moderna and vice versa. They were all then assessed by another investigator who was blinded to the infant’s clinical history and US results (inter observer agreement 90.2%). The scores were compared to the local physical therapists and paediatric neurologist scores.
GMs score: normal, poor repertoire (sequence of the components of the successive movements is monotonous and not complex) or cramped synchronized (rigid and lack the normal smooth and fluent character, all the limb and</td>
<td>
<table>
<tr><td>Absent fidgety movements</td><td>43</td><td>1</td></tr>
<tr><td>Total</td><td>44</td><td>40</td></tr>
</table>
Area under the reciever operating characteristic curve for general movements was 97.4.
<table>
<tr><td></td><td></td><td colspan="4">Age Period</td></tr>
<tr><td></td><td></td><td>Preterm</td><td>Term age</td><td>Post term</td><td>Fidget</td></tr>
<tr><td>Postmenstrual age, wk</td><td></td><td>28-37</td><td>38-42</td><td>43-46</td><td>47-60</td></tr>
<tr><td>No. of infants</td><td></td><td>83</td><td>79</td><td>70</td><td>84</td></tr>
<tr><td rowspan="3">General movements</td><td>LR+ (95%CI)</td><td>1.5 (1.19-1.89)</td><td>1.52 (1.20-1.93)</td><td>2.11 (1.48-3.0)</td><td>7.8 (3.44-17.78)</td></tr>
<tr><td>LR- (95% CI)</td><td><0.07 (0.01-0.48)</td><td><0.07 (0.01-0.50)</td><td><0.06 (0.01-0.39)</td><td><0.02 (0.04-0.18)</td></tr>
<tr><td>Sensitivity, %</td><td>100</td><td>100</td><td>100</td><td>100</td></tr>
</table>
</td>
<td>factor of interest is adequately measured in study participants, sufficient to limit potential bias: yes (but inter-observer agreement for the interpretations of video recordings was 90.2%)
1.4 The outcome of interest is adequately measured in study participants, sufficient to limit potential bias: yes
1.5 Important potential confounders are appropriately accounted for, limiting potential bias with respect to the prognostic factor of interest: unclear
1.6 The statistical analysis is appropriate for the design of the study, limiting potential for the presentation of</td>
</tr>
</table>

Bibliographic details	Participants	Tests	Methods	Outcomes and results						Comments
(Current Research Project 1994) and the ITI company, Moderna Italy. Giovanni Battista Cavazzuti, MD, University of Moderna and Pietro Pfanner, MD, University of Pisa, continuous support (unclear if academic or financial).	Repeated general movement (GM) assessment and neurological examination unitl about 56-60 weeks post menstrual age Neurological follow up until 2-3 years. **Exclusion Criteria** Infants with chromosomal defects or major malformations of the brain or other organs. Infants with GM observation or neurological examination missing at more than 1 key age were also excluded.		trunk muscles contract and relax almost simultaneously). From 47-60 weeks fidgety GMs scored as present (normal or abnormal) or absent. At the age of 2-3 years: Griffiths Developmental scales (normal- no neurological signs, or cerebral palsy-chronic disability characterised by aberrant control of movement or posture appearing early in life and not the result of recognized progressive disease). The severity of which was scored from level I-V according to Palisano et al.		Specificity, %	38	41	53	82	**invalid results:** no (no 95% CI provided) **Other information**
					PPV, %	63	63	55	86	
					NPV, %	100	100	100	100	
				Cramped synchronized character	LR+ (95%CI)	4.97 (1.57-15.75)	22.4 (3.18-158)	>28 (4.02-195.6)	>30 (4209)	
					LR- (95% CI)	0.68 (0.53-0.87)	0.44 (0.30-0.63)	0.25 (0.13-0.46)	0.26 (0.15-0.43)	
					Sensitivity, %	46	65	79	77	
					Specificity, %	92	97	100	100	
					PPV, %	87	96	100	100	
					NPV, %	62	73	84	80	
				Neurological examination results	LR+ (95%CI)	1.06 (0.81-1.39)	1.71 (1.11-2.61)	1.82 (1.29-2.57)	1.66 (1.26-2.18)	

<table>
<tr><th>Bibliographic details</th><th>Participants</th><th>Tests</th><th>Methods</th><th>Outcomes and results</th><th>Comments</th></tr>
<tr><td></td><td></td><td></td><td></td><td>
<table>
<tr><td></td><td>LR- (95% CI)</td><td>0.85 (0.42-1.71)</td><td>0.51 (0.3-0.87)</td><td>0.18 (0.06-0.54)</td><td>0.11 (0.03-0.43)</td></tr>
<tr><td></td><td>Sensitivity, %</td><td>58</td><td>68</td><td>89</td><td>95</td></tr>
<tr><td></td><td>Specificity, %</td><td>45</td><td>63</td><td>52</td><td>70</td></tr>
<tr><td></td><td>PPV, %</td><td>54</td><td>66</td><td>67</td><td>77</td></tr>
<tr><td></td><td>NPV, %</td><td>48</td><td>65</td><td>84</td><td>93</td></tr>
</table>
</td><td></td></tr>
<tr><td>Full citation

Groen, S. E., de Blecourt, A. C. E., Postema, K., Hadders-Algra, M., General movements in early infancy predict neuromotor development at 9 to 12 years of age, Developmental Medicine and Child Neurology, 47, 731-738, 2005</td><td>Sample size
Low risk infants: n = 28
High-risk infants: n = 24
Total: n = 52

Characteristics
<u>Low-risk</u>
Gender, M/F: 17/11
Gestational age, median (range): 40 (38 - 43)
Birthweight, mean (SD): 3467 g (499)

<u>High risk:</u> these were infants admitted to the NICU of Beatrix Children's Hospital (UMC), Groningen. Considered high risk due to preterm birth (n = 18) or hypoxic ischemic encephalopathy after birth (n = 6).
<u>High risk, term:</u>
Gender, M/F: 2/4</td><td>Tests
<u>GM assessment</u>
Spontaneous motility in supine position was video-recorded multiple times during the first postnatal months. Each recording lasted 10 minutes. Videotapes were assessed and categorised according to GM ages:</td><td>Methods
<u>Setting</u>
University medical centre (UMC), Groningen

<u>Details</u>
At the time of each video recording for GM assessment of infants, there was also a standardised neurological examination (techniques of Prechtl 1977</td><td>Results
8/24 High risk infants were diagnosed as having CP at 4 to 9 years of age.
<u>Relationship between Likert-score of quality of GMs at fidgety age and neurological outcome:</u>
<table>
<tr><th><u>GM classification</u></th><th><u>10-point score</u></th><th><u>Normal</u></th><th><u>Cerebral Palsy</u></th></tr>
<tr><td>Definitely abnormal</td><td>2</td><td>0</td><td>3</td></tr>
<tr><td>Definitely abnormal</td><td>3</td><td>0</td><td>4</td></tr>
</table>
</td><td>Limitations
NICE manual Appendix I: Methodology checklist: prognostic studies
1.1 The study sample represents the population of interest with regard to key characteristics, sufficient to limit potential bias to the results: yes
1.2 Loss to follow-up is unrelated to key</td></tr>
</table>

<table>
<tr><th>Bibliographic details</th><th>Participants</th><th>Tests</th><th>Methods</th><th>Outcomes and results</th><th>Comments</th></tr>
<tr>
<td>Ref Id

336409

Country/ies where the study was carried out

Netherlands

Study type

Prospective cohort study

Aim of the study
To explore the value of GM assessment in predicting minor neurological dysfunction (MND) at 9 to 12 years of age.

Study dates
1988 - 1993

Source of funding
None reported.</td>
<td>Gestational age, median (range): 40 (38 - 43)
Birthweight, mean (SD): 3014 g (394)

<u>High risk, pre-term:</u>

Gender, M/F: 11/7
Gestational age, median (range): 30 (26 - 36)
Birthweight, mean (SD): 1438 g (548)

Inclusion Criteria
All children who have participated in past EMG-studies on the development of normal and abnormal GMs (Hadders-Algra 1997). n = 24 were admitted to NICU and n = 28 born at term and recruited at the obstetric department.

Exclusion Criteria
None reported.</td>
<td>preterm GM age (before 38 weeks postmenstrual age (PMA))
During writhing GM age (b38 - 47 weeks PMA)
During fidgety GM age (8 - 17 weeks postterm)
Only movements during awake, non-crying state were analysed.

<u>Reference</u>
Standardised neurological examination (techniques of Prechtl 1977 with age-spec adaptions according to Touwen (1976), at the time of GM assessment. At follow up (aged 9 - 12), the standardised and age-specific neurological examination according to Touwen (1979)</td>
<td>with age-specific adaptions of the norms according to Touwen 1976). The value of GM assessment for the prediction of MND at 9 to 12 years will be compared with that of the traditional neurological as sessment during early infancy.
GM assessment: a refined quality assessment was used which consisted of a Likert (10 point) score, with higher scores denoting better movement qualities. Scores of normal ranged from 8 - 10. The following three features were assessed:</td>
<td>
<table>
<tr><td>Mildly abnormal</td><td>5</td><td>3</td><td>1</td></tr>
</table>
7/9 of the children who showed cramped-synchronised GMs at least during one recording at the writhing GM age developed CP. The presence of cramped-synchronised GMs were dignificantly related to the development of CP (Fisher, p = 0.001).
A discrepancy in the movement quality of arms and legs was not related to the development of CP.
Presence of discrepancy in movement quality of arms and legs and neurological outcome:
<table>
<tr><td rowspan="2">Discrepancy</td><td colspan="2">Neurological outcome</td></tr>
<tr><td>Normal</td><td>Cerebral Palsy</td></tr>
<tr><td>At writhing GM age:</td><td></td><td></td></tr>
<tr><td>No discrepancy/or arms worse quality</td><td>14</td><td>5</td></tr>
</table>
</td>
<td>characteristics (that is, the study data adequately represent the sample), sufficient to limit potential bias: N/A
1.3 The prognostic factor of interest is adequately measured in study participants, sufficient to limit potential bias: yes
1.4 The outcome of interest is adequately measured in study participants, sufficient to limit potential bias: yes
1.5 Important potential confounders are appropriately accounted for, limiting potential bias with respect to the prognostic factor of interest: N/A
1.6 The statistical</td>
</tr>
</table>

<table>
<tr><th>Bibliographic details</th><th>Participants</th><th>Tests</th><th>Methods</th><th>Outcomes and results</th><th>Comments</th></tr>
<tr>
<td></td>
<td></td>
<td>was carried out by the first author who was unaware of perinatal history or quality of GMs.</td>
<td>1. Cramped, synchronised pattern
2. Presence of a discrepancy in quality of movement
3. Type of non-fluent movements i.e. whether movements were jerky, stiff or a mix

<u>Reference</u>
Re-examination between 4 and 9 years with same method.</td>
<td>
<table>
<tr><td>Legs worse quality</td><td>2</td><td>3</td></tr>
<tr><td>At fidgety GM age:</td><td></td><td></td></tr>
<tr><td>No discrepancy/or arms worse quality</td><td>16</td><td>7</td></tr>
<tr><td>Legs worse quality</td><td>0</td><td>1</td></tr>
</table>
Type of non-fluent general movements (GMs) and neurological outcome
<table>
<tr><td rowspan="2">Type of non-fluency</td><td colspan="2">Neurological outcome</td></tr>
<tr><td>Normal</td><td>Cerebral Palsy</td></tr>
<tr><td>At writhing GM age:</td><td></td><td></td></tr>
<tr><td>Jerky and stiff</td><td>7</td><td>4</td></tr>
</table>
</td>
<td>analysis is appropriate for the design of the study, limiting potential for the presentation of invalid results: yes

Other information</td>
</tr>
</table>

<table>
<tr><th>Bibliographic details</th><th>Participants</th><th>Tests</th><th>Methods</th><th>Outcomes and results</th><th>Comments</th></tr>
<tr><td></td><td></td><td></td><td></td><td>
<table>
<tr><td>Predominantly jerky</td><td>7</td><td>2</td></tr>
<tr><td>Predominantly stiff</td><td>2</td><td>2</td></tr>
<tr><td></td><td></td><td></td></tr>
<tr><td>At fidgety GM age:</td><td></td><td></td></tr>
<tr><td>Jerky and stiff</td><td>4</td><td>2</td></tr>
<tr><td>Predominantly jerky</td><td>11</td><td>4</td></tr>
<tr><td>Predominantly stiff</td><td>0</td><td>2</td></tr>
</table>
</td><td></td></tr>
<tr><td>Full citation

Heineman,K.R., Bos,A.F., Hadders-Algra,M., Infant Motor Profile and cerebral palsy: promising associations, Developmental Medicine and Child</td><td>Sample size
Preterm: n = 59
Term: n = 30

Characteristics

Inclusion Criteria
Preterm:

• Gestational age below 35 weeks</td><td>Tests
<u>Index test:</u>
Infant motor profile (IMP) - a video-based assessment of motor behaviour in infancy. The IMP evaluates motor behaviour in 5 domains:</td><td>Methods
<u>Setting</u>
Preterm infants who had been admitted to Beatrix Children's Hospital of University Medical Centre, Groningen, Netherlands.</td><td>Results
In the term group, no children were diagnosed with CP. In preterm group, 8 had CP at 18 months. Of these, 3 had unilateral spastic CP and 5 had bilateral spastic CP.

<u>Area under ROC curve</u> (95% CI)
<u>Total IMP score (mean of 5 domains)</u>
4 Months: 0.89 (0.80 - 0.98)
6 months: 0.91 (0.75 - 1.00)
10 months: 0.99 (0.96 - 1.00)
12 months: 0.99 (0.97 - 1.00)</td><td>Limitations
NICE manual
Appendix I: Methodology checklist: prognostic studies
1.1 The study sample represents the population of interest with regard to key characteristics,</td></tr>
</table>

Bibliographic details	Participants	Tests	Methods	Outcomes and results	Comments
Neurology, 53 Suppl 4, 40-45, 2011 **Ref Id** 316250 **Country/ies where the study was carried out** Netherlands **Study type** Prospective cohort study **Aim of the study** To assess whether infant motor profile (IMP) scores throughout infancy differ between children with and without cerebral palsy (CP) at 18 months. Additionally, the predictive ability of IMP scores throughout infancy for CP were evaluated.	• Sigleton or twin • parents with appropriate understanding of Dutch • Max travel time between child's home and the hospital of 1 hour. term infants: recruited from families of colleagues and acquaintances of the researchers. **Exclusion Criteria** Infants with severe congenital anomalies.	1. Variation 2. Variability (ability to select motor strategies) 3. Movement fluency 4. Movement symmetry 5. Motor performance. Intra-observer and inter-observer reliability were satisfactory. IMP assessments were carried out at 4, 6, 10 and 12 months. <u>Reference test:</u> Hempel assessment at corrected age of 18 months used to determine neurological outcome. This evaluates 5 domains of dysfunction: 1. Fine motor dysfunction	<u>Details</u> IMP assessment were longitudinally performed at corrected age of 4, 6, 10 and 12 months and consisted of a video recording of approx. 15 minutes of spontaneous motor behaviour. Motor behaviour was recorded in supine, prone, sitting, standing and walking condition, depending on the age and functional capacities of infant. Reaching, grasping and manipulation of objects were evaluated in supine and in (supported) sitting condition. The total IMP score were	It is important to note that the lowest area under ROC values were obtained for the symmetry domain of the IMP score, which values ranged from 0.50 - 0.69. The highest values were obtained for the variation and motor performance domains.	**sufficient to limit potential bias to the results:** no (selection bias: term infants were recruited through families and colleagues) **1.2 Loss to follow-up is unrelated to key characteristics (that is, the study data adequately represent the sample), sufficient to limit potential bias:** yes **1.3 The prognostic factor of interest is adequately measured in study participants, sufficient to limit potential bias:** yes **1.4 The outcome of interest is adequately measured in study participants, sufficient to limit potential bias:** no (diagnostic criteria for CP was not reported)

Bibliographic details	Participants	Tests	Methods	Outcomes and results	Comments
Study dates Dec 2003 - Jan 2005 **Source of funding** Junior Scientific Masterclass grant of the post-grad school of Behavioural and Cognitive Neurosciences, University of Groningen.		2. Gross motor dysfunction 3. dysfunctional muscle tone regulation 4. reflex abnormalities 5. visuomotor dysfunction	constituted by the mean of the 5 domain scores. <u>Statistical analysis</u> Area under the curve of the total IMP scores and domain scores over time per infant were calculated. Mann-Whitney U test to compare areas under the curve of children with and without CP was performed. To evaluate predictive ability of total IMP scores and domain scores at the various ages for CP at 18 months, receiver operating characteristic curves were constructed by plotting sensitivities against 1 -		**1.5 Important potential confounders are appropriately accounted for, limiting potential bias with respect to the prognostic factor of interest:** N/A **1.6 The statistical analysis is appropriate for the design of the study, limiting potential for the presentation of invalid results:** yes **Other information** Selection bias of term infants.

Bibliographic details	Participants	Tests	Methods	Outcomes and results	Comments
			specificities. Global predictive ability was indicated by the area under the ROC curve. Follow-up Until corrected age of 18 months.		
Full citation Johnson,A., Goddard,O., Ashurst,H., Is late walking a marker of morbidity? Steering Committee, Oxford Region Child Development Project, Archives of Disease in Childhood, 65, 486-488, 1990 **Ref Id** 316358 **Country/ies where the**	**Sample size** n= 4527 eligible infants n=61 died between the time of discharge from the special care nursery and the age of 18 months. N=4275 walking ability at 18 months assessed (96%) ?4% lost to follow up/ missing data **Characteristics** Infants whose ability to walk was known at 18 months: Mean (SD) birth weight: 2584 (840)g Mean (SD) gestational age: 36.3 (3.5) weeks Infants whose ability to walk was not known at 18 months: Mean (SD) birth weight: 2611 (819)g Mean (SD) gestational age: 36.2 (3.3) weeks	**Tests**	**Methods** Eligible infants were identified by weekly phone calls to the special care nurseries (10 of them in the Oxford region), birth registration (babies born outside region but to mothers residing in the region) and from health visitors (larger infants born outside the region who were in special care nurseries).	**Results** At 18 months 410/4275 were not walking independently. 66 had definite cerebral palsy and 11 suspected cerebral palsy. n=33 Other neurological disease (hydrocephalus without neural tube defect (9), neural tube defect (5), microcephaly (6), associated epilepsy (8), developmental anomaly of brain (2), cytomegalovirus inclusion disease (1), acute alternating hemiplegic migraine (1), Leigh's disease (1)) n=79 Global delay (not associated with chromosome anomaly or syndrome (39), associated with one (40) n=19 other serious congenitial anomalies not affective central nervous system (cardiac (10), orthopaedic (5), other (4)) n=22 other (metabolic and endocrine (6), severe vision impairment (5), bronchopulmonary dysplasia (4), muscular dystrophy (2), not yet classified; for example neoplasm, dysmorphic features (5))	**Limitations** **NICE manual Appendix I: Methodology checklist: prognostic studies** **1.1 The study sample represents the population of interest with regard to key characteristics, sufficient to limit potential bias to the results:** yes **1.2 Loss to follow-up is unrelated to key characteristics (that is, the study data adequately**

Bibliographic details	Participants	Tests	Methods	Outcomes and results	Comments
study was carried out UK **Study type** Prospective cohort study **Aim of the study** To determine whether late walking is associated with neurological and non-neurological abnormalities and gestational age at birth. **Study dates** Infants born in 1984-1985 **Source of funding** Funded by the Oxford regional health authority and the Department of Health.	**Inclusion Criteria** Infants born in 1984 and 1985 to mothers residing in the Oxford Health region at the time of delivery <2000g birthweight or were admitted to a special car nursery for >24hrs during the neonatal period Those who survived were enrolled in the study. The cases of cerebral palsy on a regional register of impairment in 3 year old children were used to assess the predictive ability of failure to walk at the age of 18 months for cerebral palsy. **Exclusion Criteria** None described.		Routine screening tests collected at 7-8 months and 18 months (not corrected for gestational age). Form sent to the health visitor to complete at the time of the assessment of which one question was can the child walk five steps independently ? Late walkers, and those where no outcome was known was followed up at 3years old, by a form to the health visitor asking the eventual age of walking and any abnormality that had been diagnosed.	78 children were entered as definite cases of Cerebral palsy, 66 of which were not walking at 18 months. 1 child's ability to walk was not known. Walking at 18 months as an indicator of cerebral palsy: Sensitivity: 86% Specificity: 92% PPV: 16%	**represent the sample), sufficient to limit potential bias:** yes (61 died and 193 did not have their walking assessed at 18 months) **1.3 The prognostic factor of interest is adequately measured in study participants, sufficient to limit potential bias:** unclear (parents needed to answer the question: is the child walking 5 steps independently?) **1.4 The outcome of interest is adequately measured in study participants, sufficient to limit potential bias:** unclear (diagnostic criteria for CP was not specified) **1.5 Important potential confounders are appropriately**

Bibliographic details	Participants	Tests	Methods	Outcomes and results	Comments
					accounted for, limiting potential bias with respect to the prognostic factor of interest: N/A **1.6 The statistical analysis is appropriate for the design of the study, limiting potential for the presentation of invalid results:** No (95% CI were not reported) **Other information** The authors suggested that late walking would not be a useful screening test (many causes had already been identified by this age), but could highlight those needing further investigation.
Full citation	**Sample size**	**Tests** Index test:	**Methods**	**Results**	**Limitations**

<table>
<tr><th>Bibliographic details</th><th>Participants</th><th>Tests</th><th>Methods</th><th>Outcomes and results</th><th>Comments</th></tr>
<tr>
<td>Morgan,A.M., Aldag,J.C., Early identification of cerebral palsy using a profile of abnormal motor patterns, Pediatrics, 98, 692-697, 1996

Ref Id

316661

Country/ies where the study was carried out

US

Study type

Prospective cohort study

Aim of the study
To determine whether a profile of abnormal motor pattens can identify children with cerebral palsy in the first year of life.</td>
<td>1337 infants were included, of these 1247 had follow up data at 36 months or more (93.3%). Final study sample: n=1171 children at 6 months and n=942 at 12 months. Unclear why the figures are lower,? missing data at those time points.

Characteristics
<table>
<tr><th rowspan="2">Variable</th><th colspan="2">Follow up of 36 months o more</th></tr>
<tr><th>Absent (90)</th><th>Present (n=1246)</th></tr>
<tr><td>Weight, mean (SD), grams</td><td>1654.42 (879.05)</td><td>1839.54 (902.98)</td></tr>
<tr><td>Gestation, mean (SD), weeks</td><td>31.69 (4.62)</td><td>32.72 (4.32</td></tr>
<tr><td>Intraventricular haemorrhage, No/Yes, %</td><td>76.4/23.6</td><td>84.0/16.0</td></tr>
<tr><td>Mechanical ventilation, No/Yes, %</td><td>40.0/60.0</td><td>37.6/62.4</td></tr>
<tr><td>Motor outcome,<36 months, %
Normal
Suspect
Abnormal</td><td>
62.9
14.6
22.5</td><td>
73.4
9.9
16.8</td></tr>
</table>
Birth weight p=0.32
Gestation p=0.28</td>
<td>Early Motor Pattern Profile (EMPP): each scored from 0-2. Carried out by a physician (developmental paediatrician) and two neonatologists (had training in the EMPP).

1. Head lag: none, <30 degrees, >30 degrees
2. Slip through: none, partial, complete
3. Astasis: none, partial, complete
4. Hip abduction: normal, stiff/loose, complete
5. Ankle dorsiflexion: normal, stiff/loose, complete
6. Deep tendon reflexes: 1-2+, 0 or 3+, clonus
7. Asymmetric tonic neck reflex: resolved,</td>
<td>Multidisciplinary evaluations at 6, 12, and 18 months corrected age and 3, 5 and 7 or more years. If they were not seen at 3,5, or 7 years a telephone interview with the parents, physicians and teachers using a questionnaire was carried out. Note: CP was not diagnosed solely by telephone interview.
<u>Motor outcome</u>
Normal: no neurologic abnormalities or functional deficits.
Normal range scored on the standardised motor testing.
Suspect/ minimally impaired: Non specific motor abnormalities or minor functional</td>
<td>Graphs were plotted for the sensitivity and specificity at 6 months and 12months for the EMPP scores for predicting CP. The cutoffs that maximize sensitivity and specificity are scores of 7 at 6 months and 2 at 12 months (90.1% sens, 87.3% spec and 93.8% sens, 93.3 spec respectively).
To increase PPV, cut offs of 9 at 6 months and 3 at 12 months with the following results:
<table>
<tr><th></th><th colspan="2">6 month EMPP</th><th colspan="2">12 month EMPP</th></tr>
<tr><th></th><th>CP</th><th>No CP</th><th>CP</th><th>No CP</th></tr>
<tr><td>Fail (above cut off), n</td><td>176</td><td>21</td><td>162</td><td>16</td></tr>
<tr><td>Pass (below cut off), n</td><td>26</td><td>948</td><td>15</td><td>749</td></tr>
<tr><td>Sensitivity,%</td><td colspan="2">87.1</td><td colspan="2">91.5</td></tr>
<tr><td>Specificity, %</td><td colspan="2">97.8</td><td colspan="2">97.9</td></tr>
<tr><td>PPV, %</td><td colspan="2">89.4</td><td colspan="2">91.0</td></tr>
<tr><td>NPV, %</td><td colspan="2">97.3</td><td colspan="2">98.0</td></tr>
</table>
The 95% CI were not provided in the paper. The following have been calculated from the data table above:
6 months EMPP: Sensitivity 87.13 (81.71-91.42), specificity 97.83 (96.71-98.65), PPV 89.34 (84.17-93.28), NPV 97.33 (96.11-98.25).
12 months EMPP: Sensitivity 91.53 (86.41-95.18), specificity 97.91 (96.63-98.80), PPV 91.01 (85.81-94.77), NPV 98.04 (96.78-98.90)</td>
<td>NICE manual Appendix I: Methodology checklist: prognostic studies
1.1 The study sample represents the population of interest with regard to key characteristics, sufficient to limit potential bias to the results: yes
1.2 Loss to follow-up is unrelated to key characteristics (that is, the study data adequately represent the sample), sufficient to limit potential bias: no (90 infants did not have follow up data at 36 or more months)
1.3 The prognostic factor of interest is adequately measured in study participants, sufficient to limit potential</td>
</tr>
</table>

Bibliographic details	Participants	Tests	Methods	Outcomes and results	Comments
Study dates 1982-1991. **Source of funding** Grants from the Illinois Department of Public Health and the Spastic Paralysis Foundation of the Illinois Eastern Iowa District of Kiwanis International.	**Inclusion Criteria** Children who were already enrolled in the Regional Developmental Follow up Project at the University of Illinois College of Medicine at Peoria and St Francis Medical Center between 1982 and 1991. These children were high risk of developing mental disabilities. They had a least one of the following: • Birth weight <1500g • Assisted ventilation for >48hrs • 5 minute Apgar score <4 • any neurologic complication such as seizures, meningitis, hydrocephalus, intraventricular hemorrhage or hypotonia Children were included if they were seen at approx 6 or 12 months corrected age and an EMPP (Early Motor Pattern Profile) was taken. **Exclusion Criteria** Spina Bifida or any recognised neuromuscular disorder. Children with <36 months follow up.	resolving, obligate 8. Tonic labyrinthine reflex: resolved, resolving, obligate 9. Equilibrium in sitting: functional, emerging, absent 10. Protective extension: functional, emerging, absent 11. Fisting: none, inconsistent, obligate 12. Shoulder retraction:none, inconsistent, obligate 13. Tonic extension:none, inconsistent, obligate 14. Scissoring:none, inconsistent, obligate 15. Equinus:none, inconsistent, obligate	deficits. Variable to borderline score on the standardised motor tests. Abnormal: Clear signs of CP or if motor performance was abnormal on the standardised tests. Classified as having CP. Note: some children had significant cognitive impairment and motor performance but did not have the neurological abnormalities of CP. They were put in the suspect group. Clinicians scoring the motor outcome were unaware of the EMPP scores. Normal and suspect were combined in analysis for the group 'no CP'.		**bias:** yes (but intertester agreement on 42 children was 90.34% assessed by 2 project physicians.) **1.4 The outcome of interest is adequately measured in study participants, sufficient to limit potential bias:** yes **1.5 Important potential confounders are appropriately accounted for, limiting potential bias with respect to the prognostic factor of interest:** N/A **1.6 The statistical analysis is appropriate for the design of the study, limiting potential for the presentation of invalid results:** yes (but 95% CI were not reported. The ones stated in this

Bibliographic details	Participants	Tests	Methods	Outcomes and results	Comments
		Intertester agreement: 42 children repeated examinations. 90.34%. <u>Reference test:</u> Motor outcome assessed through a variety of tests: • Clinical Adaptive Test/ Clinical Linguistic and Auditory Milestone Scale • The Peabody Developmental Motor Scales • The Bruininks-Oseretsky Test • The Bayley Scales of Infant Development • The Stanford Binet Intelligence Scale • The comprehension subtest of the Wechsler Preschool and Primary			table have been calculated) **Other information**

Bibliographic details	Participants	Tests	Methods	Outcomes and results	Comments
		Intelligence Scale • The Developmental Test of Visual Motor Integration • The Wechsler Intelligence Scale for Children-Revised • Wide Range Achievement Tests Abnormal: Clear signs of CP or if motor performance was abnormal on the standardised tests. Classified as having CP.			
Full citation Seme-Ciglenecki,P.,	**Sample size** 232 high-risk preterm infants of gestational age ≤37 weeks.	**Tests** **High-risk group:**	**Methods** A detailed medical history was obtained	**Results** High-risk group: quality of general movements of fidgety character at the corrected age of 3 months Normal movements = 83/120 (69%) children	**Limitations NICE manual Appendix I: Methodology**

Bibliographic details	Participants	Tests	Methods	Outcomes and results	Comments
Predictive value of assessment of general movements for neurological development of high-risk preterm infants: comparative study, Croatian Medical Journal, 44, 721-727, 2003 **Ref Id** 317012 **Country/ies where the study was carried out** Slovenia **Study type** Prospective cohort study **Aim of the study** To assess the predictive value of normal, abnormal, or absent general movements in high-risk preterm infants for the later	**Characteristics** Randomly selected infants were divided into two groups, a high-risk group (n=120) and a control group (n=112). Gestational age, median and range (weeks) • high-risk: 33 (26-37) • control: 34 (24-37) Boys/girls • high-risk: 56/64 • control: 55/57 Birth weight, median and range (g) • high-risk: 1.975 (660-3.820) • control: 1.930 (600-3.680) **Inclusion Criteria** • preterm infants of gestational age ≤37 weeks • with three or more risk factors (antennal, perinatal or neonatal risk) **Exclusion Criteria**	General movement of fidgety character assessment and classical neurological examination the assessment of general movement of fidgety character was carried out according to the recs described by Einspieler (1997) and Hadders-Algra (1992). Each child was examined at the age of 12 weeks after calculated the delivery date. Reliability and validity of the method was assured by the use of videotape recordings of the spontaneous movements in children. During the examination, the children were lying completely undressed on their backs in supine position on a mat on the floor. The assessment of	for all infants. All medical records from the hospital maternity wards were reviewed and for neurological development risk factors noted. Medical history was completed as needed during the follow up visits. All children had undergone all examinations planned for the study. In children in the high-risk group, general movement assessment and classical neurological examinations were performed. Children in the control group underwent only classical neurological examinations. **statistical analysis**	Abnormal movements = 20/120 children Absent movements = 17/120 children <u>Control group: neurological examination according to Amiel-Tison and Grenier at the corrected age of 3 months</u> normal neurological development = 34/112 (30%) children abnormal neurological development = 69/112 (62%) children disharmonious neurological development = 9/112 (8%) children <u>Gold standard: neurological examination according to Illingworth's method at the corrected age of 24 months</u> • high-risk group: normal neurological development = 88/120 (73%) children abnormal neurological development = 32/120 (27%) children. Of these children, 13 had CP and normal mental development, 18 had CP and mental retardation, and 1 child was mentally retarded only. • control group: normal neurological development = 77/112 (69%) children abnormal neurological development = 35/112 (31%) children. Of these children, 11 had CP and normal mental development, 22 had CP and mental retardation, and 2 were mentally retarded only. **General movement assessment:** validity = 92% sensitivity = 94% specificity = 92%	**checklist: prognostic studies** **1.1 The study sample represents the population of interest with regard to key characteristics, sufficient to limit potential bias to the results:** yes **1.2 Loss to follow-up is unrelated to key characteristics (that is, the study data adequately represent the sample), sufficient to limit potential bias:** N/A **1.3 The prognostic factor of interest is adequately measured in study participants, sufficient to limit potential bias:** Yes **1.4 The outcome of interest is adequately measured in study participants,**

Bibliographic details	Participants	Tests	Methods	Outcomes and results	Comments
neurological development. **Study dates** Between October 1, 1994 and December 31, 2000. **Source of funding** Not reported.	• parents refused to participate • infants with birth anomalies of the central nervous system and/or other organs or organ systems • infants with clinical signs of known syndromes that could be recognised in the newborn and infant • infants at risk of inheriting neurological disorders	the general movement qualit y was performed while children were actively awake. Each video session lasted 30 minutes or longer, and was performed at least 1.5 h after the last meal the child had. Between assessments of the two video recordings, the investigator always reviewed the gold standard videotape recording that shows normal general movements in a child of a given age. The global assessment of the general movement quality was made, based on the observer's visual Gestalt perception. General movements of fidgety character were classified		PPV = 81% NPV = 98% **Classical neurological examination:** validity = 60% sensitivity = 97% specificity = 43% PPV = 44% NPV = 97%	**sufficient to limit potential bias:** Yes **1.5 Important potential confounders are appropriately accounted for, limiting potential bias with respect to the prognostic factor of interest:** N/A **1.6 The statistical analysis is appropriate for the design of the study, limiting potential for the presentation of invalid results:** yes (but not 95% CI were reported) **Other information** **Indirectness:** did the study match the review protocol with regards to population: yes intervention/index test: yes

Bibliographic details	Participants	Tests	Methods	Outcomes and results	Comments
		as normal (restless but smoothly rounded movements involving the whole body, with then normal neurological development expected), abnormal (looked like normal fidgety movements but their amplitude, speed and jerkiness were moderately or greatly exaggerated, with then neurological deficits expected in development), or absent (if they were never observed, with neurological deficits expected in development). **Control group:** classical neurological examination . Neurological examination according to Amiel-Tison and Grenier was performed in all			control/comparator: yes outcome: yes Indirectness: none **Setting:** Center for the Children with Developmental Disabilities, Maribor Public Health Center (Slovenia)

Bibliographic details	Participants	Tests	Methods	Outcomes and results	Comments
		children of the control group at 3 months of corrected age. Neurological development of the child was assessed as normal (normal movements pattern), abnormal (abnormal movements patterns were dominant and continuously present), or disharmonious (normal movement patterns intertwined with abnormal ones). **Neurological examination according to Illingworth** was performed as a neurological follow-up of all the children of the high-risk and control group at the corrected age of 12, 15, 18, 21 and 24 months. Neurological development of			

Bibliographic details	Participants	Tests	Methods	Outcomes and results	Comments
		a child with normal movements patterns and normal mental development was evaluated as normal. Neurological development was evaluated as abnormal if a child had cerebral palsy of any kind or degree and/or delayed mental development, including mental development slightly below normal. The assessment of neurological development at the corrected age of 24 months obtained by the Illingworth's method was used as a gold standard in comparison with the assessment of general movements of fidgety character and standard neurological examination			

<table>
<tr><th>Bibliographic details</th><th>Participants</th><th>Tests</th><th>Methods</th><th>Outcomes and results</th><th>Comments</th></tr>
<tr><td></td><td></td><td>according to Amiel-Tison and Grenier.</td><td></td><td></td><td></td></tr>
<tr><td>Full citation

Spittle,A.J., Spencer-Smith,M.M., Eeles,A.L., Lee,K.J., Lorefice,L.E., Anderson,P.J., Doyle,L.W., Does the Bayley-III Motor Scale at 2 years predict motor outcome at 4 years in very preterm children?, Developmental Medicine and Child Neurology, 55, 448-452, 2013

Ref Id

317070

Country/ies where the study was carried out</td><td>Sample size
N=120 initially born and recruited to the RCT
N=115 completed the Bayley III at 2 years (n=3 died, n=2 withdrew from the study)
N=96 completed the MABC-2 at 4 years (n=10 lost to follow up/withdrew from study, n=9 did not complete all the items of the test/ no score)

Characteristics
Characteristics of those with MABC-2 test results at 4 years compared to those who had no data available (drop out/lost to follow up/ incomplete test data)<table><tr><td>Demographic characteristics</td><td>MABC-2 at 4 yrs (n=96)</td><td>No MAB at 4yrs (n=24)</td></tr><tr><td>Gestational age, mean (SD), wks</td><td>27.4 (1.6)</td><td>27.2 (1.</td></tr><tr><td>Birth weight, mean (SD), grams</td><td>1034 (271)</td><td>915 (22</td></tr><tr><td>Gender, M/F (%)</td><td>49/47</td><td>12/12</td></tr><tr><td>Twins/triplets, n (%)</td><td>34 (35)</td><td>5 (21)</td></tr></table></td><td>Tests
Bayley Scales of Infant and Toddler Development-Third edition (Bayley-III)- can be used on children aged 1-42months
2 years old (corrected age) assessment carried out by occupational therapist or psychologist trained in the tool.
<u>Score:</u>

• <-1SD (<85) Suspect motor impairment
• <-2SD (<70): Definite motor impairment</td><td>Methods
See information listed under Tests.
Note: the authors describe that there was little evidence for differences in motor performances in the very preterm children in both groups at 2 or 4 years corrected age, so the data was pooled for this study.</td><td>Results
2 years Bayley-III results:
n=9 (9%): suspect motor impairment
n=4 (4%): definite motor impairment
4 years MABC-2 results:
n=22 (22%): at risk of motor impairment
n=19 (19%): definite motor impairment
At 4 years CP diagnosis:
n=6 (n=3 with quadriplegia, n=2 diplegia, n=1 hemiplegia), they were unable to complete the MABC-2 and allotted a centile of 1.
GMFCS classification for those diagnosed with CP: n=3 level II, n=2 in level III, 1 in level IV.
Bayley III at 2 years and predicting MABC-2 score indicating cerebral palsy at 4 years
<u>Cut off <-1SD</u>
Sensitivity (95%CI): 83 (36,100)
Specificity (95% CI): 94 (87, 98)
PPV (95% CI): 46 (17,77)
NPV (95% CI): 99 (94,100)
<u>Cut off <-2SD</u>
Sensitivity (95%CI): 67 (22,96)
Specificity (95% CI): 100 (96, 100)
PPV (95% CI): 100 (40,100)
NPV (95% CI): 98 (93,100)</td><td>Limitations NICE manual Appendix I: Methodology checklist: prognostic studies
1.1 The study sample represents the population of interest with regard to key characteristics, sufficient to limit potential bias to the results: yes (but participants were recruited as part of a previously published RCT of a preventative care programme to improve developmental outcomes)
1.2 Loss to follow-up is unrelated to key characteristics (that is, the</td></tr>
</table>

Bibliographic details	Participants	Tests	Methods	Outcomes and results	Comments
Australia **Study type** Prospective cohort study **Aim of the study** To assess the predictive validity of the Bayley Scales of Infant and Toddler Development-third edition (Bayley-III) for later motor outcome. **Study dates** January 2005-January 2007. **Source of funding** Grants from the National Health and Medical Council, the Cerebral Palsy Alliance, Cerebral Palsy Alliance/NHMRC co-funded PhD	<table><tr><td>Bronchopulmonary dysplasia, n (%)</td><td>30 (31)</td><td>5 (21)</td></tr><tr><td>Postnatal corticosteroids, n (%)</td><td>4 (4)</td><td>1 (4)</td></tr><tr><td>Grade 3/4 intraventricular haemorrhage, n (%)</td><td>5 (5)</td><td>1 (4)</td></tr><tr><td>Cystic periventricular leukomalacia, n (%)</td><td>2 (2)</td><td>1 (4)</td></tr></table>Birth weight differences between the two groups, p=0.05 Mean age at the 2 year assessment: 24.8 months (range 23.1-29.9) Mean age the 4 year assessment: 53.1 months (range 48.4-65.5) **Inclusion Criteria** Very preterm children recruited as part of a previously published RCT of a preventive care programme to improve developmental outcomes. Born <30 weeks gestation Admitted to the Royal Women's Hospital or Royal Children's Hospital, Melbourne between January 2005 and January 2007. **Exclusion Criteria** Child's parents did not speak English Live >100km from the hospital Congenital abnormality	**Movement Assessment Battery for Children-second edition (MABC-2)** - used on children aged 3-16 years Carried out by a physiotherapist blinded to previous results. Score: • Not more than 5th centile: significant movement difficulty • 6th-15th centile: at risk of movement difficulty **Gross Motor Function Classification System** - carried out at 4 years Diagnosis of CP made when the			**study data adequately represent the sample), sufficient to limit potential bias:** unclear **1.3 The prognostic factor of interest is adequately measured in study participants, sufficient to limit potential bias:** yes **1.4 The outcome of interest is adequately measured in study participants, sufficient to limit potential bias:** yes **1.5 Important potential confounders are appropriately accounted for, limiting potential bias with respect to the prognostic factor of interest:** unclear (logistic regression was used,

<table>
<tr><th>Bibliographic details</th><th>Participants</th><th>Tests</th><th>Methods</th><th>Outcomes and results</th><th>Comments</th></tr>
<tr><td>scholarship, Murdoch Childrens Research Institute, Myer Foundation, Allens Arthur Robinson, Thyne Reid Foundation and the Victorian Government's Operational Infrastructure Support Program.</td><td></td><td>child was 4 years old.</td><td></td><td></td><td>confounders were not specified).
1.6 The statistical analysis is appropriate for the design of the study, limiting potential for the presentation of invalid results: yes

Other information</td></tr>
<tr><td>Full citation

Wolf,M.J., Wolf,B., Bijleveld,C., Beunen,G., Casaer,P., Neurodevelopmental outcome in babies with a low Apgar score from Zimbabwe, Developmental Medicine and Child Neurology, 39, 821-826, 1997

Ref Id</td><td>Sample size
N = 142
Term: 139, of which 16 were small for gestational age
Preterm: 26 of which 4 were small for GA

Characteristics

Inclusion Criteria
Infants with an Apgar score of 5 or less within 5 minutes of birth who had been admitted to the special baby care unit.

Exclusion Criteria
Not reported.</td><td>Tests
<u>Index test</u>
Neonatal neurological examination (NNE) at term or at the latest 5 days after birth. This was adapted from Prechtl (1977) and several predictive items were added, including:

• variation of fluency of movements
• fixation</td><td>Methods
<u>Setting</u>
Special care baby unit, Mpilo Central Hospital
<u>Details</u>
The modified NNE consisted of 84 items. For each item of the test an optimal range was defined which when totalled resulted in the neurological optimality score - the sum score -</td><td>Results
N = 23 diagnosed with CP. Of these:
16 with quadriplegia,
2 with diplegia,
1 with hemiplegia,
4 with choreoathetosis.

<u>Contingency table:</u>
<table><tr><td>NNE using 9 predictors</td><td colspan="2">Diagnosis (using BSID)</td></tr><tr><td></td><td>CP</td><td>Normal</td></tr><tr><td>CP</td><td>17</td><td>2</td></tr><tr><td>Normal</td><td>6</td><td>103</td></tr></table></td><td>Limitations NICE manual Appendix I: Methodology checklist: prognostic studies
1.1 The study sample represents the population of interest with regard to key characteristics, sufficient to limit potential bias to the results: unclear (recruitment has not been</td></tr>
</table>

Bibliographic details	Participants	Tests	Methods	Outcomes and results	Comments
317280 **Country/ies where the study was carried out** Zimbabwe **Study type** Prospective cohort study **Aim of the study** To evaluate the neurological examination adapted from Prechtl for its ability to detect neuromotor deficits in the neonatal period in babies with low Apgar scores. **Study dates** July 1991 - June 1992 **Source of funding** Not reported.		• fluctuating tone • adduction of the thumbs • nasogastric tube feeding • Irritability • Consolability • State regulation. In total, 9 predictors were used to predict CP. Omissions included: abdominal reflex, cremaster reflex, anal reflex, corneal reflex, biceps reflex, ankle jerk, knee jerk <u>Gold Standard/reference</u> At 1 year of age, examinations including a medical history, physical examination and Bayley Scale of Infant Development (BSID) (Bayley, 1969) was	with a possible maximum score of 84. An interpretation of neurological condition was made using method of Jurgens-van der Zee (1979). Infant was considered neurologically abnormal if one or more of the following syndromes present: hyperexcitability syndrome, apathy syndrome, severe hypertonia, severe hypotonia and central or peripheral asymmetry. Paediatrition who evaluated infant's motor performance at 1 year of age and categorised into diagnostic category had no knowledge of infant's	<u>Diagnostic accuracy, % (95% CI)</u> Sensitivity: 73.9 (51.6 - 89.7) Specificity: 98.1 (93.3 - 99.7) PPV: 89.5 (66.8 - 98.4) NPV: 94.5 (88.4 - 97.9) LR positive: 38.8 (9.6 - 156.41) LR negative: 0.27 (0.13 - 0.53)	adequately described) **1.2 Loss to follow-up is unrelated to key characteristics (that is, the study data adequately represent the sample), sufficient to limit potential bias:** unclear (no reason for loss to follow-up was reported) **1.3 The prognostic factor of interest is adequately measured in study participants, sufficient to limit potential bias:** yes **1.4 The outcome of interest is adequately measured in study participants, sufficient to limit potential bias:** yes **1.5 Important potential confounders are appropriately accounted for,**

Bibliographic details	Participants	Tests	Methods	Outcomes and results	Comments
		carried out. The BSID was used as a gold standard.	previous test performance. Follow-up 1 year		**limiting potential bias with respect to the prognostic factor of interest:** yes (birthweight and gestational age) **1.6 The statistical analysis is appropriate for the design of the study, limiting potential for the presentation of invalid results:** yes **Other information**
Full citation Morgan, C., Crowle, C., Goyen, T. A., Hardman, C., Jackman, M., Novak, I., Badawi, N., Sensitivity and specificity of General Movements Assessment for diagnostic	**Sample size** N = 259 high risk infants, 1-year follow up data available for N = 187 **Characteristics** Not reported **Inclusion Criteria** (i) All infants included were those prospectively enrolled in follow – up clinics and screened using the GMA from the study sites: four NICUs in	**Tests** Index test: General Movement Assessment (GMA) Reference test: Neurodevelopmental outcome at 12-24 months post term age. True positives were defined as a confirmed diagnosis of CP	**Methods** Infants were assessed during the fidgety movement period at the developmental follow-up clinic or in the family home. Since GMs in the fidgety period are the most predictive for a	**Results** GMA fidgety results and 12 month outcome results **GMA result** | **12 month outcome**	**Limitations NICE manual Appendix I: Methodology checklist: prognostic studies** **1.1 The study sample represents the population of interest with regard to key characteristics, sufficient to limit**

<table>
<tr><th>Bibliographic details</th><th>Participants</th><th>Tests</th><th>Methods</th><th>Outcomes and results</th><th>Comments</th></tr>
<tr>
<td>accuracy of detecting cerebral palsy early in an Australian context, Journal of Paediatrics and Child Health, 52, 54-59, 2016

Ref Id

436733

Country/ies where the study was carried out

Australia

Study type

Prospective cohort study

Aim of the study
To calculate the sensitivity and specificity of the General Movements Assessment (GMA) for estimating diagnostic accuracy in detecting cerebral palsy (CP) in an</td>
<td>NSW Australia (Westmead Hospital, the Children’s Hospital at Westmead, John Hunter Children’s Hospital and Royal Prince Alfred Hospital) and the Cerebral Palsy Alliance (CPA); (ii) All infants were designated high-risk of poor neurodevelopmental outcome based on their medical history and /or neuroimaging by at least one member of their treating team. This included infants admitted to NICUs post-surgery or with neurological risk factors (e.g. severe intraventricular haemorrhage, periventricular leukomalacia, neonatal stroke), HIE (stages II–III), or due to prematurity; or infants referred to CPA with motor delay or neurological signs suggestive of CP.

Exclusion Criteria
Nil</td>
<td>from a medical doctor. The diagnosis was made based on neurological examination, clinical history and developmental motor assessment. For those not diagnosed with CP, an abnormal outcome was defined as having scored on one or more domains of the Bayley Scales of Infant and Toddler Development-third edition (BSID-III) greater that 1 SD below the mean at follow-up.</td>
<td>later diagnosis of CP, the outcome of interest, the researchers fo cused on results from this GMA period. GMAs for 259 infants were collected on conventional video following the protocol outlined by Einspieler et al. All study sites used certified GM assessors to score the videos blinded to medical and clinical history. Although all sites had certified blind raters there was a number of minor pragmatic practice variations across the study sites in relation to the processes for arranging the scoring. Despite</td>
<td>
<table>
<tr><th>Type of fidgety</th><th>Normal</th><th>CP</th><th>Abnormal</th></tr>
<tr><td>Normal (F+)</td><td>n=99 (72%)</td><td>n=1 (<1%)</td><td>n=38 (28%)</td></tr>
<tr><td>Abnormal (AF)</td><td>n=0 (0%)</td><td>n=0 (0%)</td><td>n=1 (100%)</td></tr>
<tr><td>Absent (F-)</td><td>n=3 (6%)</td><td>n=39 (81%)</td><td>n=6 (13%)</td></tr>
</table>
Sensitivity: 98% [95% CI: 86.79– 99.58]
Sensitivity for detecting any abnormal outcome with abnormal or absent fidgety GMs was 54% (95% CI: 42.66–64.98)
Specificity 94% (95% CI: 88.69–97.16)
Specificity for detecting any abnormal outcome with abnormal or absent fidgety GMs was 97% (95% CI: 91.63–99.36)</td>
<td>potential bias to the results: unclear (participants' characteristics have not been described)
1.2 Loss to follow-up is unrelated to key characteristics (that is, the study data adequately represent the sample), sufficient to limit potential bias: N/A
1.3 The prognostic factor of interest is adequately measured in study participants, sufficient to limit potential bias: yes
1.4 The outcome of interest is adequately measured in study participants, sufficient to limit potential bias: yes
1.5 Important potential confounders are</td>
</tr>
</table>

Bibliographic details	Participants	Tests	Methods	Outcomes and results	Comments
Australian context by a newly established NSW rater network. **Study dates** Not reported **Source of funding** Not reported. Ms Morgan is funded by an NHMRC doctoral scholarship.			uniformity being preferable, in the clinical setting local variations was deemed allowable as the greater knowledge translation goal was for as many raters as possible to be using the GMA and all study sites to develop feasible and acceptable local processes that led to routine GMA use. For instance, one service had a number of raters who scored independently and were blinded, another had two raters but only one blinded, and the other services had two blinded raters. A third rater, unaware		**appropriately accounted for, limiting potential bias with respect to the prognostic factor of interest:** N/A **1.6 The statistical analysis is appropriate for the design of the study, limiting potential for the presentation of invalid results:** yes **Other information**

Bibliographic details	Participants	Tests	Methods	Outcomes and results	Comments
			of medical and clinical history and part of the GM Network, resolved disagreements for any case at any site. There were no scoring accuracy differences between the study sites, despite the differing processes.		

I.4 Red flags for other neurological disorders

No studies were identified for this review.

I.5 MRIand identification of causes of cerebral palsy

Bibliographic details	Participants	Tests	Methods	Outcomes and results	Comments
Full citation de Vries, L. S., Eken, P.,	**Sample size** N = 20 infants who had PVL	**Tests** Ultrasound: infants were scanned with	**Methods** Ultrasound scans were performed daily during the	**Results** Ultrasound | MRI	**Limitations** NICE GUIDELINE 2012: Appendix D (Cohort)

Bibliographic details	Participants	Tests	Methods	Outcomes and results			Comments
Groenendaal, F., van Haastert, I. C., Meiners, L. C., Correlation between the degree of periventricular leukomalacia diagnosed using cranial ultrasound and MRI later in infancy in children with cerebral palsy, Neuropediatrics, 24, 263-8, 1993 **Ref Id** 336274 **Country/ies where the study was carried out** **Study type** Prospective cohort study **Aim of the study** To assess whether the degree of periventricular leukomalacia (PVL)	and developed cerebral palsy. **Characteristics** Gestational age: around 26 - 34 weeks Birth weight (g): around 800 - 1740 Most infants had diplegia at follow-up. **Inclusion Criteria** All newborn infants of 34 weeks gestational or less admitted to level III neonatal intensive care unit. 92 infants had grade I - III leukomalacia on cranial ultrasound. 20 developed cerebral palsy and were included in the study.	ATL UM-4 mechanical sector scanner with a multifrequency transducer (5 -7.5-10 MHz crystals). MRI: performed on a Philips T% imaging system operating at a 0.5 Tesla.	first week and twice a week thereafter until discharge and then again in the clinic as long as the fontanelle remained open. Following discharge, all infants were seen back at 40 weeks postmenstrual age (PMA). PVL was graded as: Grade I: periventricular areas of increased echogenicity Grade II: periventricular areas of increased echogenicity evolving into small localised cysts Grade III: periventricular areas of increased echogenecity evolving into extensive periventricular cystic lesions involving occipital and frontal parietal periventricular white matter. MRI scans performed between 11 and	Grade I leukomalacia (n = 8)	Present beyond 10 days of age in 4/8, remaining 4/8 were discharged between day 7 - 10 and were scanned again at 40 weeks postmenstrual age (PMA), not showing any evolution of cysts.	Parental consent was given for 5/8 cases. Ventricular enlargement was present in 1/5 case and 3/5 had an irregular ventricular shape. 3/5 showed diminished peritrigona; white matter. Delay in myelination was present in the occipital area in 1/5. Periventricular hypersensitivity was seen in all infants, restricted to trigone along the body of the lateral ventricle in 4 and also tending into the frontal periventricular white matter in 1 infant. Thinning of corpus callosum was seen in 2/5.	A: Selection Bias The method of allocation to treatment groups was unrelated to potential confounding factors (that is, the reason for participant allocation to treatment groups is not expected to affect the outcome[s] under study): N/A Attempts were made within the design or analysis to balance the comparison groups for potential confounders: Yes The groups were comparable at baseline, including all major confounding and prognostic factors: N/A Level of risk: Unclear B: Performance bias The comparison groups received the same care apart from the intervention(s) studied: N/A
				Grade II leukomalacia (n = 4)	2/4 developed localised cysts and 2/4 were asked back for a repeat ultrasound within 4 weeks following discharge. They showed an evolution to local cystic lesions, which were still present when reviewed at 40 weeks PMA. These infants were between 16 - 28 months when last examined. 1 learned to walk independently though with a slight gait at 18 months	Permission received for all cases. Ventricular enlargement present in all cases and 2/4 infants had an irregular ventricular shape. 3/4 showed diminished peritrigonal white matter. Delay in myelination was present in 1/4 infant. Periventricular hypersensitivity was present on the T2-weighted image was present in all, restricted to trigone area and along the body of lateral ventricle in 2/4 cases and extending into frontal periventricular white matter in 2/4 cases. Thinning of corpus callosum was seen in 3/4 cases.	

Bibliographic details	Participants	Tests	Methods	Outcomes and results			Comments
diagnosed using cranial ultrasound in the neonatal period, correlates well with the degree of adverse neurological sequelae and with the findings on MRI, performed later during infancy in a group of preterm infants who developed cerebral palsy. **Study dates** September 1989 - May 1992 **Source of funding** Prinses Beatrix-Fonds.	**Exclusion Criteria** None reported.		30 months chronological age. Infants were sedated with 0.1 ml/kg containing 20 mg pethidin, 5 mg chlorpromazine and 5 mg promethzin per ml. T1-weighted images were made in the transverse and/or coronal plane. T" weighted images were made in the transverse plane. All MRI scans were reviewed by a radiologist with a special interest in neuroradiology who was unaware of the neonatal ultrasound data. Special attention was given to ventricular size and shape, involvement of periventricular and deep white matter, degree of myelination on IR, the presence and distribution of areas of periventricular hypersensitiviy (PVHI) and T2-	Grade III leukomalacia (n = 8)	7/8 developed extensive cysts before discharge and in 1 case, extensive cysts were first seen at 40 weeks PMA. Infants were between 12 - 36 months when last examined and none were able to walk independently.	MRI carried out in 6/8 infants. All showed ventricular enlargement associated with an irregular ventricular shape. All showed diminished peritrigonal white matter and a delay in myelination was noted in 5 infants, restricted to occipital area in 2 infants. Periventricular hypersensitivity on T2-weighted images extended from the occipital into the frontal periventricular white matter in all cases. All cases showed thinning of corpus callosum.	Participants receiving care were kept 'blind' to treatment allocation: N/A Individuals administering care were kept 'blind' to treatment allocation: N/A level of risk: N/A C: Attrition bias C1. All groups were followed up for an equal length of time (or analysis was adjusted to allow for differences in length of follow-up): Yes C2a. How many participants did not complete treatment in each group?: N/A C2b. The groups were comparable for treatment completion (that is, there were no important or systematic differences between groups in terms of those who did not complete treatment): N/A C3a: For how many participants in each group were no

Bibliographic details	Participants	Tests	Methods	Outcomes and results	Comments
			weighted images and thinning of corpus callosum.		outcome data available?: N/A C3b. The groups were comparable with respect to the availability of outcome data (that is, there were no important or systematic differences between groups in terms of those for whom outcome data were not available): yes Lack of outcome reporting – no correlations, p-values or diagnostic accuracy reported. D: Detection bias (bias in how outcomes are ascertained, diagnosed or verified) D1: The study had an appropriate length of follow-up: yes D2: The study used a precise definition of outcome: yes D3: A valid and reliable method was used to determine the outcome: yes

Bibliographic details	Participants	Tests	Methods	Outcomes and results	Comments
					D4: Investigators were kept 'blind' to participants' exposure to the intervention/test: yes D5: Investigators were kept 'blind' to other important confounding and prognostic factors: yes **Other information**

I.6 MRI and prognosis of cerebral palsy

Study details	Participants	Interventions	Outcomes and Results	Comments
Full citation van Kooij, B. J., van Handel, M., Nievelstein, R. A., Groenendaal, F., Jongmans, M. J., de Vries, L. S., Serial MRI and neurodevelopmental outcome in 9- to 10-year-old children with neonatal encephalopathy, Journal of Pediatrics, 157, 221-227.e2, 2010 **Ref Id**	**Sample size** 80 children. **Characteristics** All children were born before the introduction of hypothermia treatment. 7 children also received extracorporeal membrane oxygenation.	**Interventions** Neonatal MRI performed in 40/80 children and 34 scans were available for assessment. Childhood MRI obtained without sedation in 77/80 children. The MRI was read by a pediatric radiologist who was blinded to the clinical data. neonatal and childhood MRI were compared with regard	**Results** adverse outcome / Normal/mild lesion: n/total in MRI class (%) / Moderate/severe lesions: n/total in MRI class (%) / p value **neonatal MRI (n=34)** TIS<=15 percentile: 8/13 (61.5) / 11/11 (100) / 0.021	**Limitations** **Other information**

<table>
<tr><th>Study details</th><th>Participants</th><th>Interventions</th><th>Outcomes and Results</th><th>Comments</th></tr>
<tr>
<td>339855

Country/ies where the study was carried out

The Netherlands

Study type
Cohort study.

Aim of the study
To assess whether neonatal MRI was comparable with childhood MRI and long-term outcome.

Study dates
Between 1993 and 1997.

Source of funding
First author received a grant from the Princess Beatrix Fund.</td>
<td>Inclusion criteria

○ Full-term
○ With development of mild neonatal encephalopathy or moderate neonatal encephalopathy
○ On the basis of the highest Sarnat score as assessed during the first week after birth

at least one of the following 3 criteria:

• Late decelerations on fetal monitoring or meconium staining
• Delayed onset of respiration
• Arterial cord blood pH less than 7.10
• Apgar score less than 7 at 5 minutes
• Multiorgan failure

Exclusion criteria</td>
<td>to site and pattern of injury and classified as:

• no lesions
• solitary white matter lesion
• watershed injury
• basal ganglia/thalamus injury
• focal infarction

To assess the relationship between neurodevelopment and MRI findings, the MRI findings were categorised in 3 grades:

• no injury
• mild injury
• moderate to severe injury</td>
<td>
<table>
<tr><td>IQ<=85</td><td>3/13 (23.1)</td><td>14/21 (66.7)</td><td>0.013</td></tr>
<tr><td>CP</td><td>0/13 (0)</td><td>10/21 (47.6)</td><td>0.003</td></tr>
<tr><td>Epilepsy</td><td>0/13 (0)</td><td>7/21 (33.3)</td><td>0.019</td></tr>
<tr><td>special education</td><td>2/13 (15.4)</td><td>9/21 (42.9)</td><td>0.096</td></tr>
<tr><td>childhood MRI (n=77)</td><td></td><td></td><td></td></tr>
<tr><td>TIS<=15 percentile</td><td>24/51 (47.1)</td><td>14/14 (100)</td><td><0.001</td></tr>
<tr><td>IQ<=85</td><td>12/55 (21.8)</td><td>15/21 (71.4)</td><td><0.001</td></tr>
<tr><td>CP</td><td>3/55 (5.5)</td><td>8/22 (36.4)</td><td><0.001</td></tr>
<tr><td>Epilepsy</td><td>0/55 (0)</td><td>8/22 (36.4)</td><td><0.001</td></tr>
<tr><td>special education</td><td>5/55 (9.1)</td><td>11/22 (50)</td><td><0.001</td></tr>
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Study details	Participants	Interventions	Outcomes and Results	Comments
	-			

I.7 Prognosis for walking, talking and life expectancy

Study details	Participants	Methods	Prognostic Factors	Results	Comments
Full citation Beckung, E., Hagberg, G., Uldall, P., Cans, C., Surveillance of Cerebral Palsy in, Europe, Probability of walking in children with cerebral palsy in Europe, Pediatrics, 121, e187-92, 2008 **Ref Id** 336129 **Study type** Cohort study **Country/ies where the study was carried out** Multicentre: France, UK,	**Characteristics** <u>Distribution of walking ability on CP type (n)</u> Unaided walking/walking with aids/unable to walk Unilateral spastic: 2599/178/97 Bilateral spastic: 1837/1091/2216 Dyskinetic: 106/147/360 Ataxic: 281/62/38 Intellectual impairment (IQ, n): Unaided walking/walking with aids/unable to walk ≥85 or normal schooling: 2713/559/278 50-84: 1274/413/375 <50: 366/281/1607 **Inclusion criteria** -Eligible number of participants=9012 Children born between 1097 and 1996 CP was defined as a group of disorders: permanent but not unchanging disorders of movement and/or posture and of motor function, a result of a non-progressive interference, lesion or	**Outcome measure** -CP was divided up into spastic unilateral, spastic bilateral, dyskinetic and ataxic as defined by the SCPE -walking ability was the primary way of walking at 5 years and was graded as 1. Unaided walking, 2. Walking with aids, 3. Unable to walk -Intellectual impairment was graded as 1. IQ≥85 or normal schooling, 2. IQ 84 to 50, 3. IQ <50 **Statistical method and adjusted analysis** -X2 test was used for contingency tables with Bonferroni correction for paired comparisons -Spearman rank correlation test was used for regression analyses -P value of ≤ 0.05 was considered significant and was chosen to avoid non-relevant significance of statistical	**Factors** Ability to walk (in children with CP by CP type)	**Results** <u>Logistic regression analysis of walking ability in 5872 children with CP by CP type</u> <u>Unilateral spastic CP (n=1834; R^2=0.462)</u> -IQ <50: OR 55.76 (95%CI 23.57-131.89); P<0.0001 <u>Bilateral spastic CP (n=3397; R^2= 0.287)</u> -IQ <50: OR 9.35 (95%CI 7.69-11.37); P<0.0001 <u>Dyskinetic CP (n=409; R^2= 0.192)</u> -IQ <50: OR 5.43 (95%CI 3.34-8.83); P<0.0001 <u>Ataxic CP (n=232; R^2= 0.126)</u> -IQ <50: OR 5.21 (95%CI 1.98-13.73); P=0.0008	**Limitations** Based on NICE manual checklist for prognostic studies (2012) • No limitations found according to checklist **Indirectness** Does the study match the review protocol in terms of: population: yes outcome: yes indirectness: none **Other information**

Study details	Participants	Methods	Prognostic Factors	Results	Comments
Northern Ireland, Sweden, Denmark, Italy, Norway **Aim of the study** To describe walking ability in children with cerebral palsy front he Surveillance of Cerebral Palsy in Europe (SCPE) common database through 21 years and to examine the association between walking ability and predicting factors **Source of funding** -Supported by grants from the European Commission	abnormality in the developing or immature brain -Inclusion criteria was based on centre, birth year, CP type, walking ability, intellectual impairment, birth weight, and gestational age -CP was divided up into spastic unilateral, spastic bilateral, dyskinetic and ataxic as defined by the SCPE -Walking ability was the primary way of walking at 5 years and was graded as 1. Unaided walking, 2. Walking with aids, 3. Unable to walk -Intellectual impairment was graded as 1. IQ ≥85 or normal schooling, 2. IQ 84 to 50, 3. IQ <50 -Epilepsy was graded as 1. No active epilepsy, 2. Active epilepsy (seizures the last year or anti epileptic treatment) -Visual impairment was graded as 1. No severe visual impairment, 2. Severe visual impairment (0.3 visual acuteness on the better eye, after correction) -Hearing impairment was graded as 1. No severe hearing impairment, 2. Severe hearing impairment (loss of 70 dB) **Exclusion criteria** -Two centres were excluded from the analysis because subjects had not reported all 4 types of CP (n=347) -n=323 were excluded because they had unknown CP type -n=360 were excluded because they had missing information on walking ability	results because of the large sample size of the population data -Logistic regression analyses were performed to identify variables associated with variations in walking ability **Follow up** 21 years			
Full citation	**Characteristics** Total: n = 2014	**Outcome measure** Adjusted mortality risk ratio.	**Factors**	**Results** Severity:	**Limitations**

Study details	Participants	Methods	Prognostic Factors	Results	Comments
Blair,E., Watson,L., Badawi,N., Stanley,F.J., Life expectancy among people with cerebral palsy in Western Australia, Developmental Medicine and Child Neurology, 43, 508-515, 2001 **Ref Id** 322440 **Study type** Cohort study **Country/ies where the study was carried out** Australia **Aim of the study** Describe rates and causes of death until 31 May 1997 in all people with CP born in Western Australia from 1956 - 1994 (Western	Male/female: 1154/860 <u>Gestational age at delivery</u> > 36 weeks: 1393 33 - 36: 224 28 - 32: 247 <28 weeks: 70 Unknown: 80 <u>Type of motor impairment:</u> Spastic hemiplegia: 703 Spastic diplegia: 562 spastic quadriplegia: 339 Predominantly non-spastic: 301 Unknown: 9 <u>Severity of motor impairment:</u> Minimal: 170 Mild: 732 Moderate: 584 Severe: 470 Unknown: 58 <u>Intellectual impairment:</u> None: 1046 Mild: 292 Moderate: 189 Severe/profound: 477 Unknown: 10 <u>Other impairments</u> Ongoing epilepsy: 785 Blindness: 182 Bilateral deafness: 92 **Inclusion criteria**	**Statistical method and adjusted analysis** Survival curves were constructed for different levels of single variables and inspected visually. The relative risks of mortality and 95% CI associated with different levels fo a given variable were estimated, as were the simultaneous effects on mortality of coexisting variables, with 'risk limits' (proportional hazard regression). Variables included in model unclear. Potentially included: severity, IQ and 'overall disability score' which includes category of motor disorder, severity, cognitive deficit and other impairment. **Follow up** 5 years (birth to 5 years)	Intellectual ability classified as: <u>IQ:</u> < 20, 20 – 30, 35 – 49, 50 – 69, 70 – 85, > 85 <u>Severity</u> classified as: minimal: motor signs present but no functional impairment mild: symptoms result in some functional impairment moderate: Between mild and severe e.g. ambulant with walking frame severe: little purposeful voluntary action, though function may be acquired, IQ permitting	Mortality RR: 1.39 (95% CI: 1.14 – 1.71) <u>IQ:</u> Mortality RR: 2.14 (95% CI: 1.88 – 2.44)	Based on checklist for prognostic studies (2012): • Prognostic factor measured not using GMFCS levels. • Some confounders adjusted for. • Variables in model unclear - possible over-adjustment. **Indirectness** None. **Other information**

Study details	Participants	Methods	Prognostic Factors	Results	Comments
Australian CP register). Unclear **Source of funding** National Health and Medical Research Council of Australia grant 96/3209.	• Ascertained from Western Australian CP Register • Resident in Western Austalia between 1956 and 1994, including those with Cp due to postneonatal causes occurring before 5 years of age. **Exclusion criteria** • None stated.				
Full citation Chen, C. M., Hsu, H. C., Chen, C. L., Chung, C. Y., Chen, K. H., Liaw, M. Y., Predictors for changes in various developmental outcomes of children with cerebral palsy-A longitudinal study, Research in Developmental Disabilities, 34, 3867-3874, 2013 **Ref Id**	**Characteristics** Total: n = 78 <u>Age</u> Mean: 3 years 8 months, standard deviation (SD): 1 year 7 months Age range: 1 year to 5 years <u>CP subtypes</u>: monoplegia, diplegia or hemiplegia: 40 Triplegia or quadriplegia: 38 <u>GMFCS levels</u> level I: 20 level II: 16 Level III: 11 Level IV:14 Level V: 17 **Inclusion criteria**	**Outcome measure** Language (includes expression and comprehension) assessed using Comprehensive Development Inventory for Infants and Toddlers (CDIIT). **Statistical method and adjusted analysis** The dependent variable was the change in developmental outcome between the baseline and follow-up. A 2 step process determined whether a variable was considered a predictor. A pearson correlation coefficient (r) determined correlations between potential predictors at the baseline assessment and scores on the outcome	**Factors** GMFCS levels	**Results** <u>Language</u> Standardised coefficient (β) = -0.22 p = < 0.001 Unstandardised coefficient (β) = -0.58 95% CI (-1.08, -0.08)	**Limitations** Based on NICE manual checklist for prognostic studies (2012) • Unclear if speech was assessed apropriately: a ssessed within 'language' in a diagnostic test which includes expression and comprehensio n. • Some confounders adjusted for

Study details	Participants	Methods	Prognostic Factors	Results	Comments
347766 **Study type** Cohort study. **Country/ies where the study was carried out** Taiwan **Aim of the study** To identify predictors for the change of various developmental outcomes in preschool children with CP. **Source of funding** National Science Council of Taiwan and Chang Gung Memorial Hospital.	• Diagnosis of CP • Age between 1 to 5 years, 6 months **Exclusion criteria** • Genetic or metabolic disorders • Progressive neurological disorders • Severe concurrent illness or medical condition unassociated with CP (e.g. traumatic brain injury or active pneumonia)	measures. A p value was set to 0.25 for the criterion to include potential predictors in the regression analysis. Secondly, the predictors were used in a forward stepwise procedure to generate a linear regression model for each change in an outcome measure. model adjusts for: age and GMFCS levels **Follow up** 6 months			• Only 6 months follow up. **Indirectness** None. **Other information**
Full citation Parkes,J., Hill,N., Platt,M.J., Donnelly,C.,	**Characteristics** Total n = 1357 born between 1980 and 2001 Male/female: 781/576	**Outcome measure** Motor speech problems assessed in standardised assessment form (detail of	**Factors** CP Subtype (bilateral versus unilateral), GMFCS level,	**Results**	**Limitations** Based on NICE manual checklist for prognostic studies (2012)

Study details	Participants	Methods	Prognostic Factors	Results	Comments
Oromotor dysfunction and communication impairments in children with cerebral palsy: a register study, Developmental Medicine and Child Neurology, 52, 1113-1119, 2010 **Ref Id** 321783 **Study type** Reported as "a register study". Analysis of cohort data from Northern Ireland Cerebral Palsy register (NICPR). **Country/ies where the study was carried out** Northern Ireland. **Aim of the study** To report on the prevalence of oromotor dysfunction (motor speech problems,	Mean age at first notifation to NICPR: 4 yrs 2 months, Interquartile range: 2-8yrs Median age at first assessment: 5 years 11 months, Interquartile range: 3 - 9 Early onset CP: n = 1268 Late-onset CP: n = 89 <u>Birthweight</u> (g) < 1500: 258 1500 - 2499: 281 2500 +: 705 Missing: 123 <u>CP subtype:</u> Spastic unilateral: 447 Bilateral spastic: 496 of which 17 were dyskinetic Dyskinetic: 36 Ataxic: 29 Unclassifiable: 47 Missing: 302 <u>Intellectual impairment:</u> None (IQ>70): 641 Moderate (IQ 50 - 70): 200 Severe (IQ<50): 371 Missing: 156 <u>Seizures:</u> None ever: 713 Past only: 198 Currently active: 336 Missing: 120 **Inclusion criteria** - Children with CP born between 1980 and 2001, present in NICPR by June 2009.	assessment form not provided). Motor speech problems: articulation defects or dysarthria. **Statistical method and adjusted analysis** Logistic regression was used to investigate the relation between oro-motor and communication impairments (dependent variables) and the clinical and social characteristics of the children (independent variables). Only independent variables significant at p<0.2 were selected for entry into a multivariable model. In the multivariable model: the addition of each new independent variable in the model was checked using the likelihood ratio statistic and only included if p<0.01. Final model was checked using backward elimination (p<0.01). All models were checked for interaction between GMFCS and IQ. Individuals with missing data on any of the covariates were excluded. All models were checked for goodness of fit (using Homer-Lemeshow test) and were found satisfactory. <u>Speech impairment</u>:	'intellectual impairment' measured using IQ	<u>Speech impairment</u> (articulation; no impairment vs impairment) Bilateral spastic CP versus unilateral spastic CP: OR 1.6 (95% CI: 1.1 – 2.4) Non-spastic CP versus unilateral spastic CP: OR 5.1 (95% CI: 2.8 – 9.1), p < 0.001 GMFCS I (reference) GMFCS II: OR 2.1 (95% CI: 1.2 – 3.5) GMFCS III: OR 2.5 (95% CI: 1.3 – 4.9) GMFCS IV: OR 4.0 (95% CI: 1.9 – 8.4) GMFCS V: OR 8.0 (95% CI: 4.1 – 15.6)	• Prognostic factor measured appropriately: motor speech impairment assessed using a "standardised assessment" (not described). **Indirectness** None. **Other information**

Study details	Participants	Methods	Prognostic Factors	Results	Comments
swallowing/chewing difficulties, excessive drooling) and communication impairments (expressive speech and language difficulties excluding articulation defects) to quantify associations with other clinical and sociodemographic characteristics **Source of funding** Department of Health, Social Services and Public Safety, Northern Ireland.	**Exclusion criteria** - Those born in 1980 and 1998 to 2001 were excluded from analysis as a many in these years did not have standardised assessment forms	Articulation, no impairment coded '0' vs with impairment coded '1' **Follow up** Not reported, approximatel median: 1 year 9 months		p < 0.001 IQ > 70 (reference) IQ 50 – 70: OR 2.7 (95% CI: 1.8 – 4.0) IQ < 50: OR 3.6 (95% CI: 1.8 – 4.0) p < 0.001	
Full citation Strauss,D., Shavelle,R., Reynolds,R., Rosenbloom,L., Day,S., Survival in cerebral palsy in the last 20 years: signs of improvement?,	**Characteristics** Number of children (severe CP/non-severe CP): 6277/22236 Number of deaths (severe CP/non-severe CP): 917/407 Number of person-years (severe CP/non-severe CP): 24996/111761 (crude death rate: 37/4) Age (%, severe CP/non-severe CP): 4-7 years: 45/42 (crude death rate: 36/4)	**Outcome measure** • Survival • Risk of mortality by age, expressed as odds ratios and 95% confidence intervals for severe CP and not severe CP groups	**Factors** • Swallowing difficulties/dysphagia, enteral tube feeding	**Results** Logistic regression model predicting mortality by tube feeding for not severe CP group Feeding tube versus no feeding tube (reference): OR	**Limitations** Based on checklist for prognostic studies (2012): • Prognostic factor for outcome was not stratified by age group,

Study details	Participants	Methods	Prognostic Factors	Results	Comments
Developmental Medicine and Child Neurology, 49, 86-92, 2007 **Ref Id** 327522 **Study type** Retrospective cohort study **Country/ies where the study was carried out** USA **Aim of the study** To investigate the possibility of improved survival in cerebral palsy over a 20- year period **Source of funding** Not reported	8-14 years: 55/58 (crude death rate: 37/4) <u>Gastrostomy feeding status</u> (%, tube fed, severe CP/non-severe CP): 26/3 (crude death rate: 65/21) <u>Gastrostomy feeding status</u> (%, not tube fed, severe CP/non-severe CP): 74/97 (crude death rate: 27/3) <u>Mobility (%, severe CP/non-severe CP):</u> Low: 25/28 (crude death rate: 65/8) Intermediate: 52/33 (crude death rate: 32/3) High: 23/39 (crude death rate: 17/1) (Person-year data from 28 513 children aged 4-14 years; Severe CP: unable to crawl, walk or self-feed; Crude death: death per 1000 person-years; proportion in severe group requiring tube feeding: 16% in 1983, 38% in 2002; proportion in not-severe group requiring tube feeding: 0.6% in 1983, 6% in 2002; mobility in the severe group: low, does not lift head in prone; intermediate, lifts head in prone or rolls; high, full rolling and sitting; mobility in the not-severe group: low, does not walk; intermediate, walks with support or unsteadily alone; high, walks well alone) **Inclusion criteria** Participants who had: -CP -Received services from the California department of developmental service between January 1993 and December 2002	**Statistical method and adjusted analysis** -Used un-pooled repeated observational methods for analysis -Unit of observation was person-year -Logistic regression analysis was used to relate outcome variable with explanatory variables -Variables considered were: severity of CP, age, gender, mode of feeding, mobility, and calendar year -The analysis was equivalent to a Cox proportional hazard model with time-varying co-variates -Model selection was performed using Wald and deviance statistics for nested models, and the Akaike information criterion otherwise -Life tables were used to determine life expectancy (i.e.average number of additional years of life in a large group of similar persons) and median survival times (the time at which 50% of the group would still be alive) for various groups -Mortality rates for ages beyond the ranges of the cohort analyses were computed using the assumption of proportional life expectancy		4.46 (95% confidence interval 3.74-5.33) <u>Logistic regression model predicting mortality by tube feeding for severe CP group</u> Feeding tube versus no feeding tube (reference): OR 2.34 (95% confidence interval 2.00-2.74)	but was adjusted for in the analysis **Indirectness** Does the study match the review protocol in terms of: Population: Yes Outcome: Yes Indirectness: none **Other information**

Study details	Participants	Methods	Prognostic Factors	Results	Comments
	-an age of at least 4 years at some time during this period **Exclusion criteria** -persons with an International Classification of Disease 12 code for any of several degenerative conditions or conditions acquired after infancy, as these might not be considered CP	-Estimated mortality rates to be those for the end of the study period in 2002 to reduce each mortality rate by an appropriate amount to reflect the improvement that has occurred over the study period **Follow up** 136 757 person-years follow-up			
Full citation Touyama,M., Touyama,J., Ochiai,Y., Toyokawa,S., Kobayashi,Y., Long-term survival of children with cerebral palsy in Okinawa, Japan, Developmental Medicine and Child Neurology, 55, 459-463, 2013 **Ref Id**	**Characteristics** N=580 (322 males, 248 females) <u>GMFCS level (n)/gestational age (n, ≥37 weeks/<37 weeks)/birthweight(n, ≥2500g/<2500g)/death rate of population (n)</u> Level I=119/≥37wk=29/<37wk=90/bw≥2500g=27/bw<2500g=92/1 Level II=65/≥37wk=15/<37wk=49/bw≥2500g=15/bw<2500g=50/1 Level III=40/≥37wk=5/<37wk=35/bw≥2500g=8/bw<2500g=32/0 Level IV=189/≥37wk=42/<37wk=147/bw≥2500g=37/bw<2500g=152/2	**Outcome measure** • Survival of children with CP **Statistical method and adjusted analysis** -participant survival rates were estimated using Kaplan-Meier method -difference in survival curves were determined using log-rank test -Cox regression analysis was used to estimate hazard ratios	**Factors** • GMFCS level V	**Results** <u>Hazard ratios for survival of children with CP</u> GMFCS level V: HR 16.281 (95% confidence interval 5.612-47.236), P<0.001 (multivariate analysis included all variables-gender, birth weight, gestational age)	**Limitations** Based on NICE manual checklist for prognostic studies (2012): • No limitations identified **Indirectness** Does the study match the review protocol in terms of: population: yes outcome: yes Indirectness: none

Study details	Participants	Methods	Prognostic Factors	Results	Comments
322263 **Study type** Cohort study **Country/ies where the study was carried out** Japan **Aim of the study** To describe the survival prognosis of children with CP in Japan **Source of funding** Not reported	Level V=166/≥37wk=75/<37wk=90/bw≥2500g=71/bw<2500g=94/1 **Inclusion criteria** -individuals with CP -born between 1988 and 2005 in Okinawa **Exclusion criteria** -individuals born in another prefecture and who moved to Okinawa after birth	**Follow up** mean 8 years 8 months			**Other information**
Full citation Trahan,J., Marcoux,S., Factors associated with the inability of children with cerebral palsy to walk at six years: a retrospective study, Developmental	**Characteristics** -Age ranged from two months to 6 years and 10 months 264 children were included in the analysis -53% were boys, of which 56.4% were quadriplegic -47% of the children were unable to walk at the age of 6 years, and most of them were in wheelchairs and could not walk by themselves -68% of 140 children considered ambulatory, could walk without crutches	**Outcome measure** Proportion of children unable to walk at 6 years was determined for each independent stratum: -Sociodemographic factors: chronological age of child -Perinatal factors: duration of pregnancy, birthweight, being small for gestational age, Apgar score at 5 min after birth, resuscitation in delivery room	**Factors** • Quadriplegia • Diplegia	**Results** <u>Inability to walk at 6 years (187 children evaluated after 12 months of age)</u> Quadriplegia (n=56) OR 2.18 (95%CI 0.73-6.52) Diplegia (n=10) OR 1.00 (reference) Multivariate analysis adjusted for age at assessment	**Limitations** Based on NICE manual checklist for prognostic studies (2012) • Multiple regression analysis was limited to children evaluated after age of 12

Study details	Participants	Methods	Prognostic Factors	Results	Comments
Medicine and Child Neurology, 36, 787-795, 1994 **Ref Id** 322178 **Study type** Retrospective cohort study **Country/ies where the study was carried out** Canada **Aim of the study** To identify factors associated with the inability to walk in six year old children with quadriplegic or diplegic cerebral palsy **Source of funding** -Centre Cardinal-Villineuve (CCV) -Consortium de Recherché en Readaptation de l'Est du Quebec	**Inclusion criteria** Children should: -have been entered a rehabilitation programme at the CCV at any time between 1970 and 1985 -have been diagnosed by a neurologist as having spastic, athetoid, spastic-athetoid or ataxic CP, defined as a permanent and non-fixed postural and motor disorder resulting from dysfunction of the brain before completion of its growth and development -show impairment of the trunk and the 4 limbs mostly in upper extremities (quadriplegia or in lower extremities (diplegia) -be below the age of 7 years at the time of first evaluation at the CCV **Exclusion criteria** N=77 excluded because: -age was more than 6 years old at the time of initial evaluation (n=36) -stopped going to CCV before reaching the age of 6 years old (n=40) -CP appeared after the neonatal period (n=1)	-Neurological impairment and associated conditions: topography of impairment (quadriplegia, diplegia) -Neuromotor activity: presence/absence of symmetric and asymmetric tonic flexes of the neck, tonic labyrinthine reflex, Moro reflex and positive supporting reaction **Statistical method and adjusted analysis** -Proportion of children unable to walk at six years: determined for each stratum of the independent variables -Relative risk corresponds to thc proportion of non-walkers in a given stratum of a variable, divided by the proportion of non-walkers in the stratum chosen as referent -Relative risk estimates the strength of the association between the independent variable and the inability to walk -Statistical significance and the precision of the relative risk are shown by the 95 per cent confidence interval -Association is statistically significant at the 0.05 level when the confidence interval docs not include the value of 1 -A multi- variate logistic regression analysis was carried out on children aged 12			months as children evaluated before 12 months age showed at least one primitive reflex • Only age at assessment was adjusted for in the multivariate analysis, unclear of any other confounding factors **Indirectness** Does the study match the review protocol in terms of: population: yes outcome: yes indirectness:none **Other information**

Study details	Participants	Methods	Prognostic Factors	Results	Comments
-Fonds de la Recherché en Sante du Quebec -National Health Research Scholar from Health and Welfare Canada		months at the time of evaluation -All variables significantly associated P<0.05) with the inability to walk in the univariate analysis were introduced simultaneously in a logistic regression analysis; only those associated @<O-20) with the dependent variables were retained in the model. The logistic regression provides odds ratios that were adjusted for all other variables in the model -Probabilities predicted by the model were dichotomised at the threshold of 50 percent to estimate sensitivity and specificity. These measures corresponded respectively to the proportions of children unable and able to walk at six years, whose walking status at age six could be correctly predicted on the basis of the information available at the first evaluation after the age of 12 months **Follow up** Evaluation from 12 months age to 6 years age			
Full citation Westbom,L., Bergstrand,L.,	**Characteristics** Gender (total n, female/male): 297/411 Born abroad (n, yes/no):	**Outcome measure**	**Factors**	**Results** Hazard ratio (and 95% confidence interval) for	**Limitations** Based on NICE manual checklist for prognostic studies (2012):

Study details	Participants	Methods	Prognostic Factors	Results	Comments
Wagner,P., Nordmark,E., Survival at 19 years of age in a total population of children and young people with cerebral palsy, Developmental Medicine and Child Neurology, 53, 808-814, 2011 **Ref Id** 327521 **Study type** Cohort study **Country/ies where the study was carried out** Sweden **Aim of the study** To investigate survival of children with CP and to identify modifiable factors that influence survival in CP	102/606 Catchment area population (n, small/large): 382/326 GMFCS level (n, 1-IV/V): 605/102 CP subtype (n, spastic hemiplegia/spastic diplegia/spastic tetraplegia/dyskinetic/ataxic/mixed): 211/257/27/120/81/12 Epilepsy (n, yes/no): 258/450 Cognition (n, IQ>50/IQ<50): 494/179 Hip dislocation (n, yes/no): 12/696 Scoliosis (n, yes/no): 31/677 Shunted hydrocephalus (n, yes/no): 64/644 Gastrostomy (n, yes/no): 91/617 **Inclusion criteria** -Confirmed CP diagnosis -children with motor impairment and specific neurological signs (ataxia, dyskinesia and/or spasticity) caused by different genetic syndrome without progressive dysfunction all children with CP born from 1990 to 2005 -lived in or had lived in Skane and Blekinge at any time from birth up to 31st January 2010 **Exclusion criteria**	• Survival and severity of CP **Statistical method and adjusted analysis** -Cox regression analysis was used to assess hazard ratios for mortality in children with CP who were living in a small population health care catchment area- -Children living in a small population health care catchment area with motor function classified as GMFCS level V -Children living in a small population health care catchment area with motor function classified as GMFCS level V and with a gastrostomy -Gastrostomy was included in the analysis as a time-varying co-variate -Mortality hazard ratio for males versus females with CP was explored in the regression analysis -Sequential inclusion was done in order to assess possible confounding factors -Estimates were expressed as hazard ratios with 95% confidence intervals -Confounding factors included in the analysis: size of catchment area, GMFCS level, gastrostomy, gender	• GMFCS levels I-V • gastrostomy	mortality in children with CP (multivariate analysis): Small catchment area: HR 3.18 (95% confidence interval 1.36-7.45), P=0.008 GMFCS level V: HR 11.40 (95% confidence interval 3.76-35.57), P<0.001 Gastrostomy: HR 8.83 (95% confidence interval 3.39-22.96), P<0.001 Male: HR 0.84 (95% confidence interval 0.41-1.73), P=0.629 (adjusted for catchment area, GMFCS level, gastrostomy and gender)	• No limitations identified in study **Indirectness** Does the study match the review protocol in terms of: population: yes outcome: yes indirectness: none **Other information**

Study details	Participants	Methods	Prognostic Factors	Results	Comments
Source of funding Skane county council research and development foundation Medical faculty, Lund university	-children who died before their second birthday -children with pure hypotonia after three years of age according to definition of CP used (from Mutch et al., 1992)	-Survival curves were generated by the Kaplan-Meier method for GMFCS level V children, and also GMFCS levels I to IV children **Follow up** 16 years			
Full citation Wu, Y. W., Day, S. M., Strauss, D. J., Shavelle, R. M., Prognosis for ambulation in cerebral palsy: a population-based study, Pediatrics, 114, 1264-71, 2004 **Ref Id** 348105 **Study type** Retrospective cohort study **Country/ies where the study was carried out** USA **Aim of the study**	**Characteristics** <u>Clinical characteristics of 5366 children with CP who were non-ambulatory at 2 years age (n)</u> Gender (male/female): 3029/2337 Type of motor dysfunction (spasticity/ataxia/dyskinesis/hypotonia/mixed or other): 3348/110/120/884/904 Location of motor dysfunction (quadriplegia/diplegia/hemiplegia/monoplegia/triplegia): 3733/633/310/83/62 **Inclusion criteria** -All children with CP who were not yet walking at 2 to 3.5 years age when they received services from the State of California Department of Development Services between January 1 1987 and December 31 1999 -CP was defined as a group of non-progressive lesions or disorders in the brain characterised by paralysis, spasticity or abnormal control of movement or posture, such as poor coordination or lack of balance	**Outcome measure** -Full ambulation was defined as the ability to walk well alone at least 20 feet without assistive devices, on the basis of the CDER definition for ambulation at level 4 -Full ambulation was analysed at 6 years age as a dichotomous outcome, among all children who survived and received a CDER evaluation at age 6 during the study -Three levels of ambulation were considered: 1. walking unsteadily alone at least 10 feet without assistive devices, 3. walking well alone at least 20 feet without assistive devices (full ambulation) -Multistate survival techniques were used to determine probability of each outcome at various follow-up times -Mortality information was obtained from annual computer files from the State of California (1987-1999) -All children who stopped receiving annual evaluation	**Factors** • Type of CP (spastic, ataxic, dyskinetic including dystonia and chreoathetosis, hypotonic or other) • Distribution of limb movement (quadriplegia, diplegia, hemiplegia, triplegia, monoplegia or other) • Presence of spastic quadriplegia (yes or no) • gross motor function (rolling, sitting, and standing milestones)	**Results** <u>Multivariate odds ratio for achieving full ambulation by 6 years of age among 2295 children with CP who were non-ambulatory at 2 years age</u> <u>Type of CP</u> Spastic quadriplegia: reference 1.00 Other: OR 2.2 (95%CI 2.2-9.6) <u>Motor milestones:</u> Does not roll: reference 1.00 Rolls, does not sit without support: OR 4.6 (95%CI 2.2-9.6) Sits without support, does not stand: OR 12.5 (95%CI 5.8-27.2) Pulls to stand: OR 28.5 (95%CI 13.4-60.4) (OR refers to odds of being able to walk well alone at least 20 feet without assistive devices, compared with odds of not doing so by 6 years of age)	**Limitations** Based on NICE manual checklist for prognostic studies (2012) • No limitations identified **Indirectness** Does the study match the review protocol in terms of: population: yes outcome: yes Indirectness: none **Other information**

Study details	Participants	Methods	Prognostic Factors	Results	Comments
To determine independent predictors of ambulation among children with cerebral palsy and to develop a simple tool that estimates the probability that a child will walk **Source of funding** -Neurological Sciences Academic Development Award	**Exclusion criteria**	within the DDS and were not identified in the state mortality database were considered to be lost to follow-up monitoring **Statistical method and adjusted analysis** -Logistic regression was used to determine predictors of full ambulation at age 6 years -P <0.05 was considered significant, and all significant predictors of ambulation in the univariate analysis were included in the multivariate analysis, backward elimination was used to determine variables most significantly and independently predictive of full ambulation (P <0.10 was considered as the cut off for retention in the model) -Probabilities of ambulation at various levels (with or without support)were estimated at all ages through 14 years of age using Aalen-Johansen estimators of long-term transition probabilities (non-parametric) -The study cohort was separated into 4 exclusive groups on the basis of early motor milestones that were found to be most strongly predictive of future ambulation **Follow up**	• Expressive language (use of words versus no use of words) • Hand use (raking motion or better versus no functional use) • Ability to feed self (independently, needs assistance or unable) • History of seizures (yes or no) • Legal blindness (yes or no)	(Sitting refers to ability to maintain a sitting position without support or ability to achieve sitting position on one's own)	

Study details	Participants	Methods	Prognostic Factors	Results	Comments
		5.8 years			

I.8 Information and support

Study details	Participants	Findings/results	Comments
Full citation Barnfather,A., Stewart,M., Magill-Evans,J., Ray,L., Letourneau,N., Computer-mediated support for adolescents with cerebral palsy or spina bifida, CIN: Computers, Informatics, Nursing, 29, 24-33, 2011 **Ref Id** 317457 **Aim of the study** To determine the extent to which adolescents with disabilities use an online peer support intervention and to evaluate support intervention processes, perceived benefits,	**Sample size** n=27 teens began the intervention, one parent withdrew consent once he understood the Internet component of the intervention, and 4 teens did not attend any online intervention sessions. 5 peer mentors (PM) participated as intervention agents. Qualitative data are based on the 22 teens who participated. **Characteristics** On average, participants were 15 years old (mean 14.6 [SD, 1.6], from English-speaking homes, and lived with, on average, three other family members. There were 15 boys and 12 girls, half with spina bifida (SB) and half with cerebral palsy (CP). All but 2 teens attended public schools; one was in a private school, and 1 was educated at home. **Inclusion criteria** Having a diagnosis of SB or CP; being 12 to 18 years old; having a capacity to use a computer with modifications if necessary (eg, key guard, track, balls, visual enlargement, etc); and having parent-reported ability to read at a grade 6 level with IQ of more than 80.	**Themes/categories** ***Theme: types of support provided in the intervention*** The peer mentors (PMs) "authenticated" stories from teens as they had experienced similar situations. They believed they could provide affirmation support better than parents, friends, or doctors who did not have experience knowledge: "They had much experience with the things, and they gave us information on different web sites and people to contact in finding out these things" One of the peer mentors stated: "I'm older, so I've been there. Whenever we had our chats, especially with the girls, regarding relationships, sexuality, I could support them on how they felt and reassure them that things would be better. Just support them in being how they were, and be accepting". ***Theme: intervention processes*** For participants, the online environment created a safe space and fostered social exchange. They appreciated having someone to talk to, a sense of belonging because they shared the same disability, and an open and nonjudgmental atmosphere. "It's got a sense of community to it, that everybody respects everybody; you have your own opinion, but at the same time, you don't try to shove it down people's throat to get it across..." "I always feel that I can never tell anybody because they don't understand; they don't go through what I go through. And here [chat group], it's great, and you can	**Limitations** Methodological limitations assessed using an adapted Critical Appraisal Skills Programme (CASP 2006). • **Aims:** aim of the study clearly reported, research method was appropiate for answering the research question. • **Sample selection:** how he sample was selected was clearly reported. The relationship between the researcher and the respondents not clearly reported. The participants are appropriate to address the topic. • **Data collection:** data collection clearly described. Roles of the researcher have been clearly described. Data saturation was achieved. • **Data analysis:** analysis clearly described. Data presented is enough to support the findings. Unclear how saturation in terms of analysis was achieved, unclear whether the researcher managed his own pre-understanding in relation to the analysis. Clear how the analysis was independently validated.

Study details	Participants	Findings/results	Comments
and satisfaction with the intervention. **Study dates** Not reported **Source of funding** Not reported	**Exclusion criteria** Not reported	talk about everything and anything, and nobody bashes you for it. Some people disagree with you, but they don't, like, bark at you for it. Some participants noted that the virtual, nonvisible environment allowed them to openly express opinions. The format offered anonymity and/or escape from the "real world": "If I were to have a bad day at school or something, and there was a chat that night, then I could go and talk somebody about it"; "I don't know. It just helped me - I know it's going to sound cheesy and stuff, but just because I had someone to talk to about this kind of stuff, it helped, yeah". 3 of the adolescents stated they did not experience a sense of connection, in part because their disability was not a central issue in their lives: "I don't want to sound ungrateful or spiteful toward the group, I just [pause]... some of the time, I just had better stuff to do because I assumed they would be talking about things that didn't apply to me. 7 of the participants described how hearing other's perspectives enhanced their self-awareness through social comparison: "It gave me a different window into myself, not just into other people. It made me understand a bit more about myself and my limitations and my goals and the way I can fit them"; "The chats made me have a better attitude toward life, going through it and knowing that there were other people like me out there in the world and other who are worse than I am". ***Theme: Satisfaction with interventions*** 14 participants reported that they had "fun" being part of the online support intervention. They mentioned that the support intervention was "enjoyable", "humorous", and "interesting". "I got into a routine where I always wanted to be in the computer at a certain time"; "It was fun, we had a lot of laughs, and we joked about stuff, and people actually cared about what you say, so that's why I found it so fun" On the other hand, other participants found the experience impersonal, restrictive, and stressful. One	• **Findings/results:** results clearly described and applicable to the aims. Hypothesis were generated. Theory or model were not generated. Overall quality based on limitations: **moderate**

Study details	Participants	Findings/results	Comments
		of the participants did not appreciate the disability focus: "I personally don't like being grouped in specifically with people who have disabilities, because it makes me think I'm not normal if I'm being stuck with other people who have disabilities, too. It makes me focus on the fact that I'm different, and I don't really like that. **Theme: Peer Mentor's experiences** One mentioned that she "wouldn't have felt so alone or isolated". They highlighted the value of having an "understanding ear" or advice from someone who "had walked in their shoes!: "just being able to vocalise some of the things and maybe having it reinforced, Yeah, it's okay. I went through that too".	
Full citation Darrah, J., Magil-Evans, J., Adkins, R., How well are we doing? Families of adolescents or young adults with cerebral palsy share their perceptions of service delivery, Disability and Rehabilitation, 24, 542-549, 2002 **Ref Id** 336257 **Aim of the study** The satisfaction of families of adolescents and young adults with a diagnosis of cerebral	**Sample size** 49 young people and 39 young adults and their families **Characteristics** Young people's age ranged from 13 to 15 years and young adults' age ranged from 19 to 23 years **Inclusion criteria** Adolescent or young adult family member with a diagnosis of any type of cerebral palsy who had regular contact with parents or other family members. Both the youth and at least one parent had to agree to participate in the study. **Exclusion criteria** Not reported	**Themes/categories** ***Theme: Caring and supportive people*** A mother of an adolescent remembered how much it meant for them to have a nurse spend a few minutes with them to explain their child's surgery: "I, in particular, with her first operation, before we took her home, I remember. One of the nurses said to me, and they were so busy, just rushes. And she said, you know, 'Are you worrying?' And I said, 'Yes, I'm really worried. I really, I've never nursed, I don't know anything about casts. I don't know anything about operations'. So she said, 'Tell you what, we'll sit down for 15 minutes and we'll go through this'. And she sat down on the bed and she took me through all sorts of stuff that I needed. And she said. 'you will see, you know, blood will start coming through from the operation. It will come through the plaster cast. (...). What she did is she gave me confidence to look after myself. And that was more important than anything else she could do. Participants attending the town hall information meeting reiterated how important genuine personal comments or deeds were to their perception of service delivery.	**Limitations** Methodological limitations assessed using an adapted Critical Appraisal Skills Programme (CASP 2006). • **Aims:** aim of the study clearly reported, research method was appropriate for answering the research question. • **Sample selection:** how the sample was selected was clearly reported. The relationship between the researcher and the respondents was clear. The participants are appropriate to address the topic. • **Data collection:** data collection was clearly described. Roles of the researcher have been clearly described. Unclear whether data saturation was achieved. • **Data analysis:** analysis not described. Data presented is enough to support the findings. Unclear how saturation in terms of analysis was

Study details	Participants	Findings/results	Comments
palsy with the service delivery they had experienced in the areas of health, education, recreation, employment, housing and transportation was examined. Common themes across the six service areas were identified. **Study dates** Not reported **Source of funding** Not reported		***Theme: communication and information*** Parents talked about the use of complex terminology and the adolescents and young adults share experiences of being ignored in conversations, and of service providers talking 'over their heads', as if they were not present in the room. A mother of an adolescent described her son's trip to a dentist: "... The first dentist we would go to, he wouldn't even speak to him. There was no conversation at all. It was just like he was looking at an inanimate object or something, you know. There was nothing, he never acknowledge Fred from the time we went until the time we left". An adolescent noted: "I guess, like, the doctors use big terminology and I think that, if I want to be a part of the decision, they kind of should talk so that I can understand it". Other parents noted that their comments and suggestions were not perceived as important by service providers: "We're not just these parents out there flapping and I honestly got the feeling in the past when we were dealing with the schools. You were afraid to say anything because it was like, 'Oh God, not you guys again', or, ' You don't understand' or 'We know what we are doing. Who do you think you are?'. In addition, information was difficult to give and to receive. Families expressed frustration at having to repeat their child's history with every new teacher, doctor, therapist or new service agency involved with their child. A mother of an adolescent said: " . . . at the beginning of the school year, we usually call a meeting, all her teachers get together, so they're all sitting there and they all hear the same thing. I usually make out a form of, like, what she can and can't do, or what she has difficulty with. And I hand it out to all the teachers so they all have a copy, and it's on her file. What we did is: I got pamphlets, and we had them put it in her file this year. But it's like every	achieved, unclear whether the researcher managed his own pre-understanding in relation to the analysis. Unclear how the analysis was independently validated. • **Findings/results:** results clearly described and applicable to the aims. Hypothesis, theory or model not generated. Overall quality based on limitations: **low** **Other information** This is a mixed methods research study.Parents completed a questionnaire rating their overall satisfaction with 6 service areas on a 7-point Likert scale and for each service area, participants were asked to circle the words that indicated their level of satisfaction with a given service that their child had received. Ultimately, parents completed a semi-structured interview in the participants' home in which parents elaborated on the reasons for their choice of ratings. Results reported in this table are those obtained from the semi-structured interviews.

Study details	Participants	Findings/results	Comments
		year starting over, and you do it again the next year . . ." Parents suggested the generation of an educational file or portfolio that described the child's abilities and challenges, methods of learning and communication, etc. This file could travel with the child at school. In terms of receiving information, parents reported that information is not easily accessible to them in any area of service. Obtaining good information depended on belonging to certain networks and the families who didn't, they missed out on service opportunities because either they didn't know they existed, or they didn't know how to apply for them. Across all service areas, parents felt that service providers often did not share information about available services spontaneously, but rather restricted themselves to answering only the specific questions of the parents and caregivers. A grandmother caring for a young adult shared her frustration with this experience: "I said, 'You know, they don't tell you anything, so you don't know what help there is'. She [social worker] said, 'Maybe you don't ask the right questions'.Well, who do we ask those questions?, Where do you ask those questions? To whom do you ask? No one tells you. A mother described her frustration at trying to access recreation services for her adolescent: "...the services are there. Sometimes you have to ask specifically. Like they don't just sort of say well these are the services that are out there for you. You have to say, 'I want this'. And then they'll tell... we're finding all these things out ourselves. It would be really kind of nice to have a list of community organizations that help disabled people". Often such lists are available, but not all families are informed of their availability. Parents suggested that having a central information centre to maintain up-to-date information would be helpful. Other suggestions were provision of community television to provide information regarding available programmes. ***Theme: disability awareness***	

<table>
<tr><th>Study details</th><th>Participants</th><th>Findings/results</th><th>Comments</th></tr>
<tr><td></td><td></td><td>Participants felt that many service providers did not understand the needs and abilities of their children. They reported that often the general public and their children's peers were not comfortable with a person with a disability.
A mother of an adolescent suggested:
"... a lot of society needs to be more accepting.Educate the general public...when we go to a mall, and there's always someone following, staring, right?"
An adolescent talked about his experiences in school:
"... a lot of the teachers don't understand..about my disability. They think that I'm like, could do like more, like about the same as other kids.
Another adolescent who uses a walker shares her experience:
"Just when I seem to think they start to know how I feel, they turn around and do something like collapse my walker... These are some kids who don't even bother to tease me because they don't even know I'm alive, I think, but oh well".
Study participants provided several ideas for increasing awareness in the wider population: for example, invite high-profile persons with disabilities to speak at disability education sessions in schools. They also recommended that teachers and health care providers need more information in their educational training about how to relate to persons with disabilities.</td><td></td></tr>
<tr><td>Full citation

Reid, A., Imrie, H., Brouwer, E., Clutton, S., Evans, J., Russell, D., Bartlett, D., "If I knew then what I know now": parents' reflections on raising a child with cerebral palsy,</td><td>Sample size
9 parents

Characteristics
<table><tr><th>Name</th><th>Age (years)</th><th>GMFCS level</th><th>Living status</th><th>Employment status</th></tr></table></td><td>Themes/categories
<u>Theme: Challenges Experienced by Children and Families and Need for Supports</u>
Sub-theme : Foundational Need to Support Children and Families Through Information
Great importance of the diagnosis in order to support the child's eligibility and access to needed supports. Parents spoke of the importance of seeking information, asking questions, and knowing their rights in order to fully support and advocate for their child:</td><td>Limitations
<u>Methodological limitations</u> assessed using an adapted Critical Appraisal Skills Programme (CASP 2006).

• Aims: Aim of the study clearly reported, research method was appropriate for answering the research question.</td></tr>
</table>

Study details	Participants	Findings/results	Comments
Physical & Occupational Therapy in Pediatrics, 31, 169-83, 2011 **Ref Id** 339836 **Aim of the study** To explore the theme “If I knew then what I know now, I would have done things differently” with parents of young adults with CP. In doing so, researchers aimed to identify areas in which HCPs might be able to improve their practice in order to work more effectively with parents to provide the best care for children with CP. **Study dates** **Source of funding** Jack and Ina Pollock Charitable Foundation.	**Abigail** 22 female at home student **Brooke** 21 female at home employed **Craig** 22 male school residence student **Diane** 17 female at home student **Emma** 20 female school residence student **Francis** 22 female at home Unemployed **Greta** 17 female at home student **Harrison** 20 male at home student **Irene** 18 female at home student **Inclusion criteria** Not reported **Exclusion criteria** Not reported	"Put as many labels on her as she needs ... because without the labels, you don’t have access to all that. And that opened up everything for her. She got all the equipment she needed, we got her into the social group that she loves..."—Greta’s parent. ***Theme: External and Formal Supports*** **Sub-theme : Key Aspects of Formal Support:Honesty,Clear Communication ,and Collaboration** Parents appreciated HCPs who were honest and upfront about their child’s CP diagnosis and prognosis. Using of nontechnical language with parents and children was considered important. Parents were appreciative of HCPs who showed respect for the child as a human being by communicating with them directly and building a relationship. Involving the child in discussions and paying attention to their needs improved the child’s experience: "But the number one thing I find with my service provider, the first time I meet them if they walk over, if they say hi to me and they walk directly over to her and say hi (name of the child)—right there is the tell tale for me."—Parent of Diane**.** Positive experiences were facilitated by collaboration among members of the health care team, providing information at a pace appropriate for each child and family, and easing access to services and programs through support and provision of programs in the community. Parents who did not have these kinds of experiences expressed having a more difficult time coping: "... when you get the diagnosis you’re in shock. They give you all sorts of information and it doesn’t sink in ... and nobody really talks to you fully about it after. You know, you get all different services but they’re all like separate".—Parent of Irene. **Sub-theme : Need for Informational and Accommodation Supports for Educators** In addition to HCPs, educators played a pivotal role in the family’s life and the child’s development. Parents reported a need for increased education of teachers that fosters awareness, and not fear, about CP and the corresponding needs for children of all functional	• **Sample selection:** How the sample was selected was clearly reported. The relationship between the researcher and the respondents clearly reported. The participants were appropriate to address the topic; although the majority of participants were female. • **Data collection:** Data collection clearly described. Roles of the researcher have been clearly described (however, physiotherapist who had prior with some of the families conducted the interviews). Data saturation was achieved. • **Data analysis:** Analysis clearly described. Data presented is enough to support the findings. Clear how saturation in terms of analysis was achieved, unclear whether the researcher managed his own pre-understanding in relation to the analysis. Clear how the analysis was independently validated. • **Findings/results:** results clearly described and applicable to the aims. Hypothesis, theory or model not generated. Overall quality based on limitations: **moderate**

Study details	Participants	Findings/results	Comments
		levels. Parents recognised the challenges that educators face when teaching a child with CP and found that sensitive training, positive personal outlooks, and smaller class sizes were important to optimise their child's education. **Sub-theme:Importance of Accessing Community Programs: Both Specialised and Integrated** Parents recommended that community programs or services be more widely advertised and used, and requested assistance in negotiating long wait lists to access programs: "...but her transitions and everything have gone relatively smoothly(...)and I think it's just because we have been plugged into the right groups, and we have used them".—Greta's parent ***Theme: System-Level Supports*** Parents of children with relatively low levels of motor function (i.e. GMFCS level I) noted that their children experienced unique challenges within the school system related with their more "invisible" impairments. These parents felt that their children's learning and social–emotional impairments were less likely to gather attention and appropriate supports than their physical impairments. Although the following quote is in the context of the school, the theme resonated across all of society: "Her teacher did not understand because (child) looked very normal. And they just did not understand her condition. And because they didn't understand her condition they didn't make allowances for it".—Parent of Irene. Although exposure, integration, and increased awareness have caused the general public to better understand the diagnosis of CP, they still felt that more education is required. For example, parents would have preferred if the child was addressed directly rather than ignored or belittled with "baby talk" and conversation was not solely directed at the parents: "...the secretary talked to me,I was standing back at the door,and she had rolled up to the desk—the secretary looked over her and talked to me and asked	

<table>
<tr><th>Study details</th><th>Participants</th><th>Findings/results</th><th>Comments</th></tr>
<tr><td></td><td></td><td>me questions ...I think they just ...habit, people just do it".—Parent of Abigail.</td><td></td></tr>
<tr><td>Full citation

Knis-Matthews, L., Falzarano, M., Baum, D., Manganiello, J., Patel, S., Winters, L., Parents' experiences with services and treatment for their children diagnosed with cerebral palsy, Physical & Occupational Therapy in Pediatrics, 31, 263-74, 2011

Ref Id

336538

Aim of the study
The original aim of this study was to document the perspectives of 4 parents of children diagnosed with CP who participated in a constrant-induced movement therapy program (CIMT) program delivered using a group format. During this</td><td>Sample size
n=4 parents

Characteristics<table><tr><td>Parent</td><td>Megan</td><td>Tracy</td><td>Rachel</td><td>Marianne</td></tr><tr><td>Child</td><td>Jake</td><td>Sean</td><td>Tom</td><td>Eric</td></tr><tr><td>Child's age at the time of the study</td><td>6</td><td>5 1/2</td><td>9</td><td>5</td></tr><tr><td>Child's diagnosis</td><td>Right-side hemiplegia</td><td>Right-side hemiplegia</td><td>Right-side hemiplegia</td><td>Left-side hemiplegia</td></tr></table>Inclusion criteria
Not reported

Exclusion criteria
Not reported</td><td>Themes/categories
Theme: It Was so Hard to Get the Information and Support that I Needed to Help My Child
Sub-theme 1: Impersonal setting and lack of information.
“The doctors actually came into my room and said that [his] brain bleed was so severe and recommended just stopping all life support and all medical assistance. My husband and I said No! There’s no way. We are going to do anything we can to save him.”
Tracy and Marianne recalled similar feelings: “The hospital was like eight weeks of truly living hell and the whole roller coaster ride of ups and downs .... We had such an emotional time. It was such a roller coaster that we thought our world was ending and the next minute we would get great news.” “They (hospital staff) were like, why don’t you go downstairs and read about [herpes meningitis] and I’m like my child is not even out of intensive care (Marianne).”
Sub-theme 2: Information about available resources
Upon discharge from the hospital the participants described even more challenges finding access to available resources.
Megan stated, “When I first learned of the diagnosis, I didn’t know anything about it.I really had no idea, I tried to look it upon the internet, couldn’t find much information”.
Rachel faced similar obstacles: “It’s very hard to find somebody who has been through it. People talk to you like you should know what early intervention is. I didn’t know what early intervention was.”
Sub-theme 3: Sources of support from individuals dealing with similar life experiences:
These relationships provided moral support and also served as a resource.</td><td>Limitations
Methodological limitations assessed using an adapted Critical Appraisal Skills Programme (CASP 2006).

• Aims: Aim of the study reported. Research method was appropriate for answering the research question.
• Sample selection: How the sample was selected was clearly reported. The relationship between the researcher and the respondents not clearly reported. The participants were appropriate to address the topic.
• Data collection: Data collection clearly described. Roles of the researcher have been clearly described. Unclear whether data saturation was achieved.
• Data analysis: Analysis not clearly described. Data presented is enough to support the findings. Unclear how saturation in terms of analysis was achieved, unclear whether the researcher managed his own pre-understanding in relation to the analysis. Unclear how the analysis was independently validated.
• Findings/results: main results clearly described and additional results were reported as new themes emerged during the group discussions.</td></tr>
</table>

Study details	Participants	Findings/results	Comments
process, the parents discussed other issues that are related but separate from the primary aim of the study. To report parents' perspectives, it is important to include these additional issues that address support systems and service delivery. **Study dates** Not reported **Source of funding** Not reported		Megan stated, "I have another mom with a child with a disability and he is in the same grade as Jake. We are on the phone all the time. Jake went to a disabled preschool ...so I met people ...they understand." Tracy also found support and resources through individuals: "That was really the light bulb, knowing that there were other people that had walked this path before me. It was a great resource for me". Rachel described similar feelings as she commented on the networking process: "If you make connections you seem to get information in different ways. I really think you need to find a good source in the beginning and then you network and meet other parents. You can meet people in the waiting rooms and you get lists and stuff, different things are helpful."	Hypothesis, theory or model generated not generated. Overall quality based on limitations: **moderate**
Full citation Miller, J., Colligan, J., Colver, A., A qualitative study, using focused interviews, of the information needs of families whose children's names are on a cerebral palsy register, Child: Care, Health & Development, 29, 465-71, 2003	**Sample size** 13 families **Characteristics** **Ages of interviewees (years)**: 22-60 (median 38) **Those interviewed**: 5 couples; 7 mothers alone; 1 father alone	**Themes/categories** ***Theme: Parents' views on their need for information about NECCPS register*** Sub-theme: Parents would like more information about NECCPS. 'Information on prognosis would be helpful.' 'We don't know about prognosis. We're in the dark so any information at all would be appreciated.' 'Information on other children with the same severity.' 'The most I would like to know about cerebral palsy is more about the particular type of cerebral palsy rather than just cerebral palsy because I would like to know about our (daughter's) type of cerebral palsy than just cerebral palsy itself . . . what I find lacking is not enough information about her particular type of hemiplegia.'	**Limitations** Methodological limitations assessed using an adapted Critical Appraisal Skills Programme (CASP 2006). • **Aims:** aim of the study partially reported, research method was appropriate for answering the research question. • **Sample selection:** how the sample was selected was clearly reported. The relationship between the researcher and the respondents not clearly reported. The participants are appropriate to address the topic.

Study details	Participants	Findings/results	Comments
Ref Id 339802 **Aim of the study** To seek families' views about what information they would like about the North of England Collaborative Cerebral Palsy Survey (NECCPS) and how they would like this information to be conveyed. While interviewing these families, it became clear that they also wished to discuss their own information needs regarding cerebral palsy as distinct from information about the register so those have also been reported. **Study dates** **Source of funding** SCOPE (Northern) and Research and Development Department of Northumbria	**Married**: All (2 were adoptive mothers) **At least 1 parent with employment outside the home**: 11 families **Ages of children with CO (years)**: 2 -16 (median 8) **Types of CP**: 5 unilateral spastic CP; 2 bilateral spastic CP with lower limbs involved; 4 bilateral spastic CP with 4 limbs involved; 2 athetoid CP **Inclusion criteria** Not reported **Exclusion criteria** Not reported	'Information on behaviour you know we have had some really difficult times in the past . . . not knowing that it is common (with this type of hemiplegia) to get epilepsy and the absences.' •Who to distribute to? 'Definitely to health centres. The sort of thing you might pick up and read in the doctors waiting room, to families and to a wider audience'. 'My family know that she's got cerebral palsy but they don't know what it is and I think they're scared to ask us. Often I think they just don't want to know. Sending it to them would educate them and that would help them and us.' 'To doctors and health centres – they have information and newsletters on everything else so why not on cerebral palsy?' 'Its not the carers of people with cerebral palsy that need information or education about the impact of the condition on family life or need to have their awareness raised, it's other people who do – the general public . . . just to be more flaming helpful when your struggling with a severely disabled child in a wheelchair.' •Style: clarity of information was paramount. Parents stressed that information should be easy to read, non-threatening, and free of medical and technical jargon. Most did not want too much detail, rather a general overview. 'Easily digestible and light-hearted. Headlines that get you interested.' 'Something a bit light-hearted really, not too many facts and figures.' 'Not full of medical or technical jargon. We already get enough of information that we don't understand. The doctor baffles us with jargon and we always have to ask the physio afterwards.' 'We feel intimidated by the doctor and all the medical terms. We always have to ask for explanations and we feel stupid because we don't understand. Something in the information on our terms would be very helpful especially about diagnosis and prognosis.'	• **Data collection:** data collection not clearly described. Roles of the researcher have been clearly described. Unclear whether data saturation was achieved. • **Data analysis:** unclear how the analysis was done. Data presented is enough to support the findings. Unclear how saturation in terms of analysis was achieved, unclear whether the researcher managed his own pre-understanding in relation to the analysis. Unclear how the analysis was independently validated. • **Findings/results:** main results clearly described; additional results were also reported as new themes emerged during the group discussions. Hypothesis, theory or model not generated. Overall quality based on limitations: **moderate**

Study details	Participants	Findings/results	Comments
Healthcare NHS Trust.		***Theme: Parents' views on their need for general information*** <u>Sub-theme: Parents wanted better information sharing with professionals.</u> Parents thought that information sharing by professionals with each other and with families was inadequate. There was a clear need to be able to access any kind of information as equals to health professionals. This concerned both the quantity and quality of information. 'Professionals need to improve information sharing and be more equal.' 'On the whole I've been treat by most doctors as an equal but the neurologists in particular consistently kept information from us, lulled us into a false sense of security. I don't see why I couldn't have been told and had equal access to information about my child. They said it was due to a fear that I might not bond if I heard anything bad.' 'My GP allowed me to sit down and read through my daughter's notes and see what the neurologist had written . . . I was very angry and distressed because all the time we were being fed only partial information and being lulled into a false sense of security.' 'When we take x (daughter) to see her consultant, there are usually other doctors and health professionals in the room and he (consultant) always talks to them, he never ever talks to us. We always have to ask the physiotherapist to explain to us what was said afterwards.' All parents interviewed had a need for more information than they are currently being given: 'I feel there is still a notion of power and privilege with regard to information and doctors still keep privileged information. My GP does but he's not the child's parent. It does make me very angry. I'm as qualified in my field as doctors are in theirs and they should share information with me as an equal'. 'Being kept abreast of what they (doctors) know and what the current thinking on the condition is would be	

Study details	Participants	Findings/results	Comments
		good, rather than them have their own little secret research societies and groups.' An understanding of the complexities of sharing information was highlighted: 'The fact that I can articulate myself is unusual and I know from the other parents that I come into regular contact with, that they often don't have the same ability to articulate themselves but they do have exactly the same concerns and the same rights to information as I do.' <u>Sub-theme: Parents wanted better information about special equipment.</u> Parents experienced difficulty in accessing appropriate commercially aids, fittings and equipment even when there were no financial barriers to obtaining the items. Difficulty in knowing about and obtaining appropriate aids, fittings, and equipment. This was especially for the older child. It was a practical problem, not a financial barrier: 'Practical information would be useful – you know, on specialist equipment. We need lots of equipment as our son grows and we didn't know where to get it. It can be very expensive. We only found out by default that some good equipment is available second hand'. 'We never get told about equipment we only found out about it by chance. The doctors don't tell us. The NHS doesn't tell us. It would be excellent'. 'Definitely information on equipment. She is getting older now and has started riding a bike with stabilisers and she wants to try without the stabilisers. It is knowing about equipment . . . we don't know much about equipment and types of equipment that we can get and what is available to us and that sort of thing.' <u>Sub-theme: Parents wanted clearer information sooner after getting a diagnosis.</u> Diagnosis of cerebral palsy was not specifically on the interview schedule. One of the opening questions by the researcher was 'Can you tell me something about your son/daughter's cerebral palsy?'	

Study details	Participants	Findings/results	Comments
		Issues relating to diagnosis and communication and information problems at the time of diagnosis were raised spontaneously by each participant and appeared to be of crucial importance to them. It was discussed as a communication failure on the part of the health professionals. Breaking bad news was an issue and even though children had been diagnosed years ago, many parents remained angry and bitter about the way in which this had been done. 'We only found out by chance (that daughter had CP) when she was a year old. We overheard doctors talking about her.' <u>Sub-theme: Parents wanted information on the emotional effects of cerebral palsy on unaffected siblings.</u>	
Full citation Kruijsen-Terpstra, A. J. A., Verschuren, O., Ketelaar, M., Riedijk, L., Gorter, J. W., Jongmans, M. J., Boeije, H., Verhoef, M., Titulaer, A. F., Meinsma-van der Tuin, M., van de Laar-Bakker, Y. M., van Munster, J. C., Geerts, M. J. P. M., Voorman, J. M., van Vulpen, L., Luijten-Ansems, C. A., Gorter, H., Janssen-Potten, Y. J. M., van den Heuvel, H. A. J. M., van der Hoek, F.	**Sample size** n=21 parents of children with cerebral palsy. **Characteristics** Not reported **Inclusion criteria** Not reported **Exclusion criteria** Not reported	**Themes/categories** Theme: information Parents expressed a need for information, especially on CP in general, information regarding their child's therapy and information about what to expect for their child's future. Parents reported that their informational needs were not always met. "The first time I was asked that question [defining the child's therapeutic needs], I thought 'What? What should I ask for? How can my child become healthy? So my response was, like, 'What?' So the first few times I asked nothing. But then you get to talk to parents who have been faced with this for some time, and you get some information: 'Oh, yes, that's something you can ask. Right, about toilet training, that's a good question'. So you start to think differently about the way they think". Sub-theme: information on CP in general Parents reported having an urgent desire for general information on CP. Parents reported that it was difficult to ask for specific information at a time when they	**Limitations** <u>Methodological limitations</u> assessed using an adapted Critical Appraisal Skills Programme (CASP 2006). • **Aims:** aim of the study clearly reported, research method was appropriate for answering the research question. • **Sample selection:** how the sample was selected was clearly reported. The relationship between the researcher and the respondents not clearly reported. The participants are appropriate to address the topic. • **Data collection:** data collection not clearly described. Roles of the researcher have not been clearly described. Data saturation was not achieved.

Study details	Participants	Findings/results	Comments
D., Parents' experiences and needs regarding physical and occupational therapy for their young children with cerebral palsy, Research in Developmental Disabilities, 53-54, 314-322, 2016 **Ref Id** 445455 **Aim of the study** To explore the experiences and needs of parents of young children (aged 2-4 years) with cerebral palsy (CP) regarding their child's physical and occupational therapy process in a rehabilitation setting. **Study dates** Not reported **Source of funding** ZonMw, Johanna Kinderfonds, Stichting Rotterdam Kinderrevalidatie		were still quite unfamiliar with their child's diagnosis and the rehabilitation setting. Parents reported that they appreciated when the therapists took the initiative in providing this general information. "Yeah, that [i.e. information on the way children with CO can function in society] is what I really missed! You enter a world that you know nothing whatsoever about. You leave the hospital with the child and they tell you'Well, keep track of its development'. And that's about it. Sub-theme: therapy A substantial number of parents reported that they were not aware of what was actually happening during their child's therapy. Some of these parents did not feel they needed more information about the content of their child's therapy, whereas others expressed a desire for more information. Parents often wanted more information to enable them to practice with their child at home. "If you have to decide for yourself then I wouldn't really know how to do that. What goals you can set, or will she actually be able to do this in three months' time? So I'd think, 'We'll have to wait and see, you know?' And then the others [i.e. therapists] would be fully convinced: 'Yes, I think so'. But they know much more about it than we, f course, so I'd always appreciate it when they did that. Sub-theme: information on prospects Most parents expressed the desire for their child to be able to live independently in the future. These parents often reported the need to have information regarding on what would be realistic to expect for their child's future. Parents often experienced disappointments about their child's progress. Some parents reported that they tried to protect themselves, and no longer dared to have expectations about their child's development. "Yeah, we're always very neutral about it, so that it's all good. So it's not that you expect something and then you're disappointed.	• **Data analysis:** analysis not clearly described. Data presented is not enough to support the findings. Unclear how saturation in terms of analysis was achieved, unclear whether the researcher managed his own pre-understanding in relation to the analysis. Unclear how the analysis was independently validated. • **Findings/results:** results clearly described and applicable to the aims. Hypothesis, theory or model not generated. Overall quality based on limitations: **low-moderate**

Study details	Participants	Findings/results	Comments
Donds Adriaanstichting, Revalidatiefonds, Phelps Stichting, Revalidatie Nederland, and the Nederlandse Vereniging van Revalidatieartsen.			
Full citation Wiegerink, D., Verheijden, J., 100 questions about sex and cerebral palsy (CP) of young adults with CP, Developmental Medicine and Child Neurology, 55, 14, 2013 **Ref Id** 432626 **Aim of the study** To explorethe queries young adults with CP have about sex and the way they prefer to be informed. **Study dates** Not reported **Source of funding**	**Sample size** N=33 young people and adults with cerebral palsy. **Characteristics** Participant's age ranged between 15 and 40 years old. **Inclusion criteria** Not reported **Exclusion criteria** Not reported	**Themes/categories** Theme: Sexuality The study collected over 100 sex-related questions about coping with pain, fatigue, spasticity or physical limitaions. Questions also related to medical devices, pregnancy, fertility, contraception, communication with their partner, parenting. Young adults with CP preferred written communication as well as the Internet to find answers to their questions about and they wished to communicate with other people with CP about sexuality.	**Limitations** Methodological limitations assessed using an adapted Critical Appraisal Skills Programme (CASP 2006). • **Aims**: aim of the study clearly reported, research method was appropriate for answering the research question. • **Sample selection:** how the sample was selected was not clearly reported. The relationship between the researcher and the respondents not clearly reported. Unclear whether the participants are appropriate to address the topic. • **Data collection:** data collection not clearly described. Roles of the researcher have not been clearly described. Unclear whether data saturation was not achieved. • **Data analysis:** analysis not described. Data presented is not enough to support the findings. Unclear how saturation in terms of analysis was achieved, unclear whether the researcher managed his own pre-understanding in

Study details	Participants	Findings/results	Comments
Not reported			relation to the analysis. Unclear how the analysis was independently validated. • **Findings/results**: results not clearly described. Hypothesis, theory or model not generated. Overall quality based on limitations: **very low**

I.9 Assessment of eating, drinking and swallowing difficulties

Bibliographic details	Participants	Tests	Methods	Outcomes and results	Comments
Full citation DeMatteo,C., Matovich,D., Hjartarson,A., Comparison of clinical and videofluoroscopic evaluation of children with feeding and swallowing difficulties, Developmental Medicine and Child Neurology, 47, 149-157, 2005 **Ref Id** 257312	**Sample size** n = 75. **Characteristics** Age range: 0 - 14 yrs, 62% younger than 12 months. Type of diagnosis: • Cerebral palsy • prematurity • Pierre Robin sequence • hypoxic-ischemic encephalopathy • Vacterl syndrome	**Tests** Clinical assessment: 5 occupational therapists and 1 speech-language pathologist were involved in the intake, clinical assessment and VF of the children. An 'experienced clinician' was defined as an occupational therapist or speech and language pathologist with at least 5 years experience of working with infants and children with feeding and swallowing problems. Index test: Clinical assessment procedure	**Methods** An occupational therapist or speech language pathologist different from the clinical evaluator completed the VF evaluation. VF evaluation was discussed with the radiologist in attendance and consensus scores were used to support the accuracy and improve the validity of the VF findings. Statistical analysis: Data was split into 2 categories of food consistency (fluid and semi-solids) for both penetration and aspiration. This served to	**Results** Aspiration of fluids (p = 0.002*) Clinical assessment / VF | | Present | Absent | Total | |---|---|---|---| | + | 22 | 19 | 41 | | - | 2 | 16 | 18 | | Total | 24 | 35 | 59 | Sensitivity = 92% ± 11% Specificity = 46% ± 17% *association between clinical assessment and VF. Aspiration of solids (p = 0.67)	**Limitations** **QUADAS-2 Checklist** Domain 1: Patient selection Was a consecutive or random sample of patients enrolled? Consecutive Was a case-control design avoided? Yes Did the study avoid inappropriate exclusions? Yes Could the selection of patients have introduced bias? No, children selected based on some form of feeding difficulty. However, mixed population (not only CP). Risk: Low B. Concerns regarding applicability

Bibliographic details	Participants	Tests	Methods	Outcomes and results	Comments
Country/ies where the study was carried out Canada **Study type** Prospective cohort study **Aim of the study** 1) To evaluate the accuracy of clinical evaluation compared with videofluoroscopic swallow studies (VF) in the detection of penetration and aspiration in children aged 0 - 15 years. 2) To assess the relationship between therapists confidence ratings in making judgements between therapists' confidence ratings in making	• Angelman syndrome • infantile spasms • cardiac condition • Down sundrome • developmental delay • seizure disorder • failure to thrive • acquired brain injury • brain tumour Reason for referral to Feeding and Swallowing Service: Gastro-oesophageal reflux vomiting: n = 13 Behaviour/aversive reactions: n = 9 Failure to thrive/poor intake: n = 9 Respiratory symptoms and cough: n = 8 Sensory/texture issues: n = 8 Oral motor coordination and	A clinical evaluation form for oral motor and swallowing evaluation was designed for therapists to record their	stratify for age and oral motor function as young infants were only given fluids. 4 by 4 tables were used to assess diagnostic accuracy. Logistic regression models were used to develop the prediction model. Clinical variables examined for prediction models were: delayed swallow, cough, gag, reflux behaviours, abnormal respiration, colour changes (facial and upper lip) and voice changes. When variables were highly correlated with each other, the variable most clinically observable and least open to interpretation was entered into the prediction analysis (e.g. colour changes is more readily observable than determining how to evaluate abnormal respiration). Setting: Referred over a 15 month period to McMaster Children's Hospital at Hamilton Health Sciences (tertiary care centre with referral base and catchment area of central southwest Ontario).	Clinical assessment / VF | | Present | Absent | Total | | + | 2 | 9 | 11 | | - | 4 | 17 | 21 | | Total | 6 | 26 | 32 | Sensitivity = 33% ± 38% Specificity = 65% ± 18% Penetration of fluids (p = 0.05) Clinical assessment / VF | | Present | Absent | Total | | + | 31 | 17 | 48 | | - | 8 | 12 | 20 | | Total | 39 | 29 | 68 | Sensitivity = 80% ± 13% Specificity = 42% ± 18% Penetration of solids (p = 0.18) Clinical assessment / VF	Is there concern that the included patients do not match the review question? Concern: Yes - mixed CP and other conditions Domain 2: Index test(s) A. Risk of bias Were the index test results interpreted without knowledge of the results of the reference standard? Unclear If a threshold was used, was it pre-specified? N/A Could the conduct or interpretation of the index test have introduced bias? Unclear Risk: Unclear B. Concerns regarding applicability Is there concern that the index test, its conduct, or interpretation differ from the review question? Concern: Low Domain 3: Reference standard A. Risk of bias Is the reference standard likely to correctly classify the target condition? Yes Were the reference standard results interpreted without knowledge of the results of the index test? Yes Could the reference standard, its conduct, or its interpretation have introduced

<table>
<tr><th>Bibliographic details</th><th>Participants</th><th>Tests</th><th>Methods</th><th>Outcomes and results</th><th>Comments</th></tr>
<tr>
<td>judgements about the presence or absence of penetration and aspiration and the accuracy of their judgements, as confirmed by VF.
3) To identify clinical predictors of penetration and aspiration during clinical evaluation of children with feeding and swallowing difficulties.

Study dates
Not reported. reported: referral during a 15 month period.

Source of funding
Hamilton Health Sciences Research Development Fund.</td>
<td>feeding difficulties: n = 7
Swallowing difficulties: n = 5
Choking: n = 5
Query aspiration: n = 5
Other: n = 6

Inclusion Criteria
- Patients and outpatients with any diagnosis, aged 0 to 15 yrs, presenting with feeding and/or swallowing difficulties.
- Undergone both clinical and VF.

Exclusion Criteria
None reported.</td>
<td></td>
<td></td>
<td>
<table>
<tr><td></td><td>Present</td><td>Absent</td><td>Total</td></tr>
<tr><td>+</td><td>7</td><td>10</td><td>17</td></tr>
<tr><td>-</td><td>3</td><td>12</td><td>15</td></tr>
<tr><td>Total</td><td>10</td><td>22</td><td>32</td></tr>
</table>
Sensitivity = 70% ± 28%
Specificity = 55% ± 21%
Note: The paper reported positive and negative predictive values which are not extracted here as predictive values are not in the protocol.

Predictors of fluid aspiration and penetration (p<0.05)
<table>
<tr><th>Model for fluid aspiration[a]</th><th>Relative risk</th></tr>
<tr><td>Cough + voice changes + gag</td><td>1.7</td></tr>
<tr><td>Cough + voice changes + colour changes</td><td>1.6</td></tr>
<tr><td>Cough + delayed swallow + gag</td><td>1.6</td></tr>
<tr><td>Cough + voice changes</td><td>1.5</td></tr>
<tr><td>Cough + delayed swallow</td><td>1.5</td></tr>
</table>
(a)Any variable or combination without cough does not predict aspiration (cough was the most significant predictor of fluid aspiration).

<table>
<tr><th>Model for fluid penetration[a]</th><th>Relative risk</th></tr>
</table>
</td>
<td>bias? If the physicians also carried out the index test? No
Risk: Low

B. Concerns regarding applicability
Is there concern that the target condition as defined by the reference standard does not match the review question?
Concern: Low

Domain 4: Flow and timing
A. Risk of bias
Was there an appropriate interval between index test(s) and reference standard? Unclear
Did all patients receive a reference standard? Yes
Did patients receive the same reference standard? Yes
Were all patients included in the analysis? Yes
Could the patient flow have introduced bias? No
Risk: Low

Other information</td>
</tr>
</table>

<table>
<tr><th>Bibliographic details</th><th>Participants</th><th>Tests</th><th>Methods</th><th>Outcomes and results</th><th>Comments</th></tr>
<tr><td></td><td></td><td></td><td></td><td>
<table>
<tr><td>Cough + gag + reflux behaviours</td><td>2.3</td></tr>
<tr><td>Cough + gag</td><td>2.1</td></tr>
<tr><td>Cough</td><td>1.3</td></tr>
<tr><td>Reflux behaviours + voice changes + colour changes</td><td>0.05</td></tr>
</table>
(a)Cough alone did not predict penetration but model was stronger when other variables were combined with cough.

<u>Predictors of solid aspiration and penetration</u> (p < 0.05)

<table>
<tr><th>Model for solid aspiration[a]</th><th>Relative risk</th></tr>
<tr><td>Colour changes + abnormal respiration</td><td>3.0</td></tr>
<tr><td>Cough + abnormal respiration + colour changes</td><td>2.9</td></tr>
</table>
(a) Cough decreases the strength of the model.

<table>
<tr><th>Model for solid penetration[a]</th><th>Relative risk</th></tr>
<tr><td>Colour changes + abnormal respiration</td><td>2.6</td></tr>
<tr><td>Cough + abnormal respiration + gag</td><td>2.7</td></tr>
</table>
(a) Cough adds nothing to any model.
</td><td></td></tr>
</table>

<table>
<tr><th>Bibliographic details</th><th>Participants</th><th>Tests</th><th>Methods</th><th>Outcomes and results</th><th>Comments</th></tr>
<tr>
<td>Full citation

Beer, S., Hartlieb, T., Muller, A., Granel, M., Staudt, M., Aspiration in children and adolescents with neurogenic dysphagia: comparison of clinical judgment and fiberoptic endoscopic evaluation of swallowing, Neuropediatrics, 45, 402-5, 2014

Ref Id

403882

Country/ies where the study was carried out

Germany

Study type

Retrospective cohort study

Aim of the study</td>
<td>Sample size
n = 30, of which n = 5 had CP.

Characteristics
Of the n = 5 with CP:
Age: 41 - 90 months.
Gender: 2 female, 3 male

Inclusion Criteria
All children with neurogenic dysphagia who had received FEES between May 2011 and June 2012.

Exclusion Criteria
None reported.</td>
<td>Tests
<u>Index</u>:
Clinical assessment by German board-certified speech and swallowing therapists, all with at least 3 years of professional experience in paediatric neurorehabilitation. Clinical judgement on whether aspiration occurred was based on 1) Anamnestic information (concerning the type of food and way of feeding in the past, the occurrence of respiratory tract infections/aspiration pneumonias and of unclear fever).

2) Detailed physical examination, with special respect to:

• vigilance
• tone
• head control
• mobility
• respiration
• voice

3) Observation of spontaneous tongue and lip movements,</td>
<td>Methods
Clinical judgement was included from all 8 speech pathologists in the centre and FEES was performed by 3 different paediatric neurologists working together with respective speech pathologist and nurse taking care of the child at the time of FEES.

When penetration was detected, the clinical judgement of aspiration was still classified as true positive, since penetrations imply a high risk for aspiration (even if not all penetrations lead to aspiration).

<u>Setting</u>
Clinic for Neuropaediatrics and Neurohibilitation, Epilepsy Centre for Children and Adolescents, Vogtareuth.
<u>Statistics</u>
No statistical method reported.</td>
<td>Results
<table>
<tr><th rowspan="2">Patient number</th><th rowspan="2">Age at FEES (months)</th><th colspan="3">FEES</th><th colspan="3">Clinical</th></tr>
<tr><th>Saliva</th><th>Puree</th><th>Liquids</th><th>Saliva</th><th>Puree</th><th>Liquids</th></tr>
<tr><td>9</td><td>41</td><td>A</td><td>N/A</td><td>N/A</td><td>A</td><td>N/A</td><td>N/A</td></tr>
<tr><td>13</td><td>54</td><td>A</td><td>A</td><td>N/A</td><td>A</td><td>N/A</td><td>A</td></tr>
<tr><td>15</td><td>75</td><td>N</td><td>N</td><td>P</td><td>N</td><td>N/A</td><td>A</td></tr>
<tr><td>16</td><td>86</td><td>A</td><td>N</td><td>P</td><td>N</td><td>N</td><td>A</td></tr>
<tr><td>17</td><td>90</td><td>N</td><td>A</td><td>P</td><td>A</td><td>A</td><td>A</td></tr>
</table>
A: aspiration, N/A: not available, P: penetration

(Penetration – classified as ‘true positive’ for aspiration).</td>
<td>Limitations

QUADAS-2 Checklist

Domain 1: Patient selection

Was a consecutive or random sample of patients enrolled? Yes (consecutive)

Was a case-control design avoided? Yes

Did the study avoid inappropriate exclusions? Yes

Could the selection of patients have introduced bias? No

Risk: Low

B. Concerns regarding applicability

Is there concern that the included patients do not match the review question? No

Concern: low

Domain 2: Index test(s)</td>
</tr>
</table>

Bibliographic details	Participants	Tests	Methods	Outcomes and results	Comments
To test the validity of the clinical assessments by comparing the results with FEES. **Study dates** May 2011 - June 2012 **Source of funding** Not reported.		drooling, throat clearing, coughing, tongue protrusions, rooting and, if possible, observation of the swallowing of puree, think liquids and solid food. Reference: Fibreoptic endoscopic evaluation of swallowing (FEES) performed in an interdisciplinary team comparison a paediatric neurologist performing FEES, nurse (for patient monitoring and safety) and 2 speech and swallowing therapists (for positioning, motivation, feeding, instruction of phonation and documentation). Penetration was defined as entry of food or saliva in the laryngeal inlet but not below the folds. Aspiration was defined as entry of food or saliva below the vocal folds.			A. Risk of bias Were the index test results interpreted without knowledge of the results of the reference standard? Unclear If a threshold was used, was it pre-specified? N/A Could the conduct or interpretation of the index test have introduced bias? Unclear Risk: Unclear B. Concerns regarding applicability Is there concern that the index test, its conduct, or interpretation differ from the review question? Concern: Unclear Domain 3: Reference standard A. Risk of bias Is the reference standard likely to correctly classify the target condition? Yes

Bibliographic details	Participants	Tests	Methods	Outcomes and results	Comments
					Were the reference standard results interpreted without knowledge of the results of the index test? Yes Could the reference standard, its conduct, or its interpretation have introduced bias? No Risk: Low B. Concerns regarding applicability Is there concern that the target condition as defined by the reference standard does not match the review question? Concern: Low Domain 4: Flow and timing A. Risk of bias Was there an appropriate interval between index test(s) and reference standard? Yes Did all patients receive a reference standard? Yes Did patients receive the same reference standard? Yes

Bibliographic details	Participants	Tests	Methods	Outcomes and results	Comments
					Were all patients included in the analysis? No. Could the patient flow have introduced bias? No Risk: Low Overall: Low

I.10 Management of eating, drinking and swallowing difficulties

Study details	Participants	Interventions	Methods	Outcomes and Results	Comments
Full citation Adams,M.S., Khan,N.Z., Begum,S.A., Wirz,S.L., Hesketh,T., Pring,T.R., Feeding difficulties in children with cerebral palsy: low-cost caregiver training in Dhaka, Bangladesh, Child: Care, Health and Development, 38, 878-888, 2012 **Ref Id** 317385	**Sample size** N=37 caregivers and their children **Characteristics** **Children:** Age (mean, SD): 3 years 11 months (2 years 3 months) Age range: 19-129 months Male:female ratio: 8 male:14 female CP type (n): Spastic:17; Hypotonic: 3; Athetoid: 1; Mixed: 1 Severity of CP (n): Level III (moderate): 3; Level IV	**Interventions** Training programme of 6 sessions every 2 weeks.	**Details** Training programme: consisted of education on dietary intake, ease and efficiency of eating, utensils, behaviour of caregiver towards feeding child, postural and physical support for positioning and self-feeding. Each training session included educational content as well as supervised feeding. Teaching methods included traditional pedagogy, discussion, participation and experimental activities, use of visual aids including a 20 minute video drama created especially for the programme. Each child was given a low-cost seat and a plastic teaspoon and cup.	**Results** Respiratory health at 4 to 6 months (frequency of chest related illnesses at least once every 3 months) (n): 6/22, P 0.005 Nutritional status (weight for age scale, mean, SD) at 4 to 6 months: -4.07 (2.45), P 0.02 Time spent feeding at 4 to 6 months (observed >30 minutes per meal) (n): 3/22, P 0.005 Time spent feeding at 4 to 6 months (reported > 30	**Limitations** NICE guidelines manual 2012: Appendix D: Methodology checklist: cohort studies A. Selection bias (systematic differences between the comparison groups) A.1 The method of allocation to treatment groups was unrelated to potential confounding factors (that is, the reason for participant allocation to treatment groups is not expected to affect the outcome(s) under study)-N/A A.2 Attempts were made within the design or analysis to balance the comparison groups for potential confounders-N/A A.3 The groups were comparable at baseline,

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Country/ies where the study was carried out Bangladesh **Study type** Cohort study. **Aim of the study** To investigate the effectiveness of a low-cost, low-technology intervention to improve the feeding practices of carers of children with moderate to severe cerebral palsy and feeding difficulties in Bangladesh. **Study dates** Not reported. **Source of funding** Citycell mobile phone company, Dhaka (funded fieldwork component of study)	(Severe): 3; level V (severe): 16 Weight (WAZ) score (mean, SD): -4.83 (1.84) Height (HAZ) score (mean, SD): -2.70 (1.98) Chest-related illness (n): weekly:2; monthly:7; 2-3 monthly: 7; <3 monthly: 6 Distress/discomfort during feeding (n): 14 **Caregivers:** Overall anxiety (SRQ20) (mean, SD): 10.0 (4.5) **Inclusion criteria** Moderate to severe cerebral palsy (levels III-V on GMFCS) Reported or observed feeding difficulties Fully or semi-weaned (not exclusively breast feeding) Age 1-11 years **Exclusion criteria** Children with progressive or metabolic condition, chronic illness (cardiac, renal, gastrointestinal), congenital syndrome, taking steroids or thyroxin or receiving feeding services elsewhere		Anthropometric measures included weight and height (Z-score) measurement. Chest health was monitored through carer reports on frequency of respiratory illness. Child feeding skills were rated using video footage of observed mealtimes. Child mood was assessed through semi-structured interviews. Carer compliance was assessed through interview and observation. A checklist was developed to score child and carer behaviours during mealtimes (inter-rater reliability calculated using Cohen's Kappa). Statistical analysis: Data were analysed using independent and paired sample t tests where appropriate. Non-parametric data: Friedman test, Wilcoxon signed ranks, and McNemar test were used. Qualitative data was analysed by identifying key themes in relation to caregivers' perceptions of feeding and the outcomes of training (Grounded Theory).	minutes per meal) (n): 6/22, P 0.005	including all major confounding and prognostic factors- N/A Level of risk- N/A B. Performance bias (systematic differences between groups in the care provided, apart from the intervention under investigation) B.1 The comparison groups received the same care apart from the intervention(s) studied-N/A. B.2 Participants receiving care were kept 'blind' to treatment allocation-No (due to treatment programme) B.3 Individuals administering care were kept 'blind' to treatment allocation-No (due to treatment programme) Level of risk: High C. Attrition bias (systematic differences between the comparison groups with respect to loss of participants C.1 All groups were followed up for an equal length of time (or analysis was adjusted to allow for differences in length of follow-up)-yes C.2a How many participants did not complete treatment in each group? 13 of the participant pairs dropped out at various stages due to family moving away, lack of caregiver motivation/time, caregiver sickness, child sickness. C.2b The groups were comparable for treatment completion (that is, there were

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					no important or systematic differences between groups in terms of those who did not complete treatment)-N/A C.3a For how many participants in each group were no outcome data available?-N/A C.3b The groups were comparable with respect to the availability of outcome data (that is, there were no important or systematic differences between groups in terms of those for whom outcome data were not available)- Only one group, data for 22/37 participants was available Level of risk: High D. Detection bias (bias in how outcomes are ascertained, diagnosed or verified) D.1 The study had an appropriate length of follow-up-Yes, 4 to 6 months D.2 The study used a precise definition of outcome-Yes D.3 A valid and reliable method was used to determine the outcome-Yes D.4 Investigators were kept 'blind' to participants' exposure to the intervention-No D.5 Investigators were kept 'blind' to other important confounding and prognostic factors-No Level of bias: High Indirectness Does the study match the review protocol in terms of; Population: Yes

Study details	Participants	Interventions	Methods	Outcomes and Results	Comments
					Outcome: Yes Indirectness: No
Full citation Baghbadorani, M. K., Soleymani, Z., Dadgar, H., Salehi, M., The effect of oral sensorimotor stimulations on feeding performance in children with spastic cerebral palsy, Acta Medica Iranica, 52, 899-904, 2014 **Ref Id** 359957 **Country/ies where the study was carried out** Iran **Study type** Cohort study. **Aim of the study** To investigate the effect of oral sensorimotor stimulations on feeding performance in 2-7 year old children with cerebral palsy.	**Sample size** N=12 **Characteristics** Male:female ratio: 7 boys:5 girls Age range: 2 to 7 years All children had moderate to severe motor impairment 11/12 children used a wheelchair for mobility 1/12 children used a walker for mobility All children had a range of hypertonicity in their extremities. All children had varying quadriplegia (upper, lower, right, left extremities) Children were from two rehabilitation centres <u>Baseline OMAS score (mean, SD), p value</u> Mouth closure: 1.08 (1.08), p 0.125 Lip closure onto the utensil: 1.08 (0.79), p 0.125 Lip closure during deglutition 1.16 (0.71), p 0.125 Control of food during deglutition: 0.91 (0.79), p 0.016	**Interventions** Sensorimotor stimulation for 8 weeks	**Details** Baseline assessment: carried out using the OMAS. Sensorimotor stimulation: was focussed on tongue lateralisation, lip control, and vigour of chewing. Treatment lasted 15 minutes daily, 3 days a week. Assessments were carried out at 4 and 8 weeks. -tongue lateralisation: A small amount of jam was placed on four corners of the lips alternatively (left and right corner and middle of upper and lower lips so the tongue had to remove the stimulus from outside the oral cavity). In order to stimulate the tongue in the mouth, the stimulus was placed in the cheek pocket so that the tongue had to remove it from the cheek in order to swallow. -lip control stimulation: consisted of closing the lips around a pretzel (7mm diameter) and holding a straw between the lips and blow into it for 3 seconds. The child was encouraged to repeat the function. -vigour of chewing: consisted of placing small pieces of biscuit on the molars to the right or left alternatively. The child was encouraged to chew these.	**Results** **<u>Effect of oral motor stimulation on oral-motor skills at baseline, 4 and 8 weeks (mean, SD):</u>** <u>Mouth closure:</u> Baseline: 1.08 (1.08); at 4 weeks: 1.75 (1.21); at 8 weeks: 2.41 (0.51) <u>Lip closure onto utensil:</u> Baseline: 1.08 (0.79); at 4 weeks: 1.50 (0.79); at 8 weeks: 1.75 (0.62) <u>Lip closure during deglutition:</u> Baseline: 1.16 (0.71); at 4 weeks: 1.58 (0.51); at 8 weeks: 1.66 (0.49) <u>Control of food during deglutition:</u> Baseline: 1.50 (0.52); at 4 weeks: 1.50 (0.52); at 8 weeks: 1.91 (0.28) <u>Straw suction:</u> Baseline: 0.41 (0.66); at 4 weeks: 0.66 (0.88); at 8 weeks: 0.83 (0.93) <u>Control of liquid during deglutition:</u>	**Limitations** NICE guidelines manual 2012: Appendix D: Methodology checklist: cohort studies A. Selection bias (systematic differences between the comparison groups) A.1 The method of allocation to treatment groups was unrelated to potential confounding factors (that is, the reason for participant allocation to treatment groups is not expected to affect the outcome(s) under study)-N/A A.2 Attempts were made within the design or analysis to balance the comparison groups for potential confounders-N/A A.3 The groups were comparable at baseline, including all major confounding and prognostic factors- N/A Level of risk- N/A B. Performance bias (systematic differences between groups in the care provided, apart from the intervention under investigation) B.1 The comparison groups received the same care apart from the intervention(s) studied-N/A B.2 Participants receiving care were kept 'blind' to treatment allocation-No

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Study dates Not reported. **Source of funding** Not reported.	Straw suction: 0.41 (0.66), p 0.250 Control of liquid during deglutition: 0.75 (0.75), p 0.016 Mastication: 0.91 (0.79), p 0.008 Final score: 6.33 (3.33), p <0.001 **Inclusion criteria** Children with moderate to severe motor impairment. Children who scored at or below 10 scores on an initial assessment of the Oral Motor Assessment Scale Children who did not have sensory impairments (hearing loss, vision) Children who did not have structural abnormalities of the mouth (cleft palate, pathological oral reflexes) Children had to understand therapist instructions and be able to control head and neck **Exclusion criteria** Two children did not receive intervention three			Baseline: 0.75 (0.75); at 4 weeks: 1.33 (0.49); at 8 weeks: 1.50 (0.52) <u>Mastication:</u> Baseline: 0.91 (0.79); at 4 weeks: 1.83 (0.39); at 8 weeks: 1.91 (0.28) <u>Final score:</u> Baseline: 6.33 (3.33); at 4 weeks: 10.16 (2.12); at 8 weeks: 12.00 (1.59)	B.3 Individuals administering care were kept 'blind' to treatment allocation-No. Only the speech therapist was blinded to treatment Level of risk: High C. Attrition bias (systematic differences between the comparison groups with respect to loss of participants C.1 All groups were followed up for an equal length of time (or analysis was adjusted to allow for differences in length of follow-up)-yes C.2a How many participants did not complete treatment in each group? Not reported C.2b The groups were comparable for treatment completion (that is, there were no important or systematic differences between groups in terms of those who did not complete treatment)-N/A C.3a For how many participants in each group were no outcome data available?-N/A C.3b The groups were comparable with respect to the availability of outcome data (that is, there were no important or systematic differences between groups in terms of those for whom outcome data were not available)- Yes Level of risk: Low D. Detection bias (bias in how outcomes are ascertained, diagnosed or verified)

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	days a week regularly and were excluded.				D.1 The study had an appropriate length of follow-up-yes D.2 The study used a precise definition of outcome-Yes D.3 A valid and reliable method was used to determine the outcome-Yes D.4 Investigators were kept 'blind' to participants' exposure to the intervention-No. D.5 Investigators were kept 'blind' to other important confounding and prognostic factors-Unclear Level of bias: Hight Indirectness Does the study match the review protocol in terms of; Population: Yes Outcome: Yes Indirectness: No
Full citation Clawson,E.P., Kuchinski,K.S., Bach,R., Use of behavioral interventions and parent education to address feeding difficulties in young children with spastic diplegic cerebral palsy, Neurorehabilitation, 22, 397-406, 2007 **Ref Id** 75826	**Sample size** N=8 **Characteristics** Male: female ratio: 4 boys: 4 girls Age (mean years, SD): 2.8 (1.16) Age (range): 18 months to 4.7 years Average length of stay: 29 treatment days) Oral dysphagia (%): 88 Prematurity (%): 88 Failure to thrive (%): 75 Unable to feed (%): 63	**Interventions** Oral sensorimotor treatment. Behavioural intervention.	**Details** Baseline session: height (Infantometers height board, centimetres) and weight were measured (Health-O-Meter bucket scale, kilograms). The patient's percent of ideal body weight was determined at the 50th percentile weight for height using NCHS growth charts. For first two days caregivers and therapist fed the child without giving intervention to determine the child's feeding skills and the amount the child was able to consume in a meal. Functional skills were determined by the Beckman Oral Motor assessment.	**Results** Mealtime behaviour at admission and discharge (mean, SD): Accept food by mouth at admission (%): 51.88 (35.00) Accept food by mouth at discharge (%): 92.00 (6.63) Duration of meal at admission (minutes): 11.63 (2.90) Duration of meal at discharge (minutes): 17.83 (2.06)	**Limitations** NICE guidelines manual 2012: Appendix D: Methodology checklist: cohort studies A. Selection bias (systematic differences between the comparison groups) A.1 The method of allocation to treatment groups was unrelated to potential confounding factors (that is, the reason for participant allocation to treatment groups is not expected to affect the outcome(s) under study)-Unclear A.2 Attempts were made within

Study details	Participants	Interventions	Methods	Outcomes and Results	Comments
Country/ies where the study was carried out USA **Study type** Cohort study. **Aim of the study** To investigate the effectiveness of an intensive day patient paediatric day programme using oral sensorimotor exercises, behavioural interventions and parental education to increase the oral feeding of children with spastic displegic cerebral palsy. **Study dates** Not reported. **Source of funding** Not reported.	Transition to self-feed (%):38 Feeding via gastrostomy tube (%): 38% Nasogastric tube (%): 13 No supplemental feeding requirement (%): 50 **Inclusion criteria** All children had diagnosis of moderate to severe cerebral palsy. **Exclusion criteria** Not reported.		A seating assessment was carried out along with postural needs and activity levels prior to the intervention. Day programme: 6 hour programme from Monday to Friday, including 4 therapeutic meals each day. Each therapeutic meal included oral motor exercises followed by oral feeding. The day programme was provided by the MDT (paediatric gastroenterologist, paediatric nurse practitioner, behavioural psychologist, occupational therapist, speech-language pathologist, feeding technicians, registered dietitian, diet technician, nurses, licensed clinical social worker, and case manager). Beckman oral motor exercises were performed (by the same staff members throughout admission) for 20-30 minutes before each oral feeding. The exercises were provided to stimulate muscle contraction and facilitate movement against resistance to build strength. The aim was to increase functional response to pressure and movement (increase range, strength, variety and control of movement for lips, cheeks, jaw and tongue). Oral feeding was specified for up to 20 minutes using a timer to indicate end of meal times. Behavioural interventions: presentation of food near child's lips until child opened and	Weight and height percentile for age at admission and 1 year (mean, SD): Weight percentile at admission (kg): 0.68 (6.44) Weight percentile at 1 year (kg): 10.28 (15.41) Height percentile at admission (cm): 7.17 (8.69) Height percentile at 1 year (cm): 16.13 (17.08)	the design or analysis to balance the comparison groups for potential confounders- Unclear A.3 The groups were comparable at baseline, including all major confounding and prognostic factors- Unclear Level of risk- Unclear B. Performance bias (systematic differences between groups in the care provided, apart from the intervention under investigation) B.1 The comparison groups received the same care apart from the intervention(s) studied- N/A B.2 Participants receiving care were kept 'blind' to treatment allocation-No B.3 Individuals administering care were kept 'blind' to treatment allocation-No Level of risk: High C. Attrition bias (systematic differences between the comparison groups with respect to loss of participants C.1 All groups were followed up for an equal length of time (or analysis was adjusted to allow for differences in length of follow-up)-yes C.2a How many participants did not complete treatment in each group? N/A C.2b The groups were comparable for treatment completion (that is, there were no important or systematic

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			accepted the bite into their mouth (accepting food, chewing, swallowing). Toys, video and verbal praise were used to reward appropriate feeding. Negative behaviour (refusal of food, expelling food, not swallowing within 30 seconds, crying, gagging) were treated with removal of social attention. The feeding protocol was carried out 4 times a day. The therapists remained the primary feeders until approx. 2 weeks prior to discharge when caregivers were transitioned into meals. Parent training: involved training in food preparation and calorie boosting (puree, texture grading, food allergies). During treatment, all caregivers observed sessions via video monitor outside the treatment room. Transitioning involved training in 3 components (instructions, prompts, and consequences) and caregivers did not move to the next level until achieving 80% or more accuracy. Caregivers fed the child in the room alone and were observed by the therapist via video and instructed the parent via a wireless communication system. Follow-up appointments: patients were assessed at 1, 7 and 12 months following discharge from the programme. At each review, assessment of height, weight, calorie boosting, nutritional and behavioural counselling, estimated		differences between groups in terms of those who did not complete treatment)-N/A C.3a For how many participants in each group were no outcome data available?-N/A C.3b The groups were comparable with respect to the availability of outcome data (that is, there were no important or systematic differences between groups in terms of those for whom outcome data were not available)- N/A Level of risk: N/A D. Detection bias (bias in how outcomes are ascertained, diagnosed or verified) D.1 The study had an appropriate length of follow-up- yes D.2 The study used a precise definition of outcome-Yes D.3 A valid and reliable method was used to determine the outcome-Yes D.4 Investigators were kept 'blind' to participants' exposure to the intervention-N/A D.5 Investigators were kept 'blind' to other important confounding and prognostic factors-N/A Level of bias: low Indirectness Does the study match the review protocol in terms of; Population: Yes Outcome: Yes Indirectness: No

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			calorie counts, and tube feed adjustments were made. Statistical analysis: paired sample t-tests were used to identify significant changes in dependent variables from admission to discharge and for each follow up interval. All of the sample (N=8) was included in the analysis of change from admission to discharge. One patient was excluded from follow-up analyses due to missing data and hospitalisation for rhizotomy surgery/distance for regular follow up visits.		
Full citation Gisel,E.G., Effect of oral sensorimotor treatment on measures of growth and efficiency of eating in the moderately eating-impaired child with cerebral palsy, Dysphagia, 11, 48-58, 1996 **Ref Id** 326166 **Country/ies where the study was carried out**	**Sample size** N=35 **Characteristics** Male:female ratio: 19 boys:16 girls Age (range): 4.3 years to 13.3 years Group A: 6.3 (1.4) Group B: 7.3 (2.1) Group C: 7.7 (2.7) Weight: At 5th percentile for their age and at or below the 35th percentile for skinfold measures (triceps, subscapular) Wheelchair bound: n=27 Ambulatory: n=5	**Interventions** Group A: Sensorimotor treatment for 20 weeks. Group B: Chewing only for 20 weeks. Group C: School routine for feeding for 10 weeks followed by sensorimotor treatment for 10 weeks.	**Details** Testing Children were weighed in the school nursing office. **Video photography:** Children were seated upright in a special chair. Caregivers presented test foods to children in the form of barium sulphate paste thickened to the consistency of apple sauce, followed by liquid form barium sulphate (drinking from cup/syringe/bottle depending on skill), and then solid (biscuit or cereal ring coated with barium sulphate paste). VF was performed in lateral projection, recording two bites of solid, two swallows of puree, and two or three swallows	**Results** All results were reported at 10 weeks as the control/usual care group switched to oral sensiromotor therapy after week 10 onwards to end of the treatment at 20 weeks. **Eating time for 3 standard food textures (mean seconds, SD) (final score):** At week 0: Puree (apple sauce): Group A (n=11): 8.3 (3.9); Group C (n=12): 5.9 (4.9)	**Limitations** Based on NICE manual (2012) methodology checklist for RCTs. **Selection bias - high** • An appropriate method of randomisation was used to allocate participants to treatment group = Unclear. Children were randomly assigned, but method not reported • Adequate concealment of allocation = Unclear • The groups were comparable at baseline = Yes (but only for age.

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Canada **Study type** Open label trial. **Aim of the study** To investigate the efficacy of oral sensorimotor therapy in children with cerebral palsy. **Study dates** January 1990 to December 1991. **Source of funding** National Health Research and Development Programme (American Occupational Therapy Foundation)	Tricycles for ambulation: n=3 All children needed assistance with activities of daily living (bathing, toileting, eating) and manifested a range of hypo- to hypertonicity in their trunk and all extremities. **Inclusion criteria** All children had a diagnosis of CP with moderate to severe motor impairment. Children were only selected if they were able to eat a standard solid texture within 1 standard deviation(SD) and a puree at or below 2 SD of established time norms. Children were recruited from three special schools, and parental consent was obtained before entry into the study. **Exclusion criteria** Not reported.		of liquid. Total testing time did not exceed 20 minutes. **Mealtime observation** Children's natural feeding performance was measured by administration of the modified Functional Feeding Assessment subtest by a feeding assistant who was assigned to the same child or children daily (2-3 children). Validity was high (r=-0.61, p <0.0001) and a negative correlation indicated that as eating time decreased, oral-motor skills increased. Length of lunch meal from start of feeding to completion of meal was recorded. **Sensorimotor treatment**: Based on children's performance on the modified Functional Feeding Assessment (tailored to children's individual needs). Treatment lasted 5-7 minutes daily, Monday to Friday before lunch or snack. Tongue lateralisation, lip control and vigour of chewing were the main focus of oral-motor functioning. Small food stimuli were used to elicit a natural eating reaction. -tongue lateralisation: Small drop of peanut butter was placed on the lateral border of the tongue (right to left alternatively). When full range of desired motion was achieved, the stimulus was placed in the cheek pocket from where the tongue had to remove it in order to swallow. When the skill was achieved, the stimulus was placed alternatively from left to right of the	Viscous (raisins): Group A (n=5): 16.6 (7.9); Group C (n=8): 13.7 (4.8) Viscous (Fruit gelatine): Group A (n=6): 11.9 (6.4); Group C (n=4): 11.0 (6.8) Solid (Biscuit): Group A (n=8): 23.1 (5.8); Group C (n=10): 17.2 (5.0) Solid (Cereal biscuit): Group A (n=3): 25.2 (12.7); Group C (n=2): 14.2 (5.5) At week 10: Puree (apple sauce): Group A (n=11): 6.4 (1.3); Group C (n=12): 5.6 (3.5) Viscous (raisins): Group A (n=6): 17.8 (6.2); Group C (n=9): 14.7 (5.5) Viscous (Fruit gelatine): Group A (n=5): 11.6 (4.3); Group C (n=3): 7.9 (3.2) Solid (Biscuit): Group A (n=8): 22.5 (5.7); Group C (n=11): 18.3 (5.6) Solid (Cereal biscuit): Group A (n=3): 17.6 (6.7); Group C (n=1): 18.3 (5.6) **Test of difference between control and**	Other data not reported in numerical format) **Performance bias - very high** • The comparison groups received the same care apart from the intervention = No (group C received sensorimotor treatment after 10 weeks of routine care) • Participants receiving the treatment were kept blind to treatment allocation = No (probably no given the type of intervention) • Individuals administering care were kept blind to treatment allocation = No (probably no given the type of intervention) **Attrition bias - low** • All groups were followed up for an equal length of time = yes • The groups were comparable for treatment completion = No. Group C had 10 weeks of sensorimotor treatment, on

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			mouth and middle of the upper lip so the tongue had to remove the stimulus from outside the oral cavity. -Lip control: A 7 mm diameter liquorice stick was used to encourage children to close their lips. After achieving the skill, children were encouraged to hold a straw between lips and blow into the straw. Demonstrations of sucking motions were given and children were encouraged to imitate the motion and to suck a liquid. Children with poor sucking control were given thickened liquids. Vigour of chewing: Children were encouraged to chew by the therapist placing small pieces of biscuit (medium to strong resistance) over the molars (alternatively right and left). **Chewing only treatment:** Children were offered small pieces of fruit gelatine of medium to hard viscosity. The time given to eat the pieces of gelatine was 5-7 minutes and as children progressed they were given harder textures. Treatment was given prior to lunch from Monday to Friday. **Lunch textures:** Children were allowed to bring food from home, which was examined in order to establish a plan for each child to increase at least one texture of food, and as oral-motor function increased lunch textures were made more resistive so that new oral-motor	**treatment periods for 3 standard food textures (mean seconds, SD between week 0-week 10):** Puree: Group A: 1.882 (3.440), P 0.1; Group C: -0.791 (2.993), P 0.401 Viscous: Group A:-0.067 (5.679), P 0.973; Group C: 0.283 (4.546), P 0.833 Solid: Group A: 0.180 (8.203), P 0.946; Group C: -0.917 (6.388), P 0.629 **Duration of lunch at school (mean minutes, SD) at 0 and 10 weeks:** 0 weeks: Group A (n=11): 34.0 (8.5); Group C (n=12): 28.8 (13.4) 10 weeks: Group A (n=11): 28.1 (6.0); Group C (n=12): 27.7 (9.6) **Weight (mean kg, SD) at 0 and 10 weeks:** 0 weeks: Group A: 16.52 (4.11); Group C: 18.02 (5.96) 10 weeks: Group A: 16.97 (4.37); Group C: 19.44 (6.13)	completion, same as group A • The groups were comparable with respect to the availability of outcome data = yes **Detection bias - low** • the study had an appropriate length of follow up = Yes • the study used a precise definition of outcome = Yes • a valid an reliable method was used to determine the outcome = Yes • investigators were kept blind to participants' exposure to the intervention = Unclear • investigators were kept blind to other important confounding and prognostic factors = Unclear Other information **Indirectness**: does the study match the protocol in terms of

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			skills were reinforced at regular meal times. **Treatment compliance:** Children were assigned feeding assistants who were trained to administer treatment. Absence of assistant or child was recorded and compliance was calculated by subtracting sick days from possible treatment days as a percentage of remaining treatment days.	**Weight (percentiles for age, mean kg, SD) at 0 and10 weeks:** 0 weeks: Group A:17.22 (29.95); Group C: 7.13 (15.05) 10 weeks: Group A: 19.85 (29.77); Group C: 8.03 (16.59)	• population = yes • intervention = yes • outcomes = yes **Other information** Group C were given routine care for 10 weeks, followed by sensorimotor therapy from week 10 to end of treatment (week 20)
Full citation Gisel, E. G., Applegate-Ferrante, T., Benson, J. E., Bosma, J. F., Effect of oral sensorimotor treatment on measures of growth, eating efficiency and aspiration in the dysphagic child with cerebral palsy, Developmental Medicine & Child Neurology, 37, 528-43, 1995 **Ref Id** 336392 **Country/ies where the study was carried out**	**Sample size** N=27 **Characteristics** Male:female ratio: Group 1: 3 boys: 7 girls; Group 2: 4 boys:6 girls; group 3: all boys (all 7 aspirated) Age (Mean years, SD): Group 1: 4.8 (1.4); Group 2: 5.0 (1.9); Group 3: 5.4 (2.7) Weight at or below 35th centile for skinfold measures (triceps, subscapular) Wheelchair bound (n): 19; Children using walker (n):2; Able to walk (n): 6 All children needed some assistance with activities of daily living (bathing,	**Interventions** **VF:** Children were seated upright in a special chair. Caregivers presented test foods to children in the form of barium sulphate paste thickened to the consistency of apple sauce, followed by liquid form barium sulphate (drinking from cup/syringe/bottle depending on skill), and then solid (biscuit or cereal ring coated with barium sulphate paste). VF was performed in lateral projection, recording two bites of solid, two swallows of puree, and two or three swallows of liquid. Total fluoroscopy time did not exceed 4 minutes. **Sensorimotor treatment**: Based on children's performance on the modified	**Details** All groups were assessed at t=0, 10 weeks, and 20 weeks. Group 1 (no aspiration): sensorimotor treatment for 20 weeks. Group 2 (no aspiration): school routine for feeding/no formal oral-motor therapy for 10 weeks, followed by sensorimotor treatment for 10 weeks. Group 3 (aspiration): school routine for feeding/no formal oral-motor therapy for 10 weeks, followed by sensorimotor treatment for 10 weeks. **Testing:** Weight, skin-fold measurements (triceps, and subscapular) were taken. VF was performed in a room exclusive for testing. The interval between testing and last meal was at least 1.5 hours. Children were	**Results** All results reported at baseline and week 10 for group 1 and 2 only as group 2 switched to oral sensorimotor treatment after week 10 to week 20 **Weight in centiles for age (mean kg, SD):** At baseline (Week 0): Group 1: 2.38 (1.33) Group 2: 9.80 (3.96) Week 10: Group 1: 2.82 (1.26) Group 2: 11.91 (5.52) **VF:** Time taken to eat foods of standard texture (mean seconds, SD): Baseline (0 weeks):	**Limitations** Based on NICE manual (2012) methodology checklist for RCTs. **selection bias - high** • an appropriate method of randomisation was used to allocate participants to treatment group = Unclear • adequate concealment of allocation = Unclear • The groups were comparable at baseline = Yes (but only for age. Other data not reported) **Performance bias - very high** • The comparison groups received the same care

Study details	Participants	Interventions	Methods	Outcomes and Results	Comments
USA. **Study type** Open label randomised trial. **Aim of the study** To establish the status of aspiration in children with cerebral palsy and to investigate their response to oral sensorimotor therapy in terms of measures of growth and eating efficiency. **Study dates** 1990-1991 **Source of funding** Hearst Foundation American Occupational Therapy Foundation	toileting, and eating) and manifested a range of hypo- and hypertonicity in their trunk and extremities. Most children were quadriplegic. Severity of spasticity varied between upper and lower extremities, and between right and left. **Inclusion criteria** All children had a diagnosis of cerebral palsy with moderate to severe motor impairment. School setting. **Exclusion criteria** Not reported.	Functional Feeding Assessment (tailored to children's individual needs). Treatment lasted 5-7 minutes daily, Monday to Friday before lunch or snack. Tongue lateralisation, lip control and vigour of chewing were the main focus of oral-motor functioning. Small food stimuli were used to elicit a natural eating reaction. -tongue lateralisation: Small drop of peanut butter was placed on the lateral border of the tongue (right to left alternatively). When full range of desired motion was achieved, the stimulus was placed in the cheek pocket from where the tongue had to remove it in order to swallow. When the skill was achieved, the stimulus was placed alternatively from left to right of the mouth and middle of the upper lip so the tongue had to remove the stimulus from outside the oral cavity. -Lip control: A 7 mm diameter liquorice stick was used to encourage children to close their lips. After achieving the skill, children were encouraged to hold a straw between lips and blow into the straw. Demonstrations of sucking motions were given and children were encouraged to imitate the motion and to suck a liquid.	either seated in custom-fitted wheelchairs or on chairs that allowed flexion of hips and kneed 90o with feet flat on floor and back well supported by back rest (if able to walk). Head alignment was kept in a straight axis with the trunk and a 30o chin-tuck position. Arms were placed in a flexed position on child's lap tray or on feeding table in front of the child. The video camera was placed 1.8m to the left or right of the chair to obtain a semi-profile view of the child's face and neck. 10 trials of three food textures: puree (apple sauce), viscous (10 raisins) and solid (10 bites of wholemeal and honey biscuit) were prepared. If a childe was unable to eat raisins or biscuit, gelatin or cereal rings were used instead. Duration of chewing was measured in seconds. A mean of 10 swallows was used for statistical analysis. The same tester fed children throughout the study. Children were told which foods they would be given. Testing took a time of 20 minutes. <u>Meal-time observation:</u> The modified functional feeding assessment was used to measure children's natural eating performance. Validity of mFFA and video assessment: r=-0.61, p <0.0001) (as eating time decreased, oral motor skills increased). Length of lunch was measured (from the first bite of	Puree: Group 1 (n=10): 5.2 (2.1); group 2 (n=9): 6.0 (3.4) Viscous (raisins): group 1 (n=5): 18.4 (3.6); group 2 (n=5): 18.7 (3.8) Viscous (gelatin): group 1 (n=5): 7.6 (2.1); group 2 (n=5): 8.9 (7.2) Solid (biscuit): group 1 (n=6): 15.6 (1.3); group 2 (n=6): 13.0 (4.3) Solid (cereal ring): group 1 (n=3): 16.8 (15.2); group 2 (n=4): 22.8 (21.7) <u>Week 10:</u> Puree: Group 1 (n=10): 5.6 (1.9); group 2 (n=10): 6.0 (12.2) Viscous (raisins): group 1 (n=6): 19.7 (5.6); group 2 (n=4): 21.0 (4.6) Viscous (gelatin): group 1 (n=4): 11.9 (7.1); group 2 (n=6): 8.7 (3.6) Solid (biscuit): group 1 (n=7): 16.9 (4.0); group 2 (n=6): 14.7 (4.5) Solid (cereal ring): group 1 (n=3): 13.4 (1.9); group 2 (n=2): 23.3 (5.1)	apart from the intervention = No (group 2 received sensorimotor treatment after 10 weeks of routine care) • Participants receiving the treatment were kept blind to treatment allocation = No (probably no given the type of intervention) • Individuals administering care were kept blind to treatment allocation = No (probably no given the type of intervention) **attrition bias - low** • All groups were followed up for an equal length of time = yes • The groups were comparable for treatment completion = No. Group 2 had 10 weeks of sensorimotor treatment, on completion, same as group 1 • The groups were comparable with respect to the

Study details	Participants	Interventions	Methods	Outcomes and Results	Comments
		Children with poor sucking control were given thickened liquids. Vigour of chewing: Children were encouraged to chew by the therapist placing small pieces of biscuit (medium to strong resistance) over the molars (alternatively right and left). Food textures: Plans were individualised to patients needs. At least one food item was more textured than previously eaten. As children's oral motor ability improved, more textured food was given at lunch time to enforce oral motor skills at regular mealtimes.	food to finishing of entire meal or until child refused to eat). Treatment compliance: Feeding assistants/therapists administered treatment. A daily checklist for treatment was kept by the trained feeders, and absence of feeder or child was recorded with the reasons. Sick days were subtracted from the total number of treatment days and compliance was calculated as a percentage of the remaining treatment days.	**Duration of lunch/snack at school (mean minutes, SD)(modified functional feeding assessment scale):** Baseline (0 weeks): Lunch: Group 1 (n=7): 34.43 (6.02); group 2 (n=5): 28.60 (6.91) Snack: Group 1 (n=4): 12.63 (3.20); group 2 (n=4): 13.50 (6.03) Week 10: Lunch: Group 1 (n=6): 33.14 (7.47); group 2 (n=5): 24.67 (8.21) Snack: Group 1 (n=4): 11.75 (2.50): group 2 (n=4): 14.25 (5.68)	availability of outcome data = yes **detection bias - low** • The study had an appropriate length of follow up = Yes • The study used a precise definition of outcome = Yes • A valid an reliable method was used to determine the outcome = Yes • investigators were kept blind to participants' exposure to the intervention = Unclear • investigators were kept blind to other important confounding and prognostic factors = Unclear **Indirectness**: does the study match the protocol in terms of • population = yes • intervention = yes • outcomes = yes **Other information** Group 1: at week 0, 10, 20 had sensorimotor treatment

Study details	Participants	Interventions	Methods	Outcomes and Results	Comments
					Group 2: at week 0, 10 had routine care, but from week 10 to 20 had sensorimotor treatment. For comparability, results were reported for week 0 and week 10.
Full citation Gisel,E.G., Haberfellner,H., Schwartz,S., Impact of oral appliance therapy: are oral skills and growth maintained one year after termination of therapy?, Dysphagia, 16, 296-307, 2001 **Ref Id** 327039 **Country/ies where the study was carried out** USA **Study type** Cohort study.	**Sample size** N=17 **Characteristics** Male:female: 7 boys: 10 girls Age range: 6.6 to 15.4 years 9/17 children used a wheelchair for transportation. 4/17 used a wheelchair for long-distance transport, and a walker for indoor ambulation. 1/17 used a stroller and a walker for the same purpose. 3/17 walked independently. 6/17 children were fully dependent in activities of daily living, including feeding.	**Interventions** Intraoral appliance therapy: ISMARs were fabricated and if satisfactory, were then fitted on the child in school environment, in the presence of caregivers. Care and written wear instructions were provided. During the first week, the research assistant contacted caregivers to ensure safety and correct wear. Caregivers kept daily log notes on when and how long the ISMAR was worn. -Wear adjustment period: After fitting, children wore the appliance daily, increasing the length of time worn until 20 minutes of continuous wear was reached. At this time point, ISMAR wear was switched from daytime to night time wear. -Treatment phase I: Onset of phase I was determined by	**Details** This was the second phase of the study (from 12 to 24 months of intervention). The first phase was reported by Haberfeller 2001. Children in group A (ISMAR appliance) continued to wear the appliance whereas children in group B stopped wearing the appliance after 12 months assessment. Testing: Children underwent measurements for height and weight, and the Functional Feeding Assessment was administered as in the Haberfellner 2001 study (phase I) at 12, 18 and 24 months. Statistical methods: Functional feeding assessments were expressed as means and standard deviations. 2 paired t tests were carried out to assess mean change from baseline (12 months) on a given outcome measure (FFA	**Results** **Weight (mean kg, SD) and height (mean cm, SD) at 18 months with and without ISMAR appliance**Weight: Group A: 23.84 (2.26); Group B: 32.92 (4.10), P 0.10 Weight (Z-score): Group A: -1.68 (0.44); Group B: -1.40 (0.31), P 0.103 Height: Group A: 128.44 (3.37); Group B: 141.43 (4.15) Height (Z-score): Group A: -1.38 (0.69); -0.87 (0.37) (Adjusted for baseline at 12 months) **Weight (mean kg, SD) and height (mean cm, SD) at 24 months with and**	**Limitations** NICE guidelines manual 2012: Appendix D: Methodology checklist: cohort studies A. Selection bias (systematic differences between the comparison groups) A.1 The method of allocation to treatment groups was unrelated to potential confounding factors (that is, the reason for participant allocation to treatment groups is not expected to affect the outcome(s) under study)- Unclear A.2 Attempts were made within the design or analysis to balance the comparison groups for potential confounders-Yes A.3 The groups were comparable at baseline, including all major confounding and prognostic factors- Unclear Level of risk- Low B. Performance bias (systematic differences between

Study details	Participants	Interventions	Methods	Outcomes and Results	Comments
Aim of the study To investigate the impact of intraoral appliance (ISMAR) therapy on functional feeding skills and growth in children with cerebral palsy. **Study dates** **Source of funding** Not reported.	11/7 children needed partial assistance. 12/17 wore diapers regularly 5/17 were able to indicate when they needed to go to the bathroom. 5/17 children received medication to control seizures. 5/17 children were able to communicate verbally. 12/17 were unable to communicate verbally. **Inclusion criteria** All children had a diagnosis of spastic cerebral palsy with tetraparesis and moderate motor impairment **Exclusion criteria** Not reported.	ISMAR wear for 20 minutes of wear daily. The appliance was not worn when children had colds and needed to breathe through the mouth. Treatment was resumed once nasal breathing was re-established. ISMARs were not worn during meal times. -Treatment phase II: children were evaluated for mobilisation of oral structures, and goals were determined for each child according to their needs. Grooves were drilled into the lingual part of the occlusal shelves or heads attached to different loci to elicit tongue movements. No intraoral appliance therapy	competence score or anthropometric measure) to increase statistical power. Separate analyses were carried out for data at 18 months and 24 months. Separate analyses were carried out for each assessment time and were dependent on multiple regression in which the between-group difference was adjusted for baseline values of the relevant measure. Conventional significance level of 0.05 was used for all hypothesis testing. The significance levels of individual tests were not corrected due to small sample size (potentially low statistical power) and also different hypotheses relate either to the same or correlated measures and carrying out independent tests would result in increased risk of type I error.	**without ISMAR appliance** Weight: Group A:26.39(2.87); Group B: 32.55 (3.82), P0.858 Weight (Z-score): Group A: -1.62 (0.41); Group B: -1.56 (0.16), P 0.944 Height: Group A: 134.48 (4.59); Group B: 141.37 (4.96) Height (Z-score): -1.11 (0.61); Group B: -1.11 (0.49) (Adjusted for baseline at 12 months) **Mean change of weight and height at 18 to 24 months with and without ISMAR appliance** Weight (mean kg, SD): Group A: 0.22 (0.47), P 0.652; Group B: 1.66 (0.47), P 0.013 Weight (Z-score): Group A: -0.17 (0.08), P 0.068; Group B: 0.11 (0.07), P 0.117 Height (mean cm, SD): Group A: 3.87 (1.25), P0.013; Group B: 1.19 (1.69), P0.509 Weight (Z-score): Group A: 0.11 (0.20), P 0.611; Group B: -0.15 (0.24), P0.571	groups in the care provided, apart from the intervention under investigation) B.1 The comparison groups received the same care apart from the intervention(s) studied-No. The control group received the intervention for 6 months after which treatment was stopped for the rest of the study. B.2 Participants receiving care were kept 'blind' to treatment allocation-Unclear B.3 Individuals administering care were kept 'blind' to treatment allocation-Unclear Level of risk: High C. Attrition bias (systematic differences between the comparison groups with respect to loss of participants C.1 All groups were followed up for an equal length of time (or analysis was adjusted to allow for differences in length of follow-up)-yes C.2a How many participants did not complete treatment in each group? All children completed treatment and assessment C.2b The groups were comparable for treatment completion (that is, there were no important or systematic differences between groups in terms of those who did not complete treatment)-Yes C.3a For how many participants in each group were no outcome data available?-N/A

Study details	Participants	Interventions	Methods	Outcomes and Results	Comments
				Competency in feeding (mean percentage, SD) at 18 months (adjusted for baseline 12 months assessment): Spoon feeding: Group A: 84.1 (13.1); Group B: 89.9 (9.6) Biting: Group A: 90.1 (11.8); Group B: 98.3 (2.5) Chewing: Group A: 88.3 (15.6); Group B: 94.1 (8.3) Cup drinking: Group A: 91.9 (9.6); Group B: 93.8 (7.6) Straw drinking: Group A: 61.5 (12.2); Group B: 73.1 (21.1) Swallowing: Group A: 64.1 (21.0); Group B: 80.1 (12.1) Clearing: Group A: 61.8 (20.4); Group B:77.3 (11.5) **Competency in feeding (mean percentage, SD) at 24 months (adjusted for baseline 12 months assessment):** Spoon feeding: Group A:83.6 (10.6); Group B:86.1 (14.3) Biting: Group A: 85.8 (15.2) ; Group B: 97.3 (4.6)	C.3b The groups were comparable with respect to the availability of outcome data (that is, there were no important or systematic differences between groups in terms of those for whom outcome data were not available)- Yes Level of risk: Low D. Detection bias (bias in how outcomes are ascertained, diagnosed or verified) D.1 The study had an appropriate length of follow-up-Yes D.2 The study used a precise definition of outcome-Yes D.3 A valid and reliable method was used to determine the outcome-Yes D.4 Investigators were kept 'blind' to participants' exposure to the intervention-Unclear D.5 Investigators were kept 'blind' to other important confounding and prognostic factors-Unclear Level of bias: low Indirectness Does the study match the review protocol in terms of; Population: Yes Outcome: Yes Indirectness: No **Other information**

Study details	Participants	Interventions	Methods	Outcomes and Results	Comments
				Chewing: Group A: 86.1 (14.7) ; Group B: 96.4 (6.6) Cup drinking: Group A: 83.4 (12.3) ; Group B: 95.6 (6.4) Straw drinking: Group A: 67.1 (17.6) ; Group B: 82.0 (21.1) Swallowing: Group A: 66.2 (19.5) ; Group B: 85.2 (8.6) Clearing: Group A: 70.0 (12.4) ; Group B: 83.9 (9.4) **Competency in feeding (mean percentage, SD) at 18 to 24 months (change):** Spoon feeding: Group A: -1.9(5.0), P 0.259 ; Group B: -2.7(9.6), P 0.483 Biting: Group A: -5.3 (15.9), P0.318 ; Group B: -0.8 (3.5), P0.552 Chewing: Group A: -3.3(9.6), 0.301 ; Group B: 3.2(9.8), P0.425 Cup drinking: Group A: -8.3 (7.0), P0.005; Group B: 1.3 (2.2), P0.178 Straw drinking: Group A: 5.1 (14.5), 0.294 ; Group B: 7.9 (21.7), P 0.371	

Study details	Participants	Interventions	Methods	Outcomes and Results	Comments
				Swallowing: Group A: 1.5 (9.2), 0.617 ; Group B: 3.7 (9.8), P 0.358 Clearing: Group A: 8.1 (12.2), P 0.064 ; Group B: 4.5 (11.8), P0.356	
Full citation Sigan,S., Uzunhan,T., Aydinli,N., Eraslan,E., Ekici,B., Caliskan,M., Effects of oral motor therapy in children with cerebral palsy, Annals of Indian Academy of Neurology, 16, 342-346, 2013 **Ref Id** 324034 **Country/ies where the study was carried out** Turkey **Study type** Single centred, randomised study. **Aim of the study**	**Sample size** N=81 (consecutively chosen) **Characteristics** Age (months): 12-42 Clinical types of cerebral palsy in training and control groups (n): Tetraparesis: Training group=17; control group=16 Diparesis: Training group=16; control group=12 Hemiparesis: Training group=3; control group=9 Hypotonia: Training group=4; control group=2 Ataxic: Training group=0; control group=1	**Interventions** **Training group:** Oral motor therapy: one hour therapy sessions with a physiotherapist once a week for 6 months (12 sessions in total). To improve swallowing and chewing, the tactile and proprioceptive aspect of eating was intended to be increased. To improve mouth function and control, the texture of food was gradually thickened, and families were taught about proper positioning. When mouth muscle control was insufficient, mouth control was performed to enable feeding. Methods of spoon feeding were shown to families. Oral stimulation was performed manually. For drinking training, moderately dense liquids were used and correct glass	**Details** Randomisation Patients were randomised consecutively in the sequence that they entered the study. Training group (n)=41; control group (n)=40 Blinding/evaluation Only physiotherapist during evaluation before and after training.All patients were evaluated before and after training including name, gender, date of birth, diagnosis, status of swallowing, gag and asymmetric tonic neck reflexes, an oral motor assessment form and Functional Feeding Assessment subscale of the Multidisciplinary Feeding Profile. A blinded pedagogue who was not involved in the training sessions performed the Bayley scales of infant development (BSID-II) before and after the training. FFA and BSID-II were analysed and compared between groups. People analysing the data were blinded during the study.	**Results** **Final functional feeding assessment scores of both groups (Mean%,SD) (6 months duration):** Spoon feeding: training group=16.51 (19.62); control group=7.66 (13.38). Biting: training group=12.07 (16.10); control group=6.50 (11.29). Chewing: training group=34.55 (26.17); control group=9.08 (10.71). Drinking: training group=7.29 (9.59); control=3.16 (2.22). Swallowing: training group=18.35 (17.37); control=9.95 (14.00).	**Limitations** Based on NICE manual (2012) methodology checklist for RCTs. **selection bias - low** • An appropriate method of randomisation was used to allocate participants to treatment group = Yes. Patients were randomised by the sequence in which they entered the study • Adequate concealment of allocation = Unclear • The groups were comparable at baseline = Yes **performance bias - high** • The comparison groups received the same care apart from the intervention = Yes

Study details	Participants	Interventions	Methods	Outcomes and Results	Comments
To investigate the effect of oral motor therapy on paediatric cerebral palsy patients with feeding problems. **Study dates** Not reported. **Source of funding** Not reported.	**Inclusion criteria** • Diagnosed with cerebral palsy, who had at least one or more problems of oral motor functions such as sucking, chewing, swallowing, drooling and independent feeding during routine follow-up. **Exclusion criteria** • Patients who had seizures frequent enough to prevent daily activity and physiotherapy and who were receiving drug treatment for drooling • Non-participation for more than three sessions (training group)	use technique was taught. Children were taught correct midline hand use to facilitate independent feeding. Mouth control, positioning and posture control were taught in order to reduce drooling. **Control group:** Children diagnosed with CP and oral motor dysfunction were called for the first evaluation and then for an evaluation at 6 months. During this time, routine physiotherapy was continued. All patients attended routine physiotherapy according to the established programme during the 6 months.	Oral motor assessment Difficulties with sucking, swallowing, chewing, drooling, independent feeding, and feeding problems were graded as present or absent. Food texture, tongue, jaw and mouth function, swallowing function, swallowing assessment and severity of drooling, aspiration and choking were evaluated. Functional feeding subscale of the Multidisciplinary Feeding Profile The subscale was used to assess spoon feeding, biting, chewing, drinking and swallowing. Behaviour in each category was categorised as normal or abnormal. Normal behaviour was categorised as adequate, poor, absent or not found. Abnormal behaviour was categorised as absent, undecided, present or not found. Performance in each area was rated as a percentage (normal=90-100%; mildly impaired=70-89%; moderately impaired=50-69% and severely impaired=<50%) Statistical analysis 2 tailed comparison of groups in terms of initial characteristics (pre and post therapy results and observed changes), P <0.05 was considered statistically significant. Chi squared test or Fisher's exact test were used for comparison of categorical variables. Mann-Whitney U and Student's t-test were used when dependent		• Participants receiving the treatment were kept blind to treatment allocation = Unclear (probably due to type of intervention) • Individuals administering care were kept blind to treatment allocation = Yes (initial evaluation of all patients was carried out in a blinded manner by physiotherapist and pedagogue) **attrition bias - low** • All groups were followed up for an equal length of time = yes • The groups were comparable for treatment completion = Yes • The groups were comparable with respect to the availability of outcome data = yes **detection bias - low** • The study had an appropriate length of follow up = Yes

Study details	Participants	Interventions	Methods	Outcomes and Results	Comments
			variables were not normally distributed.		• The study used a precise definition of outcome = Yes • A valid an reliable method was used to determine the outcome = Yes • Investigators were kept blind to participants' exposure to the intervention = Unclear • Investigators were kept blind to other important confounding and prognostic factors = Unclear **Indirectness**: does the study match the protocol in terms of • population = yes • intervention = yes • outcomes = yes
Full citation Ottenbacher, K., Scoggins, A., Wayland, J., The	**Sample size** N=20	**Interventions**	**Details** <u>Oral motor therapy:</u>	**Results** Pre-therapy weight (mean pounds, SD): Oral motor therapy group:34.07 (7.5)	**Limitations** Based on NICE manual (2012) methodology checklist for RCTs. **selection bias - high**

Study details	Participants	Interventions	Methods	Outcomes and Results	Comments
effectiveness of a program of oral sensory motor therapy with the severely and profoundly disabled, Occupational Therapy Journal of Research, 1, 147-160, 1981 **Ref Id** 403884 **Country/ies where the study was carried out** USA **Study type** Randomised controlled trial. **Aim of the study** To investigate the effectiveness of a programme of oral sensorimotor therapy in children with severely and profoundly developmental disability. **Study dates** Not reported.	**Characteristics** Age (mean years, SD): 11.5 (4.38) Weight (mean pounds, SD): 39.5 (13.8) Weight of all children was below average weight, but older children weighed more (r=0.67, p <0.1) Spastic quadriplegic (n): 11/20 Athetoid (n): 2/20 Mixed (n): 5/20 Pre-therapy evaluation (Vulpe Assessment Battery mean score, SD): Oral motor therapy group=16.5 (2.2) and control group=17.3 (4.2) for reflex assessment Pre-therapy evaluation (Vulpe Assessment Battery mean score, SD): Oral motor therapy group=37.7 (6.4) and control group=41.4 (13.1) (p <0.1) for feeding assessment **Inclusion criteria** Severe or profound neuromotor disorder, with n=18/20 participants diagnosed with cerebral palsy, with dependency in most areas of self-care and required assistance	• Oral sensorimotor therapy. • Routine programme of therapy and education.	Each participant received 30 to 40 minutes of therapy daily, 5 days a week for 9 weeks. Some participants received therapy just prior to or in conjunction with their meals, and others were scheduled for therapy at various times during the day. The treating therapist determined which children received therapy during or just before meal times based on the nature of the oral-motor and/or feeding problem exhibited by the participant. There were 3 major components to the treatment: 1. inhibition of abnormal oral and postural reflexes 2. facilitation of normal muscle tone 3. desensitisation of the oral region The exact treatment programme for each participant was developed based on the initial oral-motor evaluation and an observation of the individual subject's feeding pattern. Food textures: Consistency of food ranged from pureed to normal, depending on feeding skills of the participant. Majority of the participants were fed pureed food	Control group:44.93 (13.04) p <0.05 Post-therapy weight: Oral motor therapy:35.85 (8.41) Control group:45.41 (12.02) p>0.1	• An appropriate method of randomisation was used to allocate participants to treatment group = Unclear. Children were randomly assigned, but method not reported • Adequate concealment of allocation = Unclear. Not reported. • The groups were comparable at baseline = Yes. **performance bias - very high** • The comparison groups received the same care apart from the intervention = Yes. • Participants receiving the treatment were kept blind to treatment allocation = No (probably no given the type of intervention) • Individuals administering care were kept blind to treatment allocation = No (probably no given the type of intervention) **attrition bias - High**

Study details	Participants	Interventions	Methods	Outcomes and Results	Comments
Source of funding Not reported.	in feeding (some degree of oral-motor problems). **Exclusion criteria** Not reported.		by an assistant assigned to the unit. <u>Control group:</u> Participants received their regular programme of therapy and education. No specific treatment of oral-motor dysfunction or feeding disorders was administered, and children continued to receive the same diet as the oral-motor therapy group and were fed by their regular assistants.		• All groups were followed up for an equal length of time = Yes • The groups were comparable for treatment completion = No. Due to staffing changes at the institution during the study, not all participants were able to be administered post-therapy oral motor evaluations. Post-therapy evaluations were available for 9 participants in the treatment group and 2 in the control. • The groups were comparable with respect to the availability of outcome data = No. Post-therapy evaluation was not available for the control group. **detection bias - low** • the study had an appropriate length of follow up = Yes • the study used a precise definition of outcome = Yes

Study details	Participants	Interventions	Methods	Outcomes and Results	Comments
					• a valid an reliable method was used to determine the outcome = Yes • Investigators were kept blind to participants' exposure to the intervention = Unclear. Not reported. • Investigators were kept blind to other important confounding and prognostic factors = Unclear. Not reported. **Indirectness**: does the study match the protocol in terms of • population = some (mixed population with 18/20 diagnosed with CP) • intervention = yes • outcomes = yes **Other information** Not enough information was provided for baseline characteristics. The age of participants in the control group was high compared to oral sensorimotor therapy group. Participants in the control group were heavier than participants in

Study details	Participants	Interventions	Methods	Outcomes and Results	Comments
					the oral sensorimotor therapy group, which could be due to the age of participants in the group. The sample size was small, which could result in bias.

I.11 Optimising nutritional status

Study details	Participants	Interventions	Methods	Outcomes and Results	Comments
Full citation Patrick,J., Boland,M., Stoski,D., Murray,G.E., Rapid correction of wasting in children with cerebral palsy, Developmental Medicine and Child Neurology, 28, 734-739, 1986 **Ref Id** 326432 **Country/ies where the study was carried out** Canada **Study type** Randomised controlled trial	**Sample size** Immediate high energy feeding group: n = 10 Control: n = 10 **Characteristics** <u>Mean age ± SD</u> Immediate high energy feeding group: 11.1 ± 3.1 Control: 6.7 ± 4.1 Initial weight in kg (± SD) Immediate high energy feeding group: 18.1 ± 2.7 Control: 13.8 ± 3.2 **Inclusion criteria** Children with cerebral palsy who had skinfold thickness below 5th percentile for age	**Interventions** Immediate high energy feeding programme, consisting of: 1. Initial phase which aims at re-establishing normal metabolism, without inducing growth. 2. Second phase which aims at increasing energy intake to maximum tolerated until weight gain ceases or intolerance of the feed indicates that energy stores are replete. Enteral feeds like 'Isocal' and "Ensure' stated to be more appropriate than infant formula. Continuous pump	**Details** <u>Setting</u> Not reported. <u>Randomisation method</u> Not reported. <u>Statistical analysis</u> Student t test was used to compare groups and assess each individual's weight gain. <u>Follow-up</u> 5 months for intervention and control group. Control group were given tube feeding at 5 months after initiating study and follow-up not reported.	**Results** <u>Mean final weight in kg (± SD)</u> Immediate high energy feeding group: 24.0 ± 2.0 Control: 13.6 ± 3.0 <u>Mean weight change from baseline (± SD)</u> Immediate high energy feeding group: 6.0 (SD not reported) Control: -0.1 (± 0.5) Changes in weight were significant (p<0.01, Student t test) when groups were compared and when patients were used as their own control. Delayed intervention group (patients who were in control group and given tube feed at 5 weeks)	**Limitations** NICE guidelines manual 2012: Appendix C: Methodology checklist: randomised controlled trials A Selection bias A1 - Was there appropriate randomisation - randomisation process not reported A2 - Was there adequate concealment - not reported A3 - Were groups comparable at baseline - no - intervention group older and have higher weight Level of bias: High B Performance bias B1 - Did groups get same level of care - yes B2 - Were participants blinded to treatment allocation- Not applicable B3 - Were individuals

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Aim of the study To examine nutritional rehabilitation of children with cerebral palsy and nutritional problems. **Study dates** Not reported. **Source of funding** The National Health Research Development Programme and Mead-Johnson Ltd.	and failure to gain weight during the previous year. **Exclusion criteria** Not reported.	assisted feeding was carried out using 'Biosearch enteral feeding pump. 3. Return to normal feeding, where tube feeding is gradually withdrawn (10 to 20% reduction daily). Tube can be left in situ while normal feeding is re-established. Total energy intake from formula started at 55 to 87 kcal/kg per day and reached maximal values of 82 to 150 kcal/kg.		Final weight change in mean kg (± SD): 2.1 ± 1.0	administering care blinded to treatment allocation- Not applicable Level of bias: low C Attrition bias C1 - Was follow-up equal for both groups - Yes C2 - Were groups comparable for dropout - Yes C3 - Were groups comparable for missing data - No - standard deviation of intervention group mean missing Level of bias: Low D Detection bias D1 - Was follow-up appropriate length - Unclear (five weeks) D2 - Were outcomes defined precisely - Yes D3 - Was a valid and reliable method used to assess outcome - Yes D4 - Were investigators blinded to intervention - N/A D5 - Were investigators blinded to confounding factors - N/A Level of bias: low Indirectness Does the study match the review protocol in terms of Population: yes Intervention: yes Outcomes: yes Indirectness: no

Study details	Participants	Interventions	Methods	Outcomes and Results	Comments
					Other information The diet programme in this RCT was delivered by an enteral feeding pump (naso-gastric).
Full citation Fung,E.B., Samson-Fang,L., Stallings,V.A., Conaway,M., Liptak,G., Henderson,R.C., Worley,G., O'donnell,M., Calvert,R., Rosenbaum,P., Chumlea,W., Stevenson,R.D., Feeding dysfunction is associated with poor growth and health status in children with cerebral palsy, Journal of the American Dietetic Association, 102, 361-373, 2002 **Ref Id** 316119 **Country/ies where the study was carried out** 6 centres in the US and Canada **Study type** Cross-sectional, population based	**Sample size** Study examined n = 230, of these n = 119 were reported for gastrostomy vs oral feeding. **Characteristics** In the whole sample (n = 230): <u>Mean age:</u> 9.7 ± 4.6 years (range = 2.0 to 17.9 years) <u>Ethnicity:</u> White: 69% Black: 23% Other: 7% <u>Gender:</u> Male: 69% **Inclusion criteria** All children with cerebral palsy, by clinical diagnosis,	**Interventions** Gastrostomy (reported as tube fed): n = 70	**Details** Children eligible for participation were assessed and their parents interviewed. Anthropometric data was collected and if there was any asymmetrical deformity, with the right side more affected, the left side was measured. All measures were obtained twice and the average was used for analysis. To assess health related quality of life, the child health questionnaire was used. CHQ includes assessment of the parent's perception of their child's overall health (Global Health Score), the child's physical health (Physical Summary Score) which includes components of physical function, societal role and participation and 2 subscales (Impact on Parent-Time and Parent-Emotion) designed to assess the parent's	**Results** <u>Anthropometric measure: weight (Z-score)</u> Tube fed (n = 49): -2.15 ± 2.19 Orally fed (n = 70): -2.77 ± 2.56 Total (n = 119): -2.52 ± 2.43 <u>Health related Quality of Life: Child Health Questionnaire (CHQ) response from parents</u> <u>Global Health Z-score</u> Tube fed: -1.84 ± 1.04 Orally fed: -0.46 ± 1.24 <u>Physical Summary Score</u> Tube fed: 23.6 ± 17.3 Orally fed: 38.1 ± 15.6 <u>Impact on Parent-Time Z-score</u> Tube fed: -1.38 ± 1.70 Orally fed: -0.91 ± 1.80 <u>Impact on Parent-Emotion Z-score</u> Tube fed: -0.80 ± 1.40 Orally fed: -0.07 ± 1.20	**Limitations** NICE guidelines manual 2012: Appendix D: Methodology checklist: cohort studies A. Selection bias (systematic differences between the comparison groups) A.1 The method of allocation to treatment groups was unrelated to potential confounding factors (that is, the reason for participant allocation to treatment groups is not expected to affect the outcome(s) under study)-N/A A.2 Attempts were made within the design or analysis to balance the comparison groups for potential confounders-N/A A.3 The groups were comparable at baseline, including all major confounding and prognostic factors- Yes Level of risk-low B. Performance bias (systematic differences between groups in the care provided, apart from the

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Aim of the study To describe parent-reported feeding dysfunction and its associated with health and nutritional status in children with cerebral palsy. **Study dates** Not reported **Source of funding** Not reported	who were of moderate to severe motor impairement as determined by the Gross Motor Function Classification system (GMFCS III to V). **Exclusion criteria** Children with a history of genetic, metabolic or neurodegenerative disease or children with medical illnesses known to impact growth.		perception of the impact of their child's health on their own emotional health and societal participation. For all the CHQ components, a higher the score indicates a better or more positive outcome. <u>Setting</u> Study conducted as part of the North American Growth in Cerebral Palsy Project (NAGCPP) in 6 sites, 4 in the United States and 2 in Canada. <u>Allocation concealments</u> N/A <u>Statistical analysis</u> Average anthropometric measures values for each subject were compared to reference data and Z-scores were calculated. For weight Z-score, National Centre for Health Statistics reference standards were used. For continuous outcomes, the Kruskal-Wallis test was used to test for an association between levels of feeding dysfunction and measures of severity of disability, nutritional status, health and parental impact. <u>Follow-up</u> N/A		intervention under investigation) B.1 The comparison groups received the same care apart from the intervention(s) studied- Unclear -age of participants in each group not reported B.2 Participants receiving care were kept 'blind' to treatment allocation-N/A B.3 Individuals administering care were kept 'blind' to treatment allocation-N/A Level of risk: some C. Attrition bias (systematic differences between the comparison groups with respect to loss of participants C.1 All groups were followed up for an equal length of time (or analysis was adjusted to allow for differences in length of follow-up)-N/A - no follow up, cross sectional design C.2a How many participants did not complete treatment in each group?-N/A C.2b The groups were comparable for treatment completion (that is, there were no important or systematic differences between groups in terms of those who did not complete treatment)-N/A C.3a For how many participants in each group were no outcome data available?-N/A C.3b The groups were comparable with respect to

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					the availability of outcome data (that is, there were no important or systematic differences between groups in terms of those for whom outcome data were not available)-N/A Level of risk: low D. Detection bias (bias in how outcomes are ascertained, diagnosed or verified) D.1 The study had an appropriate length of follow-up-N/A D.2 The study used a precise definition of outcome- Yes D.3 A valid and reliable method was used to determine the outcome-Yes D.4 Investigators were kept 'blind' to participants' exposure to the intervention-N/A D.5 Investigators were kept 'blind' to other important confounding and prognostic factors-N/A Level of bias: low Indirectness Does the study match the review protocol in terms of; Population: Yes Outcome: Yes Indirectness: No **Other information**

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Full citation Sullivan,P.B., Alder,N., Bachlet,A.M., Grant,H., Juszczak,E., Henry,J., Vernon-Roberts,A., Warner,J., Wells,J., Gastrostomy feeding in cerebral palsy: too much of a good thing?, Developmental Medicine and Child Neurology, 48, 877-882, 2006 **Ref Id** 326950 **Country/ies where the study was carried out** UK **Study type** Prospective cohort study. **Aim of the study** Measure energy balance and body composition in children with CP who were fed either orally or by Gastrostomy tube. **Study dates** Not reported.	**Sample size** At baseline: Total n = 40 Gastrostomy: n = 22 Orally fed: n = 17 At follow-up, weight Z-scores were presented for n = 30 in total (number in each group not reported). **Characteristics** <u>Median age</u> Gastrostomy: 9 years Orally-fed: 8 years <u>Weight at baseline (median kg and range):</u> Gastrostomy: 19.6 (8.9 to 35.8) Orally-fed: 15.9 (9.0 to 65.2) <u>Weight at baseline (median Z-score and range)</u> Gastrostomy: -2.8 (-6.5 to 2.7) Orally-fed: -3.2 (-7.0 to 3.0) <u>Total energy expenditure per kg body weight, kcal/24hrs/kg (median and range)</u> Gastrostomy: -43.7 (20.9 to 94.1) Orally-fed: 62.8 (22.7 to 93.6)	**Interventions** Gastrostomy. All children who required gastrostomy received enteral feed via a nasogastric tube for 1 month prior to gastrostomy. Children with gastrostomy were fed with Nutrini, a nutritionally complete enteral feed that contains 1kcal/ml. The number of feeds prescribed was determined clinically based on patient's weight, age, nutritional status and nutritional intake by the attending physician and dietician.	**Details** Body weight was measured using sit-on electronic weighing scales with the child wearing light indoor clothing and measurements were taken three times and averages. <u>Setting</u> University Department of Pediatrics, John Radcliffe Hospital, Oxford, UK. <u>Allocation concealment</u> N/A <u>Statistical analysis</u> For weight, measurements were standardised to the 1990 British Growth reference centiles. <u>Follow-up</u> 12 months.	**Results** <u>Weight z-score at 12 months</u> (only available for n = 30 patients): Median difference between gastrostomy and orally-fed group (95% CI): 0.002 (-0.64 to 0.65)	**Limitations** NICE guidelines manual 2012: Appendix D: Methodology checklist: cohort studies A. Selection bias (systematic differences between the comparison groups) A.1 The method of allocation to treatment groups was unrelated to potential confounding factors (that is, the reason for participant allocation to treatment groups is not expected to affect the outcome(s) under study)-N/A A.2 Attempts were made within the design or analysis to balance the comparison groups for potential confounders- N/A - groups were comparable by age but more patients with severe cerebral palsy (GMFCS level V) in gastrostomy group. A.3 The groups were comparable at baseline, including all major confounding and prognostic factors-N/A Level of risk- N/A B. Performance bias (systematic differences between groups in the care provided, apart from the intervention under investigation) B.1 The comparison groups received the same care apart

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Source of funding Sports Aiding Research for Kids (SPARKS).	**Inclusion criteria** Spastic quadriplegic cerebral palsy patients with: • A severe degree of oral-motor dysfunction that was compromising nutritional status as indicated by body-weight for age and triceps skinfold thickness for age • Clinical signs of under nutrition (e.g. wasting and pale, cold, mottled skin of arms and legs) were considered for gastrostomy feeding. **Exclusion criteria** Evidence of a genetic, metabolic, or neurodegenerative disease.				from the intervention(s) studied-Yes B.2 Participants receiving care were kept 'blind' to treatment allocation-N/A B.3 Individuals administering care were kept 'blind' to treatment allocation-N/A Level of risk: Low C. Attrition bias (systematic differences between the comparison groups with respect to loss of participants C.1 All groups were followed up for an equal length of time (or analysis was adjusted to allow for differences in length of follow-up)-Yes C.2a How many participants did not complete treatment in each group?- unclear how many participants in each group at follow-up C.2b The groups were comparable for treatment completion (that is, there were no important or systematic differences between groups in terms of those who did not complete treatment)- unclear C.3a For how many participants in each group were no outcome data available?- unclear - data not reported C.3b The groups were comparable with respect to the availability of outcome data (that is, there were no important or systematic differences between groups

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					in terms of those for whom outcome data were not available)- unclear Level of risk: High D. Detection bias (bias in how outcomes are ascertained, diagnosed or verified) D.1 The study had an appropriate length of follow-up- Yes D.2 The study used a precise definition of outcome- Yes D.3 A valid and reliable method was used to determine the outcome- Yes D.4 Investigators were kept 'blind' to participants' exposure to the intervention-N/A D.5 Investigators were kept 'blind' to other important confounding and prognostic factors-N/A Level of bias: Low Indirectness Does the study match the review protocol in terms of; Population: Yes Outcome: Yes Indirectness: No **Other information**
Full citation	**Sample size** Tube fed: n = 48 Orally fed: n = 62	**Interventions** Tube feeding. Further details on type of tube feed	**Details** Children with quadriplegic CP were identified from the	**Results** Boys Mean weight in kg (± SD)	**Limitations** NICE guidelines manual 2012: Appendix D:

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Kong,C.K., Wong,H.S., Weight-for-height values and limb anthropometric composition of tube-fed children with quadriplegic cerebral palsy, Pediatrics, 116, e839-e845, 2005 **Ref Id** 327658 **Country/ies where the study was carried out** China **Study type** Cross-sectional **Aim of the study** To examine the plausible effects of tube feeding on weight-for-height, fat and muscle values for children with quadriplegic cerebral palsy. **Study dates** Not reported. **Source of funding** Not reported.	Total: n = 110 **Characteristics** 5 orally fed children and 4 tube-fed children with CP had dyskinetic CP. Other children had either spastic or mixed type quadriplegic CP. None of the children had independent ambulatory ability. Boys Mean age (± SD) Tube fed: 11.2 ± 3.9 Orally fed: 12.4 ± 4.2 Girls Mean age (± SD) Tube fed: 11.4 ± 3.3 Orally fed: 13.3 ± 3.4 **Inclusion criteria** Children with quadriplegic cerebral palsy. **Exclusion criteria** Children with metabolic disorders, genetic diseases and congenital anomalies.	and nutrient intake not provided.	patient register of the Development Disabilities Unit. Body weights were measured with a digital bed scale (Scale-Tronix 2001). Setting The Development Disabilities unit of Caritas Medical Centre of Hong Kong. Statistical analysis ANCOVA using height as a covariate. If results were found to be significant, posthoc analysis were performed to identify differences between groups using ANCOVA. Follow-up N/A	Tube fed: 22.1 ± 5.7 Orally fed: 20.7 ± 5.8 Girls Mean age in kg (± SD) Tube fed: 22.3 ± 7.0 Orally fed: 23.0 ± 5.8	Methodology checklist: cohort studies A. Selection bias (systematic differences between the comparison groups) A.1 The method of allocation to treatment groups was unrelated to potential confounding factors (that is, the reason for participant allocation to treatment groups is not expected to affect the outcome(s) under study)-N/A A.2 Attempts were made within the design or analysis to balance the comparison groups for potential confounders-N/A A.3 The groups were comparable at baseline, including all major confounding and prognostic factors- N/A Level of risk- N/A B. Performance bias (systematic differences between groups in the care provided, apart from the intervention under investigation) B.1 The comparison groups received the same care apart from the intervention(s) studied- N/A B.2 Participants receiving care were kept 'blind' to treatment allocation-N/A B.3 Individuals administering care were kept 'blind' to treatment allocation-N/A Level of risk: N/A

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					C. Attrition bias (systematic differences between the comparison groups with respect to loss of participants C.1 All groups were followed up for an equal length of time (or analysis was adjusted to allow for differences in length of follow-up)-N/A no follow-up, reterospective cross-sectional C.2a How many participants did not complete treatment in each group?-N/A C.2b The groups were comparable for treatment completion (that is, there were no important or systematic differences between groups in terms of those who did not complete treatment)-N/A C.3a For how many participants in each group were no outcome data available?-N/A C.3b The groups were comparable with respect to the availability of outcome data (that is, there were no important or systematic differences between groups in terms of those for whom outcome data were not available)- Yes Level of risk: Low D. Detection bias (bias in how outcomes are ascertained, diagnosed or verified)

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					D.1 The study had an appropriate length of follow-up- N/A D.2 The study used a precise definition of outcome-Yes D.3 A valid and reliable method was used to determine the outcome-Yes D.4 Investigators were kept 'blind' to participants' exposure to the intervention-N/A D.5 Investigators were kept 'blind' to other important confounding and prognostic factors-N/A Level of bias: low Indirectness Does the study match the review protocol in terms of; Population: Yes Outcome: Yes Indirectness: No **Other information** Mode of tube feeding was not specified.

I.12 Improving speech, language and communication: Speech intelligibility

Study details	Participants	Interventions	Methods	Outcomes	Comments
Full citation	Characteristics	Interventions	Details	Results	Limitations

Study details	Participants	Interventions	Methods	Outcomes	Comments
Campbell, C. R., Stremel-Campbell, K., Programming "loose training" as a strategy to facilitate language generalization, Journal of Applied Behavior Analysis, 15, 295-301, 1982 **Ref Id** 340123	One boy aged 10 years with CP affecting lower limbs, and moderate language delay.	Correct production of “is/are” in three syntactic structures (“wh” questions, “yes/no” reversal questions and statements) was reinforced using behaviour modification techniques. Two 15 minute sessions were given each school day, with 155 sessions in total.	Single case experimental design: within subject multiple baseline across 2 behaviours,plus one control untreated behaviour.	Frequency of correct “is/are” production in the three target syntactic structures was recorded online by an unblinded observer in each training session, and by a second assessor in 17% of sessions.	**Limitations assessed with the Cochrane Risk of bias Assessment tool:** 1. Random sequence generation (selection bias): unclear risk (not used- single case experimental design) 2. Blinding of outcome assessment (Detection bias): high risk (online, live data collection. Reliability between 2 independent raters on 17% of sessions ranged from 68-90%. 3. Incomplete outcome data (attrition bias): low risk (no missing data) 4. Selective reporting (reporting bias): low risk (all expected outcomes have been reported). **Other information** Second single case using same design also reported in same paper. Second child did not have cerebral palsy and information not reported in this review
Full citation Dada, S., Alant, E., The effect of aided language stimulation on vocabulary acquisition in children with little or no functional speech, American Journal of Speech Language	**Characteristics** Three children with fewer than 15 spoken words, aged 8-12 years	**Interventions** Aided language stimulation. One set of 8 vocabul ary items taught in a week, same activity repeated each day for five days. Activity 15-25 minutes in duration. Three weeks intervention. Total of 24 vocabulary items taught	**Details** Single case experimental design replicated across participants: within subject multiple baseline across 3 activities	**Results** Number of objects correctly selected when named.	**Limitations** **Limitations assessed with the Cochrane Risk of bias Assessment tool:** 1. Random sequence generation (selection bias): unclear risk (not used- single case experimental design) 2. Blinding of outcome assessment (Detection bias): high risk (online, live data collection. Reliability between 2 independent raters on 17% of sessions ranged from 68-90%. 3. Incomplete outcome data (attrition bias): low risk (no missing data)

Study details	Participants	Interventions	Methods	Outcomes	Comments
Pathology, 18(1): 50-64, 2009 **Ref Id** 341086					4. Selective reporting (reporting bias): low risk (all expected outcomes have been reported). **Other information**
Full citation Fox, C. M., Boliek, C. A., Intensive voice treatment (LSVT LOUD) for children with spastic cerebral palsy and dysarthria, Journal of Speech Language & Hearing Research, 55, 930-45, 2012 **Ref Id** 343429	**Characteristics** N = 5 children with a medical diagnosis of predominantly spastic cerebral palsy. age ranged between 5 and 7 years. additional recruitment criteria were: a. dysarthria b. hearing that was within normal limits or aided to normal limits c. no vocal fold pathology as determined by an otolaryngologyst d. ability to follow directions for the study tasks e. stable medications, if applicable.	**Interventions** LSVT LOUD treatment consisted of 16 individual 1-hr treatment sessions delivered on 4 consecutive days each week for 4 consecutive weeks. All treatment was delivered by an expert LSVT LOUD clinician, and all sessions were conducted in the participant's home. the first half of each treatment session consisted of three daily tasks: 1. maximum duration sustained vowels 2. maximum frequency range 3. repetition of 10 functional phrases	**Details** this study used a noncuncurrent multiple baseline design with replication across subjects. a telephone screening questionnaire was completed with parents of potential participants followed by a face-to-face screening session with the child. in addition, a laryngeal examination was conducted by an otolaryngologist to ensure that no laryngeal pathology existed. All five participants completed the entire study.	**Results** • listeners consistently preferred the speech samples taken immediately post-intervention over those taken during the baseline phase • changes in acoustic measures of vocal functioning were not consistent across participants and occurred more frequently for maximum performance tasks as opposed to speech • although parents of the treated participants reported an improved perception of vocal loudness immediately following treatment	**Limitations** Selection bias: not used – unclear risk. Detection bias: online, live coding. Inter-rater agreement 74%-89% - unclear risk. Attrition bias – low risk. Reporting bias: all expected outcomes reported - low risk. **Other information**

Study details	Participants	Interventions	Methods	Outcomes	Comments
		five times each the second half of treatment sessions was spent on a speech hierarchy progressing in difficulty from single words to conversational speech. All exercises involved a minimum of 15 repetitions of each training task while incorporating sensory augmentation, such as cueing increased vocal effort and loudness, and sensory awareness by asking the children 'did you feel your voice? did you hear how you sounded?'. Homework and carry-over exercises were assigned every day during the month of treatment. all participants and families members were encouraged to continue homework routines at the conclusion of treatment.		, maintenance of changes at 6-week follow-up varied across the participants.	

Study details	Participants	Interventions	Methods	Outcomes	Comments
Full citation Hurlbut,B.I., Iwata,B.A., Green,J.D., Nonvocal language acquisition in adolescents with severe physical disabilities: Bliss symbol versus iconic stimulus formats, Journal of Applied Behavior Analysis, 15, 241-258, 1982 **Ref Id** 317880	**Characteristics** Three US males, aged 14, 16, 18 years with severe spastic quadriplegia, moderate athetosis and severe choreoathetosis and severe speech impairment. No other further information supplied on cognitive and sensory skills. Communicated by idiosyncratic gestures, yes/no responses and 1-3 Blissymbols.	**Interventions** Participants trained to use 5 Blissymbols and 5 iconic symbols to criterion (10 correct responses) in response to ”What’s this¿‘. Teaching strategies included modeling, verbal prompting, physical and verbal prompting and reinforcement. Duration and frequency of therapy sessions not specified.	**Details** Single case experimental design. Alternating treatments design across 3 subjects. Compared trials to acquisition and response generalisation for Blissymbols and iconic symbols.	**Results** Percentage correct naming of 10 trained and 10 untrained items using Blissand iconic language was measured before and after intervention. Trials to acquisition for both systems was also calculated. Data were measured by an unblinded assessor, and by an independent observer on approximately half of the sessions.	**Limitations** **Limitations assessed with the Cochrane Risk of bias Assessment tool:** 1. Random sequence generation (selection bias): unclear risk (not used- single case experimental design) 2. Blinding of outcome assessment (Detection bias): low risk (Online, live coding of interaction. Second, independent rater coded 50% of baseline, 50% of intervention phase and 33-50% of sessions in which spontaneous use of behaviours was coded. Mean inter-rater agreement 98%) 3. Incomplete outcome data (attrition bias): low risk (no missing data) 4. Selective reporting (reporting bias): low risk (all expected outcomes have been reported). **Other information**
Full citation Pennington,L., Roelant,E., Thompson,V., Robson,S., Steen,N., Miller,N., Intensive dysarthria therapy for younger children with cerebral palsy, Developmental	**Characteristics** N=15 children with CP and dysarthria. In total, 9 males and 6 females were included; age range 5-11y, mean 8y, SD 2y).	**Interventions** Children received three 35- to 40-minute individual sessions of therapy at school each week for 6 weeks. Therapy focused on helping children to control their respiratory and phonatory effort, speech rate, and phrase	**Details** Interrumpted time series study. Participants were recruited via local speech and language therapists in the north-east of England. As part of the intervention, 2 recordings were made at 5	**Results** Mean speech intelligibility increased after therapy to familiar listeners (single words 10.8%, 95% CI 7.2-14.4; connected speech 9.4%, 95% CI 4.8-14.1) and unfamiliar listeners (single words 9.3%, 95% CI 6.8-11.8; connected speech 10.5%, 95% CI 7.3 - 13.8). FOCUS scores increased following therapy for parents (mean increase 30.3, 95%	**Limitations** **Limitations assessed with the Cochrane Risk of bias Assessment tool:** 1. Random sequence generation (selection bias): unclear risk (not used- single case experimental design) 2. Blinding of outcome assessment (Detection bias):low risk (Listeners were unfamiliar and they were allocated at random) 3. Incomplete outcome data (attrition bias): low risk (no missing data) 4. Selective reporting (reporting bias): low risk (all expected outcomes have been reported).

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Medicine and Child Neurology, 55, 464-471, 2013 **Ref Id** 316812		lenght/syllabes per breath, following the principles of motor learning. Both recordings from the 5 time points were heard by 3 unfamiliar listeners. Each unfamiliar listener was allocated 3 recordings at random, with the proviso that they heard the same child only once.	different time points: time 1, 6 weeks before therapy; time 2, 1 week before therapy; time 3 and 1 week; time 4, 6 weeks and time 5, 12 weeks after therapy up until the start of the experimental treatment. During the experimental therapy and for 6 weeks after its completion, children did not received other speech and language therapy.	CI 10.2-50.4) and for teachers (28.25, 35% CI 14.4-42.1), but changes did not correlate with intelligibility. A wide variation was seen in individual responses to therapy.	**Other information**
Full citation Davis, Carol A., Reichle, Joe, Southard, Kristin, Johnston, Susan, Teaching children with severe disabilities to utilise nonobligatory conversational opportunities: An application of high-probability requests, Journal of the Association for Persons with	**Characteristics** American boy aged 15 years, with spastic quadriplegia with athetosis, who communicated using vocalisation, gesture and one word phrases via voice output communication aid containing 500+ stored messages. Other development not reported. Communication partners: 2 female graduate students employed as home tutors of maths,	**Interventions** Communication partners trained to use non-obligatory requests in conversation to promote response. Treatment 2-3 times per week at home. 36 sessions in total.	**Details** Single case experimental design: multiple baseline design across 3 communication partners. One partner did not intervene and acted as control.	**Results** Percentage responses to blocks of 5 elicitation sequences was recorded by unblinded assessor. Reliability of treatment according to protocol and data coding were checked on 25% of sessions with a second, unblinded assessor	**Limitations** **Limitations assessed with the Cochrane Risk of bias Assessment tool:** 1. Random sequence generation (selection bias): unclear risk (not used- single case experimental design) 2. Blinding of outcome assessment (Detection bias): high risk (Online, live coding of interaction. Second, independent rater coded 25% of sessions. Inter-rater agreement > 94%) 3. Incomplete outcome data (attrition bias): low risk (no missing data) 4. Selective reporting (reporting bias): low risk (all expected outcomes have been reported). **Other information**

Study details	Participants	Interventions	Methods	Outcomes	Comments
Severe Handicaps, 23, 57-68, 1998 **Ref Id** 457531	reading and communication, and a male personal care attendant. No further details on the communication partners given.				Two children took part in the study. The second child did not have cerebral palsy and data from that subject is not included in this review.
Full citation Hunt, Pam, Goetz, Lori, Alwell, Morgen, Sailor, Wayne, Using an interrupted behavior chain strategy to teach generalized communication responses, Journal of the Association for Persons with Severe Handicaps, 11, 196-204, 1986 **Ref Id** 457532	**Characteristics** North American girl aged 7 years with severe intellectual impairment and multiple disabilities. No further details provided on underlying impairments. Communicated by vocalisation, 1 gesture, 2 manual signs, and by touching the listener. Could not use pictures for communication. Limited success matching representation to real object.	**Interventions** Interrupted chain training of 4 requests. Treatment given twice daily in familiar routines, with 55 sessions in total.	**Details** Single case experimental design. Multiple baseline across four request situations.	**Results** Measure: Number of requests for objects or actions to continue brushing teeth, playing with purse, pouring juice and climbing into chair Baseline scores: 4 requests made in baseline over 15 sessions Treatment scores: Sessions to criterion of 3 consecutive correct responses (content, form and function) 16 sessions, 1 session, 13 sessions and 1 session respectively Response pattern:Steady increase in communicative behaviours across treatment sessions after initial lag Follow- up: Steady upward trend in 40 session maintenance phase. No follow-up.	**Limitations** **Limitations assessed with the Cochrane Risk of bias Assessment tool:** 1. Random sequence generation (selection bias): unclear risk (not used- single case experimental design) 2. Blinding of outcome assessment (Detection bias): high risk (Online, live coding of interaction. Second, independent rater coded 20% of sessions. Inter-rater agreement > 92%) 3. Incomplete outcome data (attrition bias): low risk (no missing data) 4. Selective reporting (reporting bias): low risk (all expected outcomes have been reported). **Other information** Three children took part in the study. Only one had cerebral palsy. The other children's results will not be included in this review.
Full citation	**Characteristics**	**Interventions**	**Details**	**Results**	**Limitations**

Study details	Participants	Interventions	Methods	Outcomes	Comments
Miller, N., Pennington, L., Robson, S., Roelant, E., Steen, N., Lombardo, E., Changes in voice quality after speech-language therapy intervention in older children with cerebral palsy, Folia Phoniatrica et Logopedica, 65, 200-7, 2013 **Ref Id** 342755	N=16 individuals with CP and dysarthria (9 girls, mean age 14 years, SD = 2; 9 with spastic type CP, 2 dyskinetic, 4 mixed, 1 Worster-Drought syndrome)	All participants received 6 weeks of speech therapy at schools, comprising three 35-40 minute individual sessions per week delivered by a SLP. Therapy focused on achieving and maintaining a suitable posture for breathing and phonation, stabilising students' respiratory and phonary effort and control, speech rate and phrase length/syllables per breath. Articulation was not directly targeted.	Participants completed intelligibility assessments on separate days twice before intervention, at termination of treatment and at 6-week follow-up using 50 words from the Children's Speech Intelligibility Measure lists, and describing cartoon strips. Experienced speech-language pathologists rated voice quality employing GRBAS scales.	There was no clear evidence that change in voice quality pre-post intervention was large compared with change in the pre-intervention or post-intervention periods. Asthenia demonstrated largest improvement (effect size of 0.4). Intelligibility correlated weakly with Grade, Breathiness and Asthenia, but not with Roughness or Strain. A deterioration of 1 unit on the Grade and Asthenia scales was associated with an approximately 11% decrease in intelligibility.	**Limitations assessed with the Cochrane Risk of bias Assessment tool:** 1. Random sequence generation (selection bias): unclear risk (not used- single case experimental design) 2. Blinding of outcome assessment (Detection bias): low risk (16 experienced SLP rated voice quality using GRBAS scales; therapists were blind to all speaker and time point information) 3. Incomplete outcome data (attrition bias): low risk (no missing data) 4. Selective reporting (reporting bias): low risk (all expected outcomes have been reported). **Other information**
Full citation Pennington, L., Goldbart, J., Marshall, J., Speech and language therapy to improve the communication skills of children with cerebral palsy, Cochrane Database of Systematic	**Characteristics** Any child or individual under 20 years of age with any communication disorder associated with CP, including dysarthria, dyspraxia, ataxia, and mixed syndromes.	**Interventions** 1. Therapies given directly to the child with the aim of developing the child's communication skills. 2. Therapies given to familiar communication partners with the aim of changing the communication	**Details** Systematic review	**Results** • The Cochrane review addressed a clearly focused question. • RCTs would have been the most appropriate study design for this type of question (intervention), but since RCTs were not available the	**Limitations** **Other information**

Study details	Participants	Interventions	Methods	Outcomes	Comments
Reviews, CD003466, 2004 **Ref Id** 340258		partners' conversation style to help them facilitate children's communication development.		authors included controlled studies including group and single case experimental design. • The overall results of the review suggest that it is not possible to conclude that SALT focusing on children with CP is more effective than no intervention at all. • Given the study design considered, it is not possible to tell whether the results can be applied to a local population. • Because of the heterogeneity of children with cerebral palsy, their conversational partners and communication environments the authors suggest a broad evaluation of the effectiveness of SALT will not be possible, and evaluations should focus on the effectiveness of interventions addressing	

Study details	Participants	Interventions	Methods	Outcomes	Comments
				particular areas and stages of speech, language and communication, with emphasis on facilitating the participation of children and families in chosen life situations. • All the important outcomes have been considered by this review; however, evidence wasn't retrieved for the following outcomes: children's qol, family stress and coping, satisfaction of patients and family with treatment, non-compliance with treatment	
Full citation Pinder, Gay Lloyd, Olswang, Lesley B., Development of communicative intent in young children with	**Characteristics** N=4 US children, (2 M, 2 F), aged 11.5-13.5 months with mixed athetoid or spastic diplegia type cerebral palsy, who had difficulty grasping and releasing objects and did not sit independently. All	**Interventions** Twice weekly sessions of 50-60 minutes for up to 12 weeks in which children were taught to request objects or request more by gaze and /or	**Details** 4 single case experiments.	**Results** Requests for more and requests for objects were probed once per week in play with toys (experimental condition) and at snack time (control condition). Unblinded assessor recorded response to	**Limitations** **Limitations assessed with the Cochrane Risk of bias Assessment tool:** 1. Random sequence generation (selection bias): unclear risk (not used- single case experimental design) 2. Blinding of outcome assessment (Detection bias): high risk (Coding of interaction from

Study details	Participants	Interventions	Methods	Outcomes	Comments
cerebral palsy: A treatment efficacy study, Infant-Toddler Intervention, 5, 51-69, 1995 **Ref Id** 457533	with IQ < 50 Bailey Mental Development Index, vision correctable with glasses and hearing within normal limits.	reaching and grasping. Teaching strategies included modelling, expectant delay and reinforcement.		elicitations and modes used to make response. Reliability checked with a second observer using randomly selected 20-25% of data for each child.	videotapes. Primary rater not blind to data collection point. Second rater, independently coded 22% of all data, k>0.69) 3. Incomplete outcome data (attrition bias): low risk (no missing data) 4. Selective reporting (reporting bias): low risk (all expected outcomes have been reported). **Other information**
Full citation Richman,J.S., Kozlowski,N.L., Operant training of head control and beginning language for a severely developmentally disabled child, Journal of Behavior Therapy and Experimental Psychiatry, 8, 437-440, 1977 **Ref Id** 328550	**Characteristics** US girl aged 9 years, severe spastic quadriplegia and severe cognitive impairment. No further developmental information supplied.	**Interventions** Operant teaching strategies were used to encourage the maintenance of eye contact and head control and the production of vocal imitations in 10 minute therapy sessions given four days per week for 40 weeks.	**Details** Single case experimental design. Multiple baseline with reversal and reinstatement of treatment across three behaviours.	**Results** Percentage of time eye contact and head control were maintained during each training session. Vocal imitation was requested 30 times in each session, percentage response recorded. Data collected during each session by the therapist. Reliability checked with a number of trained observers on 12.5% session.	**Limitations** **Limitations assessed with the Cochrane Risk of bias Assessment tool:** 1. Random sequence generation (selection bias): unclear risk (not used- single case experimental design) 2. Blinding of outcome assessment (Detection bias): unclear risk (Online, live coding. Second, independent observer coded 25% of samples, inter-rater agreement >80% [mean = 92%]) 3. Incomplete outcome data (attrition bias): low risk (3/80 sessions missed) 4. Selective reporting (reporting bias): low risk (all expected outcomes have been reported). **Other information** Child absent for 3 sessions over treatment period.
Full citation Sigafoos, J., Couzens, D.,	**Characteristics** Australian boy aged 6 years with severe cerebral	**Interventions** Trained to request objects by eye gaze	**Details**	**Results** Therapist assessed percentage of trials in which	**Limitations** **Limitations assessed with the Cochrane Risk of bias Assessment tool:**

Study details	Participants	Interventions	Methods	Outcomes	Comments
Teaching functional use of an eye gaze communication board to a child with multiple disabilities, British Journal of Developmental Disabilities, 41 Part 2, 114-125, 1995 **Ref Id** 342968	palsy of unspecified type, who had moderate cognitive impairment, very poor upper limb control and required assistance for all activities of daily living. Participant was reported to understand various spoken commands and communicated using eye gaze.	in 19 sessions over 8 weeks. Teaching strategies included: creating communicative environment, expectant delay, verbal prompting, increasing expectant delay. reinforcement of response by use of object requested.	Single case experimental design	object requested. Reliability of coding established with independent observer using approximately 50% of sessions.	1. Random sequence generation (selection bias): unclear risk (not used- single case experimental design) 2. Blinding of outcome assessment (Detection bias): low risk (Online, live coding. Second, independent observer coded approximately 50% of samples, inter-rater agreement >83%) 3. Incomplete outcome data (attrition bias): high risk (Child absent from school for replication phase) 4. Selective reporting (reporting bias): low risk (all expected outcomes have been reported). **Other information** Requests for objects generalised across the three objects. All used in same activity, probably inter-related in communication.
Full citation Ward, R., Leitao, S., Strauss, G., An evaluation of the effectiveness of PROMPT therapy in improving speech production accuracy in six children with cerebral palsy, International Journal of Speechlanguage Pathology, 16, 355-71, 2014	**Characteristics** 6 children with CP (age range 3 - 11 years) with moderate to severe speech impairment.	**Interventions** Tactile-kinesthetic motor-speech intervention program (Prompts for Restructuring Oral Muscular Phonetic Targets) Phase A1 = baseline (5-8 weeks) Phase B targeted each participant's intervention priority Phase C targeted one level higher (B and C together = 10 weeks) Phase A2 =	**Details** Single-subject A1BCA2 multiple baseline design	**Results** Speech production: accuracy assessed for both attainment of the targeted motor-speech movement pattern and perceptual accuracy using weekly probes.	**Limitations** **Limitations assessed with the Cochrane Risk of bias Assessment tool:** 1. Random sequence generation (selection bias): unclear risk (not used- single case experimental design) 2. Blinding of outcome assessment (Detection bias): low risk (an independent PROMPT trained SLP blinded to the phases of the study and the participants completed the scoring of the speech data) 3. Incomplete outcome data (attrition bias): low risk (no missing data)

Study details	Participants	Interventions	Methods	Outcomes	Comments
Ref Id 343081		follow-up data collection at 12 weeks post phase C.			4. Selective reporting (reporting bias): low risk (all expected outcomes have been reported). **Other information**
Full citation Pennington,L., Miller,N., Robson,S., Steen,N., Intensive speech and language therapy for older children with cerebral palsy: a systems approach, Developmental Medicine and Child Neurology, 52, 337-344, 2010 **Ref Id** 76173	**Characteristics** N= 15 children with CP, 1 with Worster Drought, aged 12-18 years (mean=14, SD=2). Dysarthria rated mild-severe by referring therapists. All children able to comprehend simple instructions.	**Interventions** Individual therapy focused on stabilising respiratory and phonatory effort and control, speech rate and phrase length/syllables per breath.	**Details** Interrupted time series	**Results** Speech production: Percentage of words intelligible in single words and connected speech to familiar and unfamiliar listeners	**Limitations** **Limitations assessed with the Cochrane Risk of bias Assessment tool:** 1. Random sequence generation (selection bias): unclear risk (participants acted as own controls) 2. Blinding of outcome assessment (Detection bias): low risk (listeners blind to time of recording) 3. Incomplete outcome data (attrition bias): low risk (one child's data missing at Time 1) 4. Selective reporting (reporting bias): low risk (all expected outcomes have been reported). **Other information**

I.13 Improving speech, language and communication: Communication systems

Study details	Participants	Interventions	Methods	Outcomes and Results	Comments
Full citation Udwin, O., Yule, W., Augmentative communication systems taught to cerebral palsied children - a longitudinal study. I. The acquisition of signs and symbols, and syntactic aspects of their use over time, British Journal of Disorders of Communication, 25, 295-309, 1990 **Ref Id** 336977 **Country/ies where the study was carried out** UK **Study type** Longitudinal study **Aim of the study** To evaluate the impact of augmentative communication training on the communicative	**Sample size** n = 40 Bliss (Blissymbols) group: n = 20, Makaton: n = 20 **Characteristics** All children were diagnosed with cerebral palsy and aged 3.6 - 9.8 years. There was no difference between Bliss users and signing group in terms of age or gender distribution but the groups differed significantly on measures of physical handicap, non-verbal IQ and language comprehension and expression. **Bliss group** (n = 20) Age in months, mean (SD): 72.1 (16.5) Boys:girls: 9:11 Hearing loss: 10% had moderate hearing loss Visual impairment: 5% were partially sighted Number of spoken words: > 30: 5% 4 - 30: 15% 3 or less: 80% **Makaton group** (n = 10) Age in months, mean (SD): 72.9 (20.5) Boys:girls: 12: 8 Hearing loss: 5% had moderate hearing loss	**Interventions** Bliss group: Blissymbolics Sign: Makaton Vocabulary signs	**Details** The children were first assessed after they had been in symbol/sign training programmes for an average of 10.5 months (range 1 - 18 months). They were reassessed on 3 further occasions, at 6 months intervals, over a period of 1.5 years. Bliss users received an average of 1.49 hours of weakly symbol teaching time whilst the signers received 1.15 hours per week. Setting Bliss users were in schools for physically disabled children. Of the sign users: 13 were in schools for children with severe learning difficulties, 1 in a school for children with moderate learning difficulties and remainder were in schools for physically disabled children.	**Results** At initial assessment, after mean of 10.5 months using Bliss or Makaton Bliss group, mean (SD) Number of symbols taught: 68.8 (56.4) Number of symbols understood: 54.0 (47.3) Percentage of symbols understood: 70.1% (23.1) Number of symbols produced: 50.6 (42.9) Percentage symbols produced: 76.7% (16.9) Makaton sign group, mean (SD) Number of signs taught: 62.9 (38.3) Number of signs understood: 34.4 (27.9) Percentage of signs understood: 47.8% (29.8) Number of signs produced: 28.2 (25.6) Percentage signs produced: 24.4% (5.51) Significant difference found between groups for percentage symbols/signs understood: p < 0.05 (t test) Significant difference found between groups for percentage symbols/signs produced: p < 0.001 (t test)	**Limitations** **NICE GUIDELINE 2012: Appendix D (Cohort)** A: Selection Bias The method of allocation to treatment groups was unrelated to potential confounding factors (that is, the reason for participant allocation to treatment groups is not expected to affect the outcome[s] under study): Yes Attempts were made within the design or analysis to balance the comparison groups for potential confounders: Yes The groups were comparable at baseline, including all major confounding and prognostic factors: No - groups differed significantly on measures of physical handicap, non-verbal IQ and language comprehension. Level of risk: moderate B: Performance bias The comparison groups received the same care apart from the intervention(s) studied: yes Participants receiving care were kept 'blind' to treatment allocation: N/A Individuals administering care were kept 'blind' to treatment allocation: N/A level of risk: low

Study details	Participants	Interventions	Methods	Outcomes and Results	Comments
abilities of two groups of language impaired, cerebral palsied children. **Study dates** Not reported **Source of funding** Spastics Society	Visual impairment: 5% were partially sighted Number of spoken words: > 30: 15% 4 - 30: 45% 3 or less: 40% **Inclusion criteria** Not reported. **Exclusion criteria** Not reported.			1.5 years after initial assessment: Bliss group, mean (SD). n = 20 Number of symbols taught: 137.9 (82.9) No. of symbols understood: 113.7 (70.5) Number of symbols produced: 109.0 (69.9) Makaton group, mean (SD). n = 14 Number of signs taught: 100.3 (52.7) Number of signs understood: 72.1 (46.1) Number of signs produced: 65.1 (46.2)	C: Attrition bias C1. All groups were followed up for an equal length of time (or analysis was adjusted to allow for differences in length of follow-up): Yes C2a. How many participants did not complete treatment in each group?: N/A C2b. The groups were comparable for treatment completion (that is, there were no important or systematic differences between groups in terms of those who did not complete treatment): N/A C3a: For how many participants in each group were no outcome data available?: 6 in signing group C3b. The groups were comparable with respect to the availability of outcome data (that is, there were no important or systematic differences between groups in terms of those for whom outcome data were not available): No. level of risk: high D: Detection bias (bias in how outcomes are ascertained, diagnosed or verified) D1: The study had an appropriate length of follow-up. Yes D2: The study used a precise definition of outcome. Yes

Study details	Participants	Interventions	Methods	Outcomes and Results	Comments
					D3: A valid and reliable method was used to determine the outcome. Unclear D4: Investigators were kept 'blind' to participants' exposure to the intervention. N/A D5: Investigators were kept 'blind' to other important confounding and prognostic factors. N/A **Other information**
Full citation Hochstein,D.D., McDaniel,M.A., Nettleton,S., Neufeld,K.H., The fruitfulness of a nomothetic approach to investigating AAC: comparing two speech encoding schemes across cerebral palsied and nondisabled children, American Journal of Speech-Language Pathology, 12, 110-120, 2003 **Ref Id** 317677	**Sample size** n = 16 recruited (8 with CP, 8 without CP) data available for n = 14 (7 with CP, 7 without CP) **Characteristics** The 8 speech impaired participants with CP were between the vocabulary age equivalencies of 3.3 and 8.1 years (assessed by Form M of the Peabody Picture Vocabulary Test - revised (PPVT-R, Dunn & Dunn, 1981). The 8 participants without disabilities were matched for general vocabulary age and gender.	**Interventions** Two 32 item word lists composed of 16 concrete nouns (e.g. apple, boat and football) and 16 abstract nouns (e.g ghost, medicine and direction) were used. Picture communication symbols (PCS) symbols were chosen over other symbols for this study because of their high translucency or agreement regarding the relationship and meaning. PCS symbols were black and white and	**Details** Display boards were used to present large display pictures to the participants in the training phase. Each child participated in 3 testing sessions. The first meeting consisted of development screening with PPVT-R and a test for direct selection capabilities. The remaining 2 sessions were used to train and test for vocabulary acquisition. Participants were given 1 training session on both Dynavox and Alphatalker. 2 participants (1 CP, 1 non-CP) were omitted because they were unwilling to complete the second test of the dual-level display. Setting Children were drawn from several public schools and a	**Results** • There was no difference in error rates between children with CP (35%) and children without CP (31%, F < 1). • There was a significantly higher error rate for abstract items (48%) than concrete items (19%), F(1, 12) = 66.67, p<0.01 • There was a significantly higher error rate on the first test (38%) than on the second test (29%), F(1, 12) = 32.45, p<0.01 • There was significantly higher error rate with the dual-level system - Dynavox2c (48%) than with the single level system - Alphatalker (19%). All but 2 children (1 with CP, 1 without CP) made fewer	**Limitations** NICE manual Appendix E: Methodology checklist: case–control studies Study identification 1.1 The study addresses an appropriate and clearly focused question: Adequately addressed Selection of participants 1.2 The cases and controls are taken from comparable populations. Yes 1.3 The same exclusion criteria are used for both cases and controls: N/A 1.4

Study details	Participants	Interventions	Methods	Outcomes and Results	Comments
Country/ies where the study was carried out US **Study type** Observational, case-control. **Aim of the study** To examine whether or not 2 variables: number of display levels and vocabulary abstractness, produced divergent levels of effects within a group of speech impaired individuals with CP. **Study dates** Not reported. **Source of funding** National Institute of Deafness and Other Communication Disorders Grant DC03110.	**Inclusion criteria** • All participant: lack of familiarity with both of the 2 presentation systems, as determined by parent or teacher report. None of the children without disability had familiarity with AAC systems. • Speech impaired children who had familiarity with AAC were only allowed to have familiarity with non-computerised systems (e.g communication board) or level-static systems. • Hearing and vision within normal limits, as determined by parent or teacher report. • 8 children with CP had to be severely speech impaired (unable to meet everyday communication needs) They also had to be able to use direct selection techniques (i.e. pointing with a finger) in order to operate	approximately 1 in square and identical on both devices. No written words were used within the pictures. Speech generating devices: The single-level system (Alphatalker) displayed all 32 pictures simultaneously. The dual-level system (Dynavox2c): first displays 8 basic categories or contexts (e.g. appliances & sports) and the second display contained the 4 target vocabulary items within each category (e.g. television or baseball).	day care center in Albuquerque, New Mexico. Statistical analysis A 2 x 2 x 2 x 2mixed analysis of variance (ANOVA) was conducted on the data from tests 1 and 2 from both types of presentation schemes: test number (1 or 2) x Presentation scheme (single-level Alphatalker, dual-level Dynavox2c) x level of Vocabulary abstractness (concrete, abstract) x participant condition (CP or non-CP). Participant condition was a between-subjects variable. The dependent variable was the proportion of errors made on the first responses during vocabulary word retrieval). ANOVA f test statistic is reported. To assess if the speech impaired children with CP differed from the children without disabilities for semantic errors and location errors, independent samples t tests were conducted. A response was considered an error if it did not match the word requested by the experimenter. Non-attempts were also considered errors. Error rate: number of errors divided by the number of possible correct responses.	errors with the dingle-level display. The pattern of performance for children with CP was identical to the pattern of performance for children without CP. Dual-level display (Dynavox2c) errors There was a significant main effect of participant condition on error rate, F (1, 13) = 4.48, p <0.06. Children with CP tended to make fewer category errors (68.1%) than children without CP (85%). Single-level display (Alphatalker) errors There was no effect of participant condition on proportion of errors made t (14) = 0.48, p = 0.64. Median errors in Test 1 among n = 7 CP participants - (calculated from raw data presented in study) Dynavox2c: Median 0.59 (range 0.22 to 0.78) Alphatalker: Median 0.19 (range 0.09 to 0.44) Median errors in Test 2 among n = 7 CP participants - (calculated from raw data presented in study) Dynavox2c: Median 0.50 (range 0.13 to 0.72) Alphatalker: Median 0.19 (range 0.06 to 0.38)	What was the participation rate for each group (cases and controls): 7/8 for both groups/ 1.5 Participants and non-participants are compared to establish their similarities or differences: Yes 1.6 Cases are clearly defined and differentiated from controls: Yes, non-CP. 1.7 It is clearly established that controls are not cases: Yes Assessment 1.8 Measures were taken to prevent knowledge of primary exposure from influencing case ascertainment: N/A 1.9 Exposure status is measured in a standard, valid and reliable way: N/A Confounding factors 1.10 The main potential confounders are identified and taken into account in the design and analysis: yes

Study details	Participants	Interventions	Methods	Outcomes and Results	Comments
	the communication devices. **Exclusion criteria** Not reported.				Statistical analysis 1.11 Have confidence intervals been provided?: No **Other information**
Full citation McConachie, H., Pennington, L., In-service training for schools on augmentative and alternative communication, European Journal of Disorders of Communication, 32, 277-288, 1997 **Ref Id** 341652 **Country/ies where the study was carried out** UK **Study type** Before and after study **Aim of the study**	**Sample size** n = 33 adults (teachers and non-teaching assistants, including 1 nurse and physiotherapist). Facilitation of communication was evaluated for n = 9 children and young people with cerebral palsy using AAC. **Characteristics** Target children and young people (n = 9) Age range: 7 - 17 CP type: 6 had mixed CP, 2 with dystonic CP and 1 with spastic CP. AAC: 6 used Bliss symbols and 3 used Rebus. Education: 5 attended day special, 3 residential special and 1 mainstream education. Adults (n = 33) In participation group (n = 19): 9 teachers and 10 non teaching assistants, including	**Interventions** n = 19 had training n = 14 had no training 'My Turn to Speak' training workshops, aimed to train adults to facilitate the interaction of children who use AAC and to work as a team to develop children's communication skills. Package consists of: tutor's manual, participant manual and illustrative videotape and is run independently by a speech therapist and occupational therapist or a teacher with special interest in AAC. Five 90 minute sessions	**Details** Video recordings of interactions by members of the training and comparison groups with the target children and young people were taken in naturally occurring situations, such as lessons and support. 5 minute clips of interactions were coded to examine the extent to which the adults facilitated the target child's communication. Factors rated included: the positioning of adults, the children and their equipment, the use of open rather than closed questions, interest shown in and responsiveness to the child's topic and attempts at positive repair strategies after communication breakdown. Behaviour was coded on a 3 point scale: 'excellent', 'good' and 'poor'. Data were collected 1 month prior to the workshop (Time 1), 1 month after its completion (Time 2) and 4 months later (Time 3).	**Results** At Time 2, no significant change in quality of observation was observed between both groups (Chi2= 1.62, not sig). At Time 3, statistically significant improvement in interaction skills was reported in intervention compared to comparison.	**Limitations** **NICE GUIDELINE 2012: Appendix D (Cohort)** A: Selection Bias The method of allocation to treatment groups was unrelated to potential confounding factors (that is, the reason for participant allocation to treatment groups is not expected to affect the outcome[s] under study): Yes Attempts were made within the design or analysis to balance the comparison groups for potential confounders: Yes The groups were comparable at baseline, including all major confounding and prognostic factors: Unclear Level of risk: low B: Performance bias The comparison groups received the same care apart from the intervention(s) studied: yes

Study details	Participants	Interventions	Methods	Outcomes and Results	Comments
To evaluate the training package 'My Turn to Speak'. **Study dates** Not reported. **Source of funding** Viscount Nuffield Auxiliary Fund and Baring Foundation.	1 nurse and 1 physiotherapist. In comparison group (n = 14): 8 teachers and 6 assistants. **Inclusion criteria** Adults who worked with the CP children and young people and who were available to participate in the workshops. **Exclusion criteria** None reported.	(workshops) were spread across 10 - 12 weeks. Training included short talks, brainstorming, group discussion and video analysis.	Statistics Chi squared test was used to examine whether change was perceived in the quality of adult's interaction skills following training.		Participants receiving care were kept 'blind' to treatment allocation: N/A Individuals administering care were kept 'blind' to treatment allocation: N/A level of risk: low C: Attrition bias C1. All groups were followed up for an equal length of time (or analysis was adjusted to allow for differences in length of follow-up): Yes C2a. How many participants did not complete treatment in each group?: N/A C2b. The groups were comparable for treatment completion (that is, there were no important or systematic differences between groups in terms of those who did not complete treatment): N/A C3a: For how many participants in each group were no outcome data available?: 10 in intervention, 6 in comparison at time 3 C3b. The groups were comparable with respect to the availability of outcome data (that is, there were no important or systematic differences between groups in terms of those for whom outcome data were not available): No, in description stated that more comparison group were lost to follow-up.

Study details	Participants	Interventions	Methods	Outcomes and Results	Comments
					D: Detection bias (bias in how outcomes are ascertained, diagnosed or verified) D1: The study had an appropriate length of follow-up. Yes D2: The study used a precise definition of outcome. Yes D3: A valid and reliable method was used to determine the outcome. Unclear D4: Investigators were kept 'blind' to participants' exposure to the intervention. N/A D5: Investigators were kept 'blind' to other important confounding and prognostic factors. N/A **Other information**

I.14 Managing saliva control

Study details	Participants	Interventions	Methods	Outcomes and Results	Comments
Full citation Basciani,M., Di,Rienzo F., Fontana,A., Copetti,M., Pellegrini,F., Intiso,D.,	**Sample size** 47 children identified; 32 were eligible; 27 ended up being randomised in one of the four groups. **Characteristics**	**Interventions** Enrolled children with CP were randomised into one of four groups: 1. Control group (no treatment)	**Details** Children in the experimental groups were injected 1 week after the baseline drooling measurement. All children were followed at 4 – 12 weeks after BoNT-B	**Results** **Outcomes** - Frequency of sialorrhoea measured by the weight and number of bibs used per day - Severity of sialorrhoea measured by the Thomas-Stonell rating scale	**Limitations** Based on NICE 2012 guideline manual: RCT studies checklist *Selection bias:* concealment of allocation not reported;

Study details	Participants	Interventions	Methods	Outcomes and Results	Comments
Botulinum toxin type B for sialorrhoea in children with cerebral palsy: a randomized trial comparing three doses, Developmental Medicine and Child Neurology, 53, 559-564, 2011 **Ref Id** 132944 **Country/ies where the study was carried out** Italy **Study type** Randomised clinical trial **Aim of the study** The aim was to evaluate the efficacy of three different doses of BoNT-B for	- 15 males, 12 females - Mean age = 7y 10mo ±1y 7mo - 8 children were included who had been previously treated with BoNT-A for spasticity of the lower limbs - GMFCS levels ranged from III to V - All children had moderate or severe intellectual disability - 22.2% had epilepsy - All children had severe neurological dysfunction consisting of mixed disorders such as spastic paraparesis, tetraparesis, dystonic movements, and ataxia. **Inclusion criteria** Children with refractory sialorrhoea or drooling. Sialorrhoea was considered refractory when all common therapeutic agents, including anticholinergic drugs, failed. **Exclusion criteria** - History of any surgical procedure to the head and neck to reduce salivation; - Use of any medications for sialorrhoea; - Use of any pharmacological agents that could affect salivary production.	2. Group receiving low dose of BoNT-B (1500 MU) 3. Group receiving medium dose of BoNT-B (3000 MU) 4. Group receiving high dose of BoNT-B (5000 MU) BoNT-B was given by bilateral injections into the parotid and submandibular glands with ultrasound guidance after local anaesthesia. Parotid and submandibular glands received a fractioned dose of 1500, 3000, or 5000MU of BoNT-B diluted with 0.9% sodium chloride solution. Because the infiltration was traumatic for the child, the procedure was performed with the assistance of the parents and he rehabilitation therapist who was known and trusted by the child. The weight of children who received the	injection. Parents were asked to register adverse effects in a diary (they were given a list of potential adverse events). Parents were also asked to sign a written informed consent. **Randomization** Participants were randomised by a computer-generated program to a control or a BoNT-B treatment group. **Blinding** No blinding reported. **Statistical analysis** Repeated-measures analysis of variance models were performed with linear mixed models with a spatial power correlation accounting for unequally spaced measures. Post-hoc comparisons were investigated through suitable contrasts to test the difference of mean differences from baseline to4 and 12 weeks respectively, between the experimental and control groups, and p values were adjusted for multiple comparisons following Hochberg's method. The reduction of mean values over time was also investigated for each outcome at issue within group arm by estimating the effect of time as a continuous predictor into	- Adverse effects as reported by the parents **Results** <u>Number of bibs, MD (SEM), p-value</u> Low vs. Control at 4 weeks -2.857 (2.253) p=0.635 Low vs. Control at 12 weeks -5.469 (3.598) p=0.543 Medium vs. Control at 4 weeks -20.143 (2.164) p<0.001 Medium vs. Control at 12 weeks -21.219 (3.440) p<0.001 High vs. Control at 4 weeks -20.857 (2.164) p<0.001 High vs. Control at 12 weeks -22.727 (3.363) p<0.001 Medium vs. Low at 4 weeks -17.286 (2.253) p<0.001 Medium vs. Low at 12 weeks -15.750 (3.598) p<0.001 High vs. Low at 4 weeks -18.000 (2.253) p<0.001 High vs. Low at 12 weeks -17.258 (3.524) p<0.001 High vs. Medium at 4 weeks -0.714 (2.164) p=0.743 High vs. Medium at 12 weeks -1.508 (3.363) p=0.743 <u>Weight of bibs (gr), MD (SEM), p-value</u> Low vs. Control at 4 weeks -2.274 (1.285) p=0.252 Low vs. Control at 12 weeks -0.420 (2.252) p=0.853 Medium vs. Control at 4 weeks -7.071 (1.234) p<0.001 Medium vs. Control at 12 weeks -6.543 (2.152) p=0.020 High vs. Control at 4 weeks -9.257 (1.234) p<0.001 High vs. Control at 12 weeks -8.414 (2.100) p=0.002	groups haven't been compared at baseline. P*erformance bias:* this is a trial comparing treatment against no treatment and no information is reported on other types of care provided; the study is not blinded. *Attrition bias:* low dose group had 1 lost at follow-up, medium dose group had 1, control group had 1. No intention to treat analysis reported. *Detection bias:* the study is not blinded. **Other information** **Indirectness** Does the study match the protocol in terms of: Population: yes Intervention: yes Control: yes Outcomes: yes Indirectness: none **Setting** Outpatient rehabilitation centre of a Scientific Institute Hospital in Italy. **Sample size calculation** Not reported. **Other**

Study details	Participants	Interventions	Methods	Outcomes and Results	Comments
reduction of persistent hypersalivation in children with CP. **Study dates** From April to December 2009. **Source of funding** Not reported.		BoNT-T treatment was also recorded.	the repeated measures analysis of variance models.	Medium vs. Low at 4 weeks -4.798 (1.285) p=0.004 Medium vs. Low at 12 weeks -6.963 (2.252) p=0.020 High vs. Low at 4 weeks -6.983 (1.285) p<0.001 High vs. Low at 12 weeks -8.834 (2.202) p=0.002 High vs. Medium at 4 weeks -2.186 (1.234) p=0.252 High vs. Medium at 12 weeks -1.871 (2.100) p=0.756 <u>Thomas-Stonell, MD (SEM), p-value</u> Low vs. Control at 4 weeks -1.976 (0.586) p=0.006 Low vs. Control at 12 weeks -0.175 (0.703) p=0.805 Medium vs. Control at 4 weeks -5.143 (0.563) p<0.001 Medium vs. Control at 12 weeks -5.009 (0.672) p<0.001 High vs. Control at 4 weeks -5.714 (0.563) p<0.001 High vs. Control at 12 weeks -5.568 (0.659) p<0.001 Medium vs. Low at 4 weeks -3.167 (0.586) p<0.001 Medium vs. Low at 12 weeks -5.184 (0.703) p<0.001 High vs. Low at 4 weeks -3.738 (0.586) p<0.001 High vs. Low at 12 weeks -5.743 (0.690) p<0.001 High vs. Medium at 4 weeks -0.571 (0.563) p=0.802 High vs. Medium at 12 weeks -0.559 (0.659) p=0.802 <u>Adverse events</u> Difficulties in swallowing:	

Study details	Participants	Interventions	Methods	Outcomes and Results	Comments
				• High group = 2/7 • Medium group = 0/7 • Control = 0/7	
Full citation Wu,K.P.-H., Ke,J.Y., Chen,C.Y., Chen,C.L., Chou,M.Y., Pei,Y.C., Botulinum toxin type A on oral health in treating sialorrhea in children with cerebral palsy: A randomized, double-blind, placebo-controlled study, Journal of Child Neurology, 26, 838-843, 2011 **Ref Id** 133063 **Country/ies where the**	**Sample size** 20 children were recruited and randomised in 2 groups. 19 of the 20 patients who completed the study had CP, 1 had an unspecified degenerative CNS disease. **Characteristics** Type of CP: 7 diplegic children, 1 hemiplegic child, 12 quadriplegic children. Mean age (SD) • Int group = 8.6 (4.1) • Control group = 8.0 (3.3) Mean body weight, kg (SD) • Int group = 24.6 (12.3) • Control group = 25.2 (13.3) Gender = 9 males, 11 females. 10 participants assigned to treatment group, and 10 to the control group. Comorbidities: not specified.	**Interventions** An experienced physiatrist performed all the injections and salivary gland localization was marked for parotid and submandibular glands prior to injection by another physiatrist. Injection was controlled sonographically with a 30G needle. Dosage = 30U for subjects weighting <15Kg; 40U for those weighting 15-25Kg, and 50U for subjects weighting >25Kg. <u>Treatment</u> Botulinum toxin type A, supplied as freeze-dried powder of 100U and reconstituted with 1mL of saline. <u>Placebo</u>	**Details** Three assessments were performed at times before injection, and at 1 and 3 months after the injection. In each assessment, the same certified physiatrist evaluated the subjective drooling scale and salivary flow rating. Also, a certified dentist evaluated oral health. **Randomization** The randomisation was performed with a consideration of matching motor severity via the GMFCS level. Control group included 5 children of levels IV to V and 5 children of levels II to III. The treatment group included 4 children of levels IV to V and 6 children of levels II to III. **Blinding** Injection content was blinded to caregivers, participants, and the physiatrist who performed	**Results** **Outcomes** 1. Subjective drooling scale. Drooling severity was evaluated subjectively by asking each caregiver, on a 5-point scale, the following: - how severe the drooling is - bibs change scale, indicating the frequency of bibs and shirt changes 2. Saliva collection 3. Salivary composition analysis 4. Salivary cariogenic bacterial analysis 5. Adverse events **Results** <u>Subjective drooling scale, mean (SD):</u> *At baseline* = P = 1.000 *At 1 month* = P>0.05 *At 3 months* = P>0.05 <u>Salivary flow, mL/min, mean (SD):</u> *At baseline* • Botox = 1.0 (0.6) • placebo = 0.9 (0.5) P = 0.626 *At 1 month*	**Limitations** <u>Based on NICE 2012 guideline manual: RCT studies checklist</u> • *Selection bias:* unclear as the sequence generation is unspecified as well as concealment of allocation is unspecified. • *Performance bias:* low risk. • *Attrition bias:* low risk. • *Detection bias:* low risk. **Other information** **Indirectness** Does the study match the protocol in terms of:

Study details	Participants	Interventions	Methods	Outcomes and Results	Comments
study was carried out Taiwan **Study type** Randomised controlled clinical trial. **Aim of the study** To assess the impact of salivary gland botulinum A injections on oral health in children with cerebral palsy. **Study dates** Not reported. **Source of funding** The study was supported by the National Science Council (Taiwan).	**Inclusion criteria** 1. children diagnose with cerebral palsy 2. age between 3 and 16 years 3. chronic drooling problem **Exclusion criteria** Excluded patients if: 1. recognised chromosomal abnormalities 2. progressive neurological disorders or severe concurrent illness not typically associated with CP 3. active medical conditions such as epilepsy and infections 4. any major surgery or nerve block in the past 3 months 5. any known allergy to Botulinum toxin A 6. inability to chew on gauze.	Normal saline (0.9%).	the injection, the dentist and the rater. **Statistical analysis** A student t test was used to compare continuous data between the two groups. Fisher's exact test was used to compare categorical data between groups. Repeated-measures analysis of variance was used to measure the saliva compositions before and after injections between groups.	Decrease in salivary flow rate was significantly higher in Botox group with P=0.037 *At 3 months* Decrease in salivary flow rate was significantly higher in Botox group with P=0.041 <u>No adverse events reported.</u>	Population: yes Intervention: yes Control: yes Outcomes: yes Indirectness: none **Setting** Outpatient clinic in the department of rehabilitation of a university-affiliated tertiary hospital in Taiwan. **Sample size calculation** Not reported. **Other**

Study details	Participants	Interventions	Methods	Outcomes and Results	Comments
Full citation Sethy,D., Mokashi,S., Effect of a token economy behaviour therapy on drooling in children with cerebral palsy, International Journal of Therapy and Rehabilitation, 18, 494-499, 2011 **Ref Id** 324028 **Country/ies where the study was carried out** India **Study type** Single blind randomised pre- and post-test control group training study.	**Sample size** 25 children with CP. **Characteristics** 12 randomised to group A (experimental), 13 to group B (control). age range in years = 5-10 (exp) and 5-10.5 (control) mean age (SD) = 6.94 (1.52) for experimental group, and 6.91 (1.79) for control. Gender = 15 males and 10 females. Mean (SD) IQ = 66.25 (10.03) in experimental group, and 72.69 (09.18) in control group. Baseline mean (SD) frequency of drooling = 22.17 (8.09) experimental group, 21.85 (5.71) control group. **Inclusion criteria** • children disgnosed with CP and having a problem with drooling • mild intellectual disability • age range from 5 to 12 years • both genders • adequate head control (evaluated through clinical observation and examinations) **Exclusion criteria**	**Interventions** After the baseline data collection, participants in group A were administered behaviour therapy (token economy programme) along with conventional therapy, whereas those in group B received conventional therapy only. Both the token economy programme and the conventional therapy were administered 5 days a week for 20 sessions and reassessment was done for frequency of drooling on the 30th day of therapy. Treatment was discontinued for one week and again reassessment for frequency of drooling was done on the 38th day for both groups. Intervention During the session, subjects were engaged in activities like	**Details** **Allocation and randomization** Subjects who met the criteria were randomly allocated to group A (experimental n = 12) and group B (control n = 13). Group names were written as a number on paper slips. Each subject was required to draw one paper slip and accordingly to the paper slips drawn, he/she were allocated to the respective groups. **Blinding** Raters were unaware of the subjects' allocation to groups.	**Results** **Outcomes** 1. frequency of drooling at day 30: a drooling episode was recorded when saliva spilled over the lower lip and fell out of the mouth. Each drooling episode over a period of 20 minute was recorded. **Results** frequency of drooling post-intervention at day 30 group A: mean (SD) = 5.67 (3.17) group B: mean (SD) = 21.38 (2.60) MD =-15.71 (-17.99 to -13.43)* * calculated by NGA	**Limitations** Based on NICE 2012 guideline manual: RCT studies checklist *Selection bias:* low risk. P*erformance bias:* patients and carers are not blind to study allocation. *Attrition bias:* low risk. *Detection bias:* low risk. **Other information** **Indirectness** Does the study match the protocol in terms of: Population: yes Intervention: yes Control: yes Outcomes: yes Indirectness: none **Setting** Occupational therapy department of Swami Vivekanand National Institute of rehabilitation Training and Research in India. **Sample size calculation** Not reported. **Other**

Study details	Participants	Interventions	Methods	Outcomes and Results	Comments
Aim of the study To investigate the effect of token economy-a behaviour therapy technique for controlling drooling in children with cerebral palsy associated with mild intellectual disability. **Study dates** Not reported. **Source of funding** Not reported.	• children diagnosed with CP, but associated with visual and hearing problem • cleft lip and cleft palate • those receiving any medications for drooling • children who were less than 5 years of age	making a tower and peg lifting. If a subject was capable to keep the mouth dry and did not drool for the time period calculated for a single episode of drooling from the average frequency, then a token and verbal reinforcement were given. <u>Control</u> Conventional therapy included oral motor stimulations over the tongue, lips, cheeks, gums and oral motor activities like sipping coconut water, blowing out candles, etc. Oral motor stimulations included pressure on the tongue and stroking on the cheeks and gums.			
Full citation Camp-Bruno,J.A., Winsberg,B.G., Green-Parsons,A.R.,	**Sample size** 27 participants recruited, 20 completed the study. **Characteristics**	**Interventions** Benztropine "Cogentin" and placebo given for two-week period separated by a	**Details** Report stated that the study is double-blind. Participants were randomly assigned to drug or placebo arm of trial.	**Results** **Outcomes** 1. TDS (Teacher Drooling Scale) 2. behavioural/medical rating scale	**Limitations** • Selection bias: unclear risk as no information provided on the sequence

Study details	Participants	Interventions	Methods	Outcomes and Results	Comments
Abrams,J.P., Efficacy of benztropine therapy for drooling, Developmental Medicine and Child Neurology, 31, 309-319, 1989 **Ref Id** 324038 **Country/ies where the study was carried out** USA **Study type** Randomised Controlled Clinical Trial. **Aim of the study** To evaluate the effect of anticholinergic benzotropine for severe drooling in patients with cerebral palsy.	19 of the 20 participants who completed the study had CP, 1 had an unspecified degenerative central nervous system disease. Type of CP unknown. Age range = 4-44 years Mean age not provided. 14 children and 6 adults (cut-offs not specified). 11 males and 9 females. Comorbidities = more than half were considered to have severe or profound intellectual disability. No other details were provided on comorbidities. **Inclusion criteria** patients with severe drooling scores (4-5 on TDS) only included. **Exclusion criteria** Patients with the following characteristics were exluded from the trial: 1. medical condition controindicating anticholinergic medication 2. receiving neuropletic medication 3. history of seizures with or without medication for at least 1 year 4. history of poor school attendance 5. living in households with carers who are unreliable in the administration of medications outside of school hours.	minimum of one week "washout" period. Both interventions offered as pulverised tablets in soft food once a day on arrival at school. Caregivers administered at home at weekends. <u>Treatment</u> initial dose of benztropine 0.5-1 mg per day depending on participant's weight and age. Dosage determined in first week of two week trial. Dose increased at 1-2 day intervals until maximum effect on drooling achieved. Mean dose = 3.8 mg per day; Maximum dose = 6 mg. <u>Placebo</u> 2 mg of placebo	Outcome measures were taken at baseline by classroom teachers. Observations were made by teachers and nurses at one to two day intervals to guide dose increments of intervention drug in week 1 of 2 week intervention period. TDS scores were taken daily and Behavioural/Medical rating scale was completed by the same staff at 2 or 3 times a week during the trial. Research assistant observed drooling behaviour at the same time each day within 1-4 hours of drug administration. No follow-up at the end of the trial.	3. Time sampling on observed drooling behaviour 4. Observation by nurse and school staff for side effects **Results** <u>TDS at 2 weeks</u> Benztropine group: mean = 2.38 Placebo group = 3.53 p≤0.001 SMD non calculable from data given. <u>Side effects:</u> unclear.	generation process, nor on the allocation concealment. • Performance and detection bias: unclear risk, as the study is reported to be "double-blind" but unclear if all staff involved in taking outcome measures were blinded to intervention. • Attrition bias: high risk as 7 children were eliminated from the study but no details were given regarding the point at which they were excluded. Three patients developed side effects to drug and were excluded on that basis. No data provided for these participants. **Other information** **Indirectness** does the study match the review protocol in terms of: Population: some (age up to 44 years plus one patient with neurodegenerative disorder) intervention: yes

Study details	Participants	Interventions	Methods	Outcomes and Results	Comments
Study dates Not reported. **Source of funding** Study was supported by a grant from the National Institute of Child Health and Human Development.					Control: yes Outcome: yes Indirectness: some (?) **Setting** school setting in the USA **Sample size calculation** not reported **Other**
Full citation Zeller,R.S., Lee,H.M., Cavanaugh,P.F., Davidson,J., Randomized Phase III evaluation of the efficacy and safety of a novel glycopyrrolate oral solution for the management of chronic severe drooling in children with	**Sample size** 47 patients were screened and 38 patients ended up being randomised. 19 of the 20 patients who completed the study had CP, 1 had an unspecified degenerative CNS disease. **Characteristics** Type of CP: 14 and 13 patients had spastic CP and were quadriplegic, in the glycopyrrolate and placebo group respectively. Mean age • Int group = 10.2 (3.8) • Control group = 8.7 (4.0) 14 children and 6 adults (defined??).	**Interventions** <u>Treatment</u> The initial dosage was calculated based on body weight and assigned at the randomization visit. The initial dose was 0.02 mg/Kg three times a day, and was titrated according to schedule over a 4-week period to optimal response, with a maximum dose of 0.1 mg/Kg or 3 mg, three times a day,	**Details** Prospective patients were screened within 3 weeks of dosing. Those receiving anti-sialogenic compounds or other medications with anticholinergic or cholinergic activity underwent a washout phase prior to baseline, beginning 8 days before randomization. Doses of study medication were titrated over a 4-week period to optimal response, after which patients remained on that dose for an additional 4 weeks. **Randomization** Patients were randomised 1:1 to oral glycopyrrolate	**Results** **Outcomes** 1. Efficacy - Responder rate, based on change in degree (severity and frequency) of drooling, as measured by parents/carers using the mTDS which was assessed at baseline, 2, 4, 6, and 8 weeks. Statistically, it was changed in “dichotomised mTDS” which defined responders as those having and increase ≥3 units on the mTDS. 2. Global assessments by the parent/caregiver, by patients deemed cognitively capable by the investigator, and by the physician, measured at 8 weeks or at last visit by using the mBMRS scale	**Limitations** <u>Based on NICE 2012 guideline manual: RCT studies checklist</u> • *Selection bias:* unclear as the sequence generation is unspecified as well as concealment of allocation is unspecified. • *Performance bias:* the study is reported to be double-blind but it is also said that “as patients receiving placebo would be expected to continue drooling

Study details	Participants	Interventions	Methods	Outcomes and Results	Comments
cerebral palsy or other neurologic conditions, Therapeutics and Clinical Risk Management, 8, 15-23, 2012 **Ref Id** 324078 **Country/ies where the study was carried out** USA **Study type** Randomised controlled clinical trial. **Aim of the study** To assess the efficacy and safety of glycopyrrolate in managing problem drooling associated with cerebral palsy and other neurologic	Gender = 22 males, 14 females. 19 participants assigned to treatment group, and 17 to the control group. Comorbidities: all randomised patients had mental retardation and speech impairment. **Inclusion criteria** Male and female patients weighting at least 12.2 Kg and previously diagnosed with cerebral palsy, mental retardation, or another neurologic condition associated with problem drooling. Problem drooling was defined as drooling in the absence of treatment such that clothing became damp approximately 5-7 days a week. **Exclusion criteria** Excluded patients if: • their extent of drooling was wetness of lips and chin but their clothes did not become damp on most days; • they had used any anticholinergic or cholinergic medications prohibited the protocol within three plasma half-lives of that medication prior to baseline; • they had medical conditions contraindicating anticholinergic therapy or treatment with the study medication.	whichever was less. <u>Placebo</u> Similar in colour and taste, administered three times a day.	oral solution or matching placebo oral solution. **Blinding** Defined as double-blind although unclear as study states that “as patients receiving placebo would be expected to continue drooling chronically, caregivers of this group were encouraged to keep patients in the study until at least the end of 4-week titration period”. **Statistical analysis** According to the statistical analysis plan, all patients who received at least one dose of study drug were to be included in the safety population, and all randomised patients were to be included into the ITT analysis of efficacy. In practice, two patients were randomised to treatment before the protocol was amended to set un upper age limit, and these patients no longer met the inclusion criteria. Thus, efficacy was assessed in a modified ITT (mITT) population, defined as all randomised patients who were within the age range of the final, amended protocol, and received at least one dose of study medication. Consequently, these two patients were	3. Discontinuation of medication due to side effects at 8 weeks **Results** <u>Efficacy, measured by responder rate: those who showed at least 3-point improvement at week 8:</u> • Glyc. Group = 14/19 (73.7%) • Placebo group = 3/17 (17.6%) P = 0.0011 <u>Mean (SD) improvements at week 8</u>: • Glyc. Group = 3.94 (1.95) • Placebo group = 0.71 (2.14) P <0.0001 <u>Global assessments, proportion of investigators who agreed the treatment was worthwhile:</u> • Glyc. Group = 84.2% • Placebo group = 41.2% P =0.0140 <u>Global assessments, proportion of parents/carers who agreed the treatment was worthwhile:</u> • Glyc. Group = 100% • Placebo group = 56.3% P =0.0017 Adverse effects Constipation:	chronically, caregivers of this group were encouraged to keep patients in the study until at least the end of 4-week titration period”. • *Attrition bias:* safety and efficacy populations are different (2 participants not included in the efficacy analysis). • *Detection bias:* study reported to be double-blind but lack of information on this. **Other information** **Indirectness** Does the study match the protocol in terms of: Population: yes Intervention: yes Control: yes Outcomes: yes Indirectness: none **Setting** Patients screened at ten US clinical trial sites. **Sample size calculation** Not reported. **Other**

Study details	Participants	Interventions	Methods	Outcomes and Results	Comments
conditions in children. **Study dates** November 2002 to April 2007. **Source of funding** The study was sponsored by Shionogi Inc., and ResearchPoint, a Shionogi company.			included in the analyses of safety, but not of efficacy.	• Glyc. Group = 6/20 • Placebo group = 4/18	
Full citation Reid,S.M., Johnstone,B.R., Westbury,C., Rawicki,B., Reddihough, D.S., Randomized trial of botulinum toxin injections into the salivary glands to reduce	**Sample size** 50 children with neurological disorders, 31 with CP. Data on children with CP provided by authors in Cochrane review 2012. **Characteristics** Type of CP unknown. Age range = 6 – 18 years Mean age = 11.8 years, SD 12.04 years. Gender = 20 males, 11 females. 18 children with CP assigned to control group, 13 children with CP to treatment group. Comorbidities for CP children unknown.	**Interventions** Treatment Botox (allergan) diluted with 4ml of normal saline. Bilateral submandibular and parotid glands were injected. One dose with 25 units per gland was given (1ml into centre of each salivary gland), and the dose was set to 4 units/kg if the child's weight	**Details** Sequence generation specified: "a set of random numbers was produced electronically in two blocks to allow matching to 56 consecutive study participants". Allocation concealment: "the randomisation schedule was kept centrally by the study monitor; it remained concealed from all other study personnel until after the groups have been assigned". Blinding was not possible.	**Results** **Outcomes** 1. Drooling impact scale, taken at baseline and 1 month post injection, at monthly intervals from2-6 months and at 1 year for treatment group and 1 month post baseline for controls. 2. Shortened version of the Drooling Impact Scale 3. Parents of children in treatment group were asked to keep a diary and to register any perceived effects of the injection.	**Limitations** Based on NICE 2012 guideline manual: RCT studies checklist • *Selection bias:* low risk. • *Performance bias:* person delivering treatment was not blinded. Also, children, carers and parents were

Study details	Participants	Interventions	Methods	Outcomes and Results	Comments
drooling in children with neurological disorders, Developmental Medicine and Child Neurology, 50, 123-128, 2008 **Ref Id** 64888 **Country/ies where the study was carried out** Australia **Study type** Randomised controlled clinical trial. **Aim of the study** To use a randomised controlled study type to assess the effectiveness of BoNT-A injections into the submandibular and parotid glands on	**Inclusion criteria** Included children were 6 to 18 years of age; Had a significant problem with drooling ("significant" was not defined); Parents/carers were able to understand study requirements and consent to study. **Exclusion criteria** Children with any of the following were excluded: • BoNT-A previously injected to salivary glands • previous saliva control surgery • any BoNT-A in the past 6 months • unfit for general anaesthesia • unwilling to withhold anticholinergic medication for the length of the study • family history of poor compliance	was less than 25kg. Calibre of needle used is unknown. General anaesthesia was used during the procedure. Ultrasound were applied for identifying injection site. Placebo No treatment.		**Results** In control/treatment with CP N = 13/18 DrI scale, MD (95% CI), p-value, SMD BoNT-A/No interv 0-2 weeks = not available 4 weeks = 27.38 (17.44-37.31), p=0.001, SMD = 2.04 *No other data available for children with CP* Adverse effects No information specific to children with CP. N on-compliance with intervention Not reported specifically for children with CP	not blinded to intervention. • *Attrition bias:* outcome measures for baseline and 1 month post baseline for CP group only available to review authors. No outcomes available at 2-6 months and at 1 year for CP group. • *Detection bias:* investigators taken outcomes measures were not blinded to intervention. **Other information** **Indirectness** Does the study match the protocol in terms of: Population: some (CP and other neurological disorders) Intervention: yes Control: yes Outcomes: yes Indirectness: some

Study details	Participants	Interventions	Methods	Outcomes and Results	Comments
drooling in children with CP and other neurological disorders. **Study dates** October 2004 to August 2006. **Source of funding** The study was funded by the Marian and EH Flack Trust and the Waverly Branch of the Royal Children's Hospital Auxiliares.					**Setting** Multi-centre trial carried out in hospital setting in Australia. **Sample size calculation** Not reported. **Other**
Full citation Mier,R.J., Bachrach,S.J., Lakin,R.C., Barker,T., Childs,J., Moran,M., Treatment of sialorrhea with	**Sample size** 39 children with neurological impairment recruited. 27 completed the study. **Characteristics** 25/39 had CP. However, the type of CP was not specified.	**Interventions** Treatment Powder form of commercially available glycopyrrolate, ground up and appropriate dosages placed in capsule by pharmacist. The	**Details** After an initial physical evaluation and a 1-week baseline medication-free observation period, each child was assigned randomly to either the drug or placebo treatment arm, each of which was 8 weeks long. At the end of the first arm, there was a 1-week	**Results** **Outcomes** 1. Frequency and severity of drooling measured by an adaptation of the Thomas-Stonell and Greenberg scale (from 1 = never drools, to 9 = clothing, hands) 2. Physical examination at each visit to note any medical or physical side effects 3. Adverse events noted by parents/carers **Results**	**Limitations** Based on NICE 2012 guideline manual: RCT studies checklist • *Selection bias:* authors do not specify how many participants have been randomised in each group; concealment of

Study details	Participants	Interventions	Methods	Outcomes and Results	Comments
glycopyrrolate: A double-blind, dose-ranging study, Archives of Pediatrics and Adolescent Medicine, 154, 1214-1218, 2000 **Ref Id** 324115 **Country/ies where the study was carried out** USA **Study type** Randomised controlled clinical trial. **Aim of the study** To determine the safety and efficacy of glycopyrrolate in the treatment of developmentally disabled children with sialorrhoea.	Mean age (N=39) = 10 years 9 months (SD not reported). Gender: 18 boys and 9 girls completed the trial (gender of the group recruited is unknown). Weight at enrolment ranged from 11.5Kg to 61.9Kg. Comorbidities of recruited children: closed head injury, 2 children had tracheostomy, 1 each had Smith-Lemli-Opitz syndrome, partial trisomy 22, congenital toxoplasmosis, and spinal muscular atrophy. Children also had autism, fetal alcohol syndrome, hydrocephalus, congenital heart disease, hypothyroidism, retinitis pigmentosum. Five children had been previously treated for their drooling with medication, 3 of whom had taken glycopyrrolate but stopped because of adverse events. **Inclusion criteria** Children aged 4 years and older with neurodevelopmental conditions and severe sialorrhoea. **Exclusion criteria** Not reported.	dose was given three times daily in morning, early afternoon and evening. Children <30 kg commenced o 0.6 mg increasing weekly to 1.2 mg, 1.8 mg, and 2.4 mg. Children >30 Kg began at 1.2 mg, increasing weekly to 1.8 mg, 2.4 mg and 3.0 mg. Drug was given orally. If children unable to swallow the capsule, parents were instructed to open the capsule and place the powder in the food. Placebo Lactose powder or cellulose prepared and given as glycopyrrolate	washout period and a second week-long observation period followed by the reciprocal arm, also 8 weeks in length. **Randomization** Random sequence generation and allocation concealment not reported. **Blinding** Not specified. **Statistical analysis** Tests of statistical significance included the paired, 2-tailed t test and the unpaired t test.	39 children began the study, and 27 (69%) completed it. Three of the 5 children without a primary diagnosis of CP did not finish the trial, and because of the small sample size, authors stated that no inferences can be drawn regarding effectiveness or adverse effects for children with a diagnosis other than cerebral palsy. Frequency and severity of drooling score, mean and p-value: • Intervention group = 1.85 • Control group = 6.33 p-value <0.001 The mean score for children finishing the study improved in a linear manner: Mean = 6.0 on 1st dose level Mean = 4.5 on 2nd d.l. Mean = 3.6 on 3rd d.l. Mean = 2.6 on 4th d.l. Mean = 2.3 after 4 wks at their highest dose Adverse effects: Prevalence listed in the paper but it is not possible to calculate statistical estimates because of the lack of information on how many patients were randomised in each study group. • *Behavioural changes:* Int group = 8 Control group = 1 • *Constipation:* Int group = 7 Control group = 0 • *Excessive dryness of mouth or secretions:* Int group = 7 Control group = 0 • *Urinary retention:* Int group = 5 Control group = 0	allocation not reported; groups haven't been compared at baseline; • *Performance bias:* blinding of person delivering the treatment and patients receiving the treatment. However, parents reported to know when their child was receiving the intervention because of the dramatic improvement in drooling. • *Attrition bias:* data from 12 children who commenced the study (and have been randomised) were not included in the final analysis. No outcome measures reported for those 12 children. Therefore, authors reported outcomes only on the children who completed the study. • *Detection bias:* Not clear whether the person doing the physical examination for side effects was blind to the intervention. **Other information**

Study details	Participants	Interventions	Methods	Outcomes and Results	Comments
Study dates Not reported. **Source of funding** Supported in part by the Kosair Foundation and by the Nemours Foundation.				• *Facial flushing:* Int group = 4 Control group = 0 • *Nasal congestion:* Int group = 4 Control group = 1 • *Vomiting:* Int group = 4 Control group = 0 • *Diarrhoea:* Int group = 4 Control group = 1	**Indirectness** Does the study match the protocol in terms of: Population: yes Intervention: yes Control: yes Outcomes: yes Indirectness: none **Setting** Hospital setting in the USA. **Sample size calculation** Not reported. **Other**
Full citation Alrefai,A.H., Aburahma,S. K., Khader,Y.S., Treatment of sialorrhea in children with Cerebral Palsy: A double-blind placebo controlled trial, Clinical Neurology and Neurosurgery, 111, 79-82, 2009 **Ref Id**	**Sample size** 34 children recruited. 24 completed the study. **Characteristics** Type of CP unknown. Age range = 21 months to 7 years. Mean age = 3.5 years Gender = 15 boys and 9 girls completed the study. 11 children assigned to treatment group, 13 to control group. Comorbidities unknown. **Inclusion criteria** Children with severe drooling scores (≥ 7 on the Thomas-Stonell and Greenberg scale) only included.	**Interventions** <u>Treatment</u> BoNT-A. Dysport diluted with normal saline to 20U/0.1cc normal saline. Parotid glands injected bilaterally. 100 units during the first visit (50 units in each gland), 140 units (70 each gland) on the second visit 4 months later. Calibre of needle used: 10mm (30G). No anaesthesia used. Blind method to identify injection site.	**Details** **Randomization:** each patient was given a number and a registered nurse, independent from the investigators, assigned the patients to the treatment or placebo group. Allocation concealment was reported. Both the person delivering the treatment and patients receiving it were blinded to study allocation. Outcome measures taken at baseline and at follow up 1-month after first injection. Second injection given 4 months later with 1-month follow-up. **Statistical analysis:**	**Results** **Outcomes** 1. Frequency and severity of drooling, measured by the Thomas-Stonell scale 2. Carers/parents to note presence of possible adverse side effects **Outcome measures taken at baseline and at follow up 1-month after first injection.** **Results** <u>Thomas-Stonell – Greenberg scale at 4 weeks:</u> Placebo/BoNT-A Median frequency score = 4/3; p<0.05 Median severity score = 5/4; p<0.05 SMD not calculable from data available. <u>Adverse effects to BoNT-A:</u> 2/11 (18%) children reported transient increase in drooling at 2 weeks post-	**Limitations** <u>Based on NICE 2012 guideline manual: RCT studies checklist</u> • *Selection bias:* "each patient was given a number and a registered nurse, independent from the investigator assigned the patients to the treatment or placebo group" unclear if the numbers given had a non-random component; unclear allocation concealment because of lack of information.

Study details	Participants	Interventions	Methods	Outcomes and Results	Comments
64336 **Country/ies where the study was carried out** Jordan **Study type** Randomised controlled clinical trial. **Aim of the study** To evaluate the efficacy and safety of BoNT for the treatment of drooling in children with CP. **Study dates** Not reported. **Source of funding** Not reported.	**Exclusion criteria** Those taking oral treatment for drooling in the last 3 months or had received BoNT injection in the last 6 months were excluded.	<u>Placebo</u> Saline 0.9% Method to be reported to be the same as for intervention.	treatment and placebo groups were compared at baseline in age using the Mann-Whitney U test. Gender, frequency, and severity of drooling were compared using Fishers' exact test. The significance of reduction in frequency, severity and total scores was tested using Wilcoxon Signed Rank test. Data was analysed using SPSS package .	treatment but not evident at 1 month post treatment. No other side effect reported. <u>Non-compliance with intervention:</u> 8/24 (33%) withdrew from study, 6 from placebo group and 2 from treatment group.	• *Performance bias:* person delivering the treatment and patients were blinded to treatment allocation. • *Attrition bias:* data on 16 people only provided although 24 received the first inkection. No data provided for outcomes at 4 months. • *Detection bias:* unclear if parents/carers taking outcome measures were blinded to allocation as well. **Other information** **Indirectness** Does the study match the protocol in terms of: Population: yes Intervention: yes Control: yes Outcomes: yes Indirectness: none **Setting** Health setting in Jordan. **Sample size calculation** Not reported. **Other**

Study details	Participants	Interventions	Methods	Outcomes and Results	Comments
Full citation Lin,Y.C., Shieh,J.Y., Cheng,M.L., Yang,P.Y., Botulinum toxin type A for control of drooling in Asian patients with cerebral palsy, Neurology, 70, 316-318, 2008 **Ref Id** 324126 **Country/ies where the study was carried out** Taiwan **Study type** Randomised controlled clinical trial. **Aim of the study** To evaluate the effect of BoNT-A injection into the	**Sample size** 13 children with CP with severe drooling. **Characteristics** 6 children assigned to treatment group, 7 to control group. Type of CP unknown. Age range = unknown. Mean age = 14.2 years, SD 1.8 years. Gender = unknown. Comorbidities unknown. **Inclusion criteria** Children with severe drooling only included (unclear how this was measured). **Exclusion criteria** Not reported.	**Interventions** <u>Treatment</u> Botox (allergan). One parotid and contralateral submandibular gland injected. Calibre of needle unknown. Type of anaesthesia used unknown. Ultrasound were used to identify the injection site. <u>Placebo</u> 1.5 mls of saline given. Method of administration reported to be the same as for BoNT.	**Details** Sequence generation is unclear: "randomly assigned", as well as the allocation sequence concealment. The blinding of the person delivering treatment to group is unknown. It is also unclear from the paper if investigators taking outcome measures are blinded to treatment allocation. Unclear if children were blinded to treatment as well. Outcome measures were taken 1 week before injections and at 2, 4, 6, 8, 12, 14, 18, and 22 weeks after injections. **Statistical analysis:** SAS software was used.	**Results** **Outcomes** 1. Frequency and severity of drooling measure by Thomas-Stonell and Greenberg scale 2. Drooling quotient 3. Saliva weight (unknown method) **Results** <u>Thomas-Stonell and Greenberg scale, MD BoNT/Control, p-value, SMD</u> Baseline = 6.17/6.86, p.0.05, SMD = 0.54 0-2 weeks = 5.33/6.29 p<0.05, SMD = 1.21 4 weeks = 5.17/6.71, p<0.01, SMD = 1.8 6 weeks = 5.00/6.29, p=0.05, SMD = 1.24 8 weeks = 5.00/6.29, p=0.05, SMD = 1.24 10 weeks = 4.83/6.14, p>0.05, SMD = 0.86 12 weeks = 5.00/6.43, p=0.05, SMD = 0.87 14 weeks = 5.33/6.57, p>0.05, SMD = 0.74 18 weeks = 5.50/6.43, p.0.05, SMD = 0.45 22 weeks = 5.67/6.43, p>0.05, SMD = 0.37 <u>Drooling quotient</u> significant improvement in the experimental group, no raw data provided. <u>Saliva weight</u> significant improvement in the experimental group, no raw data provided.	**Limitations** <u>Based on NICE 2012 guideline manual: RCT studies checklist</u> • *Selection bias:* authors state "randomly assigned" but insufficient information to permit judgement; concealment of allocation unclear. • *Performance bias:* states "double-blind" but the blinding of the person delivering treatment to group is unknown; Unclear if children were blinded to treatment as well. • *Attrition bias:* no information on whether there were withdrawals from treatment, and no adverse effects were reported. • *Detection bias:* unclear from the paper if investigators taking outcome measures are blinded to treatment allocation. **Other information** **Indirectness**

<table>
<tr><th>Study details</th><th>Participants</th><th>Interventions</th><th>Methods</th><th>Outcomes and Results</th><th>Comments</th></tr>
<tr><td>contralateral parotid and submandibular glands to control drooling in children with cerebral palsy, and to determine the associated side effects of this treatment.

Study dates
Not reported.

Source of funding

Not reported.</td><td></td><td></td><td></td><td></td><td>Does the study match the protocol in terms of:
Population: yes
Intervention: yes
Control: yes
Outcomes: yes
Indirectness: none
Setting
Unspecified setting in Taiwan.
Sample size calculation
Not reported.
Other</td></tr>
<tr><td>Full citation

Parr, JR, Todhunter, E, Pennington, L, Stocken, DD, Kisler, J, O'Hare, A, Tuffrey, C, Williams, J, Colver, A, The Drooling</td><td>Sample size
n=90 of which n=55 (61%) were boys

Characteristics
<table><tr><th>Characteristics</th><th>Transdermal hyoscine</th><th>Glycopyrrolate (n=41)</th></tr></table></td><td>Interventions
In both trial arms, medication was increased weekly from week-1 to week-4 to the dose needed to stop drooling; to the maximum allowed dose; or to the maximum associated with</td><td>Details
Recruitment of participants was by consultant neurodevelopmental paediatricians seeing children as part of routine clinical care in the UK National Health Service (NHS) in hospital, at school or home. Participants were randomised using a password-protected web-</td><td>Results
Adjusted estimates of the treatment effect of Drooling Impact Scale at week-4<table><tr><th></th><th>Coefficient</th><th>SE</th><th>95% CI Lower</th><th>95%CI Upper</th></tr></table></td><td>Limitations
Based on NICE 2012 guideline manual: RCT studies checklist
Selection bias: low risk
Performance bias: this is a trial comparing treatment against no treatment and no information is reported on other types of care</td></tr>
</table>

Study details	Participants			Interventions	Methods	Outcomes and Results					Comments
Reduction Intervention randomised trial (DRI): comparing the efficacy and acceptability of Hyoscine patches and Glycopyrronium liquid in children with neurodisability [UNPUBLISHED ARTICLE] **Ref Id** 457522 **Country/ies where the study was carried out** UK **Study type** Multi-centre, single blind, randomised controlled trial **Aim of the study** Investigate whether transdermal hyoscine		**hydrobromide (n=49)**		tolerable adverse effects. Participants remained in the week-4 medication dose for a further 8 weeks, after which responsibility for prescribing and monitoring returned to the local paediatrician. **Children randomised to the transdermal hyoscine hydrobromide** received doses increased according to the following regime: Week-1: 1/4 patch; week-3:3/4 patch; week-4: full patch. The patch was typically placed below an ear and replaced every 3 days, alternating sites to minimise local skin reaction risk, when necessary, sites around the neck/upper torso were used. The plastic backing the patch was cut to expose the prescribed proportion of the patch; the patch	based service provided by the Newcastle Clinical Trial Unit. Participants were allocated to transdermal hyoscine hydrobromide or glycopyrrolate in the ration 1:1 and were stratified according to recruitment site and severity of drooling during the previous week. The medication type (randomised allocation) was known to parent, child and trial clinician but not 'outcome assessor'. Statistical analyses were based on 2 populations: Intention to Treat (ITT) group including all randomised patients, retaining children in their randomised treatment groups; Treatment Tolerate Group (TTG) including all patients who started treatment and were still on treatment to which randomised at the time point of the analysis. ANCOVA was used to compare week-4 DIS scores between treatment groups adjusted by the stratification factor severity of drooling at baseline, reporting the coefficient (SE) for the stratification factor at the adjusted treatment effect. Secondary anlysis of the primary outcome measure was based on adjustment	**Model 1: Unadjusted treatment effect**	6.8	4.2	-1.6	15.3	provided; the study is not blinded. *Attrition bias:* low risk *Detection bias:* the study is single blind; outcome assessors were blinded Other information **Indirectness** Does the study match the protocol in terms of: Population: yes Intervention: yes Control: yes Outcomes: yes Indirectness: partial (children with CP were included, but also children with other neurodisabilities) **Setting** Children were recruited from 15 UK National Health Service neurodevelopmental paediatric teams. **Other information**
	Female Male	**16 (33%)** 33 (67%)	**19 (46%)** 55 (61%)			**Model 2: Adjusted treatment effect Severity of drooling:**	6.8	4.2	1.7	15.2	
	Age at randomisation; median (range) in years	4.9 (3.0,14.5)	4.6 (3.0,11.9)			**Saliva usually on lips/chin**	-	-	-	-	
	Weight median (kgs)	18.1 (11.1,79.4)	16.6 (10.4,41.8)			**Saliva on lips, chin and clothes**	5.9	7.0	8.0	19.8	
	Children with CP	10 (20%)	12 (29%)			**Model 3: Adjusted treatment effect**	4.0	4.2	-4.4	12.5	
	Baseline drooling impact scale N	47	39			**Saliva usually on lips/chin and clothes**	1.6	7.4	-13.0	16.3	
	Mean (SD)	57.9 (15.5)	52.1 (12.7)			**Age at starts of treatment**	1.2	0.7	-0.2	2.5	
	Median (Range)	58 (26.85)	53 (25.75)								
	Baseline Drooling Severity and Frequency Scale** N	35	33								
	Mean (SD)	76 (1.1)	7.6 (1.1)								

Study details	Participants	Interventions	Methods	Outcomes and Results	Comments
hydrobromide or glycopyronium liquid is more effective and acceptable and acceptable to treat drooling in children with neurodisability **Study dates** Not reported (children were recruited between October 2013 and February 2015) **Source of funding** The Castang foundation; WellChild; The British Academy of Childhood Disability (Polani Fund), and The Children's Foundation. These	Median (Range) 8 (5.9) 7 (5.9) ** Baseline scores for those treatment was tolerated to week-4 Children with a range of diagnoses were recruited: CP 22; developmental delay/disorder 22; genetic conditions 14; ASD 12; learning/intellectual disability 10; structural brain disorders 6; Down syndrome 5; miscellaneous 14. Many children had complex neurodisability; 3/4 had multiple diagnoses (up to 7 diagnoses per child), and 2/3 took one or more medications (up to 7 per child) **Inclusion criteria** Children with non-progressive neurodisability who had not received medical or surgical treatments for drooling (Treatment naive); requiring medication to reduce problematic drooling; no contraindication to either medication; age> 35 months to < 16 years at the star of medication; weight ≥ 10 kg. **Exclusion criteria** Children who had received medical or surgical treatments for drooling; contraindication to either medication; parents unable to follow study protocol; parents without a telephone or unable to complete a telephone call in English; previous study withdrawal; in a trial of medication that could interact with drooling management; pregnant.	itself was not cut to avoid leakage of product from the non-loculated reservoir. **Children randomised to the glycopyrrolate** liquid received three doses per day increased according to the following regime: week-1: 40µg/kg/ per dose; week- 2: 60µg/kg/ per dose; week-3: 80 µg/kg/ per dose; week-4: µg/kg/ per dose to a maximum 2mg per dose. Medication was given orally by syringe or through the child's feeding tube (nasoastric/gastric/ jejeunal). Outcome measures: Primary outcome: Drooling Impact Scale (DIS) score at 4 weeks. The DIS has range 0-100, SD= 13. It is a parent-reported outcome measure, which addresses osychosocial	for the stratification factor severity of drooling at baseline and other baseline covariates including age; gender; and baseline DIS score. Repeated measures ANOVA was used to investigate the DIS, DSFS and TSQM scores.	**Baseline DIS score** 0.3 0.2 -0.02 0.58	

Study details	Participants	Interventions	Methods	Outcomes and Results	Comments
funders had no part in study design		impacts of the drooling itself. Secondary outcome: change DIS and Drooling Severity and Frequency Scale (DSFS) scores between baseline, week-4 and week-12, and difference between groups in the Treatment Satisfaction Questionnaire for Medication (TSQM) score at week-4 and week-12. The DSFS captures parent report of drooling severity of a 5-point scale and drooling frequency on a 4-point scale.			

I.15 Risk factors for low bone mineral density

Study details	Participants	Factors	Results	Comments
Full citation Chen, C. L., Ke, J. Y., Wang, C. J., Wu, K. P., Wu, C. Y., Wong, A. M.,	**Cases** 56 **Inclusion criteria**	**Factors** GMFCS levels	**Adjusted odds ratio** BMDa (g/cm2), coefficient, adjusted r2 and p-value: **Femur** = 0.01, r2 = 0.56, p<0.001	**Limitations** Based on NICE checklist for prognostic studies: - unadjusted for age or gender

Study details	Participants	Factors	Results	Comments
Factors associated with bone density in different skeletal regions in children with cerebral palsy of various motor severities, Developmental Medicine & Child Neurology, 53, 131-6, 2011 **Ref Id** 364311 **Country/ies where the study was carried out** Taiwan **Study dates** not specified **Funding** the study was supported by the National Science Council, Taiwan.	• A diagnosis of CP with spastic hemiplegia, diplegia, and quadriplegia • An age of 4 to 12 years • Ability to follow commands and to cooperate during assessments. **Exclusion criteria** • Recognised chromosomal abnormalities • A progressive neurological disorder • Severe concurrent illness or disease not typically associated with CP • Active medical conditions such as pneumonia • Any major surgery or nerve block in the previous 3 months • Poor cooperation during assessment **Statistical method** In bone density analysis, age, weight, height, and BMI were			**Indirectness** did the study match the review protocol with regards to: population = yes factors = yes outcome = yes indirectness = none

Study details	Participants	Factors	Results	Comments
	used as covariates. Multiple stepwise linear regression analysis was performed to characterise the relationship of BMDa and BUA with clinically related variables. **Demographics** • 56 children with spastic CP] • 10 had diplegia • 12 hemiplegia • 34 quadriplegia • age = 4 to 12 years • 35 males, 21 females			
Full citation Coppola,G., Fortunato,D., Mainolfi,C., Porcaro,F., Roccaro,D., Signoriello,G., Operto,F.F., Verrotti,A., Bone mineral density in a population of children and adolescents with cerebral palsy and mental retardation	**Cases** 113 **Inclusion criteria** • Age 3 years or older • Diagnosis of CP and mental retardation, with or without epilepsy • Patients with epilepsy had to be taking monotherapy or polytherapy with	**Factors** • BMI • Epilepsy	**Adjusted odds ratio** BMD z-scores, estimate (SE): **BMI** = 0.06 (0.02), p 0.002 BMD z-scores, estimate (SE): **Epilepsy** = -0.39 (0.20), p 0.052	**Limitations** based on 2012 NICE checklist for prognostic studies: *- mixed population: cerebral palsy, mental retardation and epilepsy.* **Indirectness** Does the study match the review protocol in terms of: population = some

Study details	Participants	Factors	Results	Comments
with or without epilepsy, Epilepsia, 53, 2172-2177, 2012 **Ref Id** 315938 **Country/ies where the study was carried out** Italy **Study dates** January 2008 to March 2011 **Funding** Not reported.	antipilectic drugs for at least 2 years • Informed consent **Exclusion criteria** • Diseases involving primarily bone metabolism or familial history of bone metabolism disorders • Chronic treatment with drugs other than anticonvulsants • Poor compliance with bone density evaluation **Statistical method** Descriptive statistics were performed by means and standard deviations; comparison of groups for continuous variables was performed by one-way analysis of variance, and Bonferroni test was used for multiple comparisons. The categorical variables were compared by means of Fisher exact test.			factors = yes outcome = yes indirectness = some

Study details	Participants	Factors	Results	Comments
	Demographics 40 patients were affected by CP and mental retardation: • 25 males and 15 females, mean age 9.13 years 47 patients were affected by CP, mental retardation and epilepsy: • 22 females and 25 males, mean age 9.89 years 26 patients were affected by epilepsy only: • 13 females and 13 males, mean age 12.88 years.			
Full citation Esen, I., Demirel, F., Guven, A., Degerliyurt, A., Kose, G., Assessment of bone density in children with cerebral palsy by areal bone mineral	**Cases** 102 **Inclusion criteria** not specified. **Exclusion criteria** not specified.	**Factors** • GMFCS levels • Anticonvulsants (yes/no) • Vit D status (deficient or insufficient/normal)	**Adjusted odds ratio** aBMD z-scores, mean ±SD: **GMFCS levels** • Level 1-3 = -2.65 ±0.68, p<0.01 • Level 4-5 = -1.62 ±1.52, p<0.01	**Limitations** Based on NICE 2012 checklist for prognostic studies: • no stepwise regression analysis performed, results can be

Study details	Participants	Factors	Results	Comments
density measurement, Turkish Journal of Pediatrics, 53, 638-44, 2011 **Ref Id** 360785 **Country/ies where the study was carried out** Turkey **Study type** cross-sectional **Study dates** between 1 September and 31 December 2009 **Funding** not reported.	**Statistical method** Descriptive stats were used, and results have been reported as mean SD. T-test was used to examine the differences between groups. Univariate regression analyses were performed with adjusted aBMD Z-scores as the dependent variable. **Demographics** • 81 patients had severe CP (median age: 9.7 years, range 3.2-17.8; 52 males and 29 females) • 21 patients had mild to moderate CP (median age: 10.5 years, range 4.4-17.8; 16 males and 5 females)		aBMD z-scores, mean ±SD: **Anticonvulsants** • Yes = -1.57 ±1.51, p>0.05 • No = -1.77 ±1.60, p>0.05 aBMD z-scores, mean ±SD: **Vitamin D status** • Deficient or insufficient = -1.79 ±1.59, p<0.01 • Normal = -0.85 ±1.00, p<0.01	interpreted as differences between groups rather than predictors **Indirectness** did the study match the review protocol with regards to: population = yes factors = yes outcomes = yes indirectness = none
Full citation Finbraten, A. K., Syversen, U., Skranes, J., Andersen, G. L., Stevenson, R. D.,	**Cases** 51 **Inclusion criteria**	**Factors** GMFCS level: walkers (level I-III) versus non-walkers (level IV-V)	**Adjusted odds ratio** OR (95% CI) for low BMD for age = 5.7 (1.5 to 22.1) in children unable to walk, using walkers as reference.	**Limitations** based on 2012 NICE checklist for prognostic factors: *- multivariate analysis adjusted for relevant confounders was*

Study details	Participants	Factors	Results	Comments
Vik, T., Bone mineral density and vitamin D status in ambulatory and non-ambulatory children with cerebral palsy, Osteoporosis International, 26, 141-50, 2015 **Ref Id** 347836 **Country/ies where the study was carried out** Norway **Study dates** January to may 2010, or January to May 2013 **Funding** Funding source: Liaison Committee between the Central Norway Regional Health Authority and the Norwegian University of Science and Technology.	• a diagnosis of CP according to SCPE definition • age between 6 and 18 years **Exclusion criteria** Authors stated that no exclusion criteria were applied. **Statistical method** Binary logistic regression was applied to calculate the OR and 95% CI. The OR for low mean BMD z-scores for age at the distal femur R3 in non-walkers was calculated using walkers as the reference. **Demographics** GMFCS levels • lev I n= 20 • lev II n= 11 • lev III n= 5 • lev IV n= 9 • lev V n= 6 CP type: 22 children with hemiplegia, 12 had right and 10 had left hemiplegia.			*conducted but data not shown* **Indirectness** Does the study match the review protocol in terms of: population = yes factors = yes outcome = yes indirectness = none

Study details	Participants	Factors	Results	Comments
	24% were currently using AED 22% had experienced a previous fracture.			
Full citation Henderson,R.C., Kairalla,J., Abbas,A., Stevenson,R.D., Predicting low bone density in children and young adults with quadriplegic cerebral palsy, Developmental Medicine and Child Neurology, 46, 416-419, 2004 **Ref Id** 322048 **Country/ies where the study was carried out** US **Study dates** not reported. **Funding** support for the core NAGCePP was provided by the Genentech	**Cases** 107 **Inclusion criteria** not specified **Exclusion criteria** not specified. **Statistical method** Univariant and then stepwise regression analyses were used to correlate BMD z-scores with the multiple clinical, nutritional and anthropometric valriables. **Demographics** Individuals with moderate to severe CP, including 93 at the University of North Carolina and 14 at the Children's Hospital of Philadelphia. Ages ranged from 2 years 1 month, to 21 years 1 month (mean 10 years 11 months; SD 4 years 4 months).	**Factors** • GMFCS level • Feeding difficulty • Previous fracture • Use of anticonvulsants *All of the above analysed separately and together in the same model.*	**Adjusted odds ratio** BMD z-scores **GMFCS** • Lev III = ref • Lev IV = -0.91 • Lev V = -1.62 P<0.0001 and r2 = 0.46 **Feeding difficulty** • None = ref • Moderate or severe = -1.20 P<0.0001, r2 = 0.48 **Previous fracture** • None = ref • Yes = -0.70 P<0.0001, r2 = 0.36 **Anticonvulsants** • None = ref • Yes = -0.79 P<0.0001, r2 = 0.39	**Limitations** based on 2012 NICE checklist for prognostic studies: no major limitations found. **Indirectness** Does the study match the review protocols in terms of: population = yes factors = yes outcomes = yes indirectness = none

Study details	Participants	Factors	Results	Comments
Foundation for Growth and Development, National center for Medical Rehabilitation Research, and the National Institute of Health.			**All four risk factors, ordered by best predictors:** 1. GMFCS levels = -0.86 (lev V) to -0.71 (lev IV) 2. Feeding difficulty = -0.813. 3. Previous fracture = -0.534. 4. Anticonvulsants = -0.31	
Full citation Henderson,R.C., Lin,P.P., Greene,W.B., Bone-mineral density in children and adolescents who have spastic cerebral palsy, Journal of Bone and Joint Surgery - Series A, 77, 1671-1681, 1995 **Ref Id** 326668 **Country/ies where the study was carried out** US **Study dates** not specified **Funding**	**Cases** 139 **Inclusion criteria** - **Exclusion criteria** • Bone-density measurements of either the lumbar spine or the proximal parts of the femora could not be obtained. **Statistical method** The best predictor of Z-score has been studied with the use of multivariable stepwise analysis in which covariance of the different variables is	**Factors** Mobility level	**Adjusted odds ratio** BMD z-scores, p value and cumulative r^2: **Mobility level** • Proximal parts of femora = 0.0001, r2 0.43 • Lumbar spine = 0.0001, r2 0.30	**Limitations** Based on 2012 NICE checklist for prognostic studies: - multivariable analyses conducted, but no raw estimates reported **Indirectness** Does the study match the review protocol in terms of: population = yes factors = some outcomes = yes indirectness = some

Study details	Participants	Factors	Results	Comments
not specified.	considered when their relationship to BMD is assessed. **Demographics** Mean age = 9 years, range 3-15 The patients were categorised with regard to walking as • normal ambulators (those who participated in the nearly all activities of physical play with their normal peers but may have lagged behind substantially) = 36 • community ambulators (those who did not routinely use a wheelchair outside of the home but were unable to participate in most activities of age-appropriate physical play) = 46 • household ambulators (those who typically used a wheelchair outside of the home but did some functional walking inside the home) = 21			

Study details	Participants	Factors	Results	Comments
	• non-ambulators = 35			
Full citation Kilpinen-Loisa, P., Paasio, T., Soiva, M., Ritanen, U. M., Lautala, P., Palmu, P., Pihko, H., Makitie, O., Low bone mass in patients with motor disability: Prevalence and risk factors in 59 Finnish children, Developmental Medicine and Child Neurology, 52, 276-282, 2010 **Ref Id** 335690 **Country/ies where the study was carried out** Finland **Study type** cross-sectional cohort **Study dates**	**Cases** 59 **Inclusion criteria** All children included in the study had at least level II disability on the GMFCS. None of the patients had been treated with long-term steroids. **Exclusion criteria** Not specified. **Statistical method** Possible predictors for fractures and low BMAD were evaluated in a logistic regression analysis. A variable was omitted in the stepwise model if the corresponding probability exceeded 0.10. The results are expressed as OR. **Demographics** • 38 males, 21 females	**Factors** • BMAD • GMFCS IV-V	**Adjusted odds ratio** Fractures, OR (95% CI) and p value • **BMAD < -1.5** = 9.82 (0.82-7.58x1052), p 0.026 • **GMFCS IV-V** = 0.85 (2.87x10-25 – 4.09x1016), p 0.86	**Limitations** Based on 2012 NICE checklist for prognostic studies: • *mixed population of various syndromes causing disability* • *loss at follow up described, but small sample size (n=38)* **Indirectness** Does the study match the review protocol in terms of : • population = some • factors = yes • outcomes = yes • Indirectness = some

Study details	Participants	Factors	Results	Comments
not reported. **Funding** Study supported by the Arvo and Lea Ylppo Foundation, the Paivikki and Sakari Sohlberg Foundation, the Foundation for Paediatric Research, the Sigrid Juselius Foundation, the Finnish Medical Society Duodecim, and the Academy of Finland, all Hensilki, Finland, and the Pajat-Hame Central Hospital research funds.	• median age = 10 years 11 months (range 5 years - 15 years 5 months) The underlying cause of disability in the study participants was • CP = 37 • myelomeningocele = 7 • Duchenne or other muscular dystrophy or spinal atrophy = 7 • chromosomal anomaly causing learning disability and motor disability = 8			

I.16 Prevention of reduced bone mineral density

Study details	Participants	Interventions	Methods	Outcomes and Results	Comments
Full citation Arrowsmith ,F.,	**Sample size** 21 children with quadriplegic CP were recruited through the Dysphagia Clinic at the Children's Hospital at Westmead.	**Interventions** The feeding regimens of the gastrostomy	**Details** The children had measurements of anthropometry, bone mineral		**Limitations** Based on the GATE - effective public health practise project

<table>
<tr><th>Study details</th><th>Participants</th><th>Interventions</th><th>Methods</th><th>Outcomes and Results</th><th>Comments</th></tr>
<tr>
<td>Allen,J., Gaskin,K., Somerville, H., Clarke,S., O'Loughlin, E., The effect of gastrostomy tube feeding on body protein and bone mineralization in children with quadriplegic cerebral palsy, Developmental Medicine and Child Neurology, 52, 1043-1047, 2010

Ref Id

327546

Country/ies where the study was carried out

Australia</td>
<td>Characteristics

• 9 females, 12 males
• diagnosis of quadriplegic CP (GMFCS level V)
• all children were reliant on wheelchair
• all children were dependent on their parent or carer for the everyday needs

Inclusion criteria
See 'characteristics' section.

Exclusion criteria
Children aged less than 4 years were excluded from the study because of the lack of available comparison data in this age range.</td>
<td>tube-fed children were determined by the Dysphagia Clinic dietician.</td>
<td>content BMC by dual-energy X-ray absorptiometry, and total body protein before and after gastrostomy tube feeding.
Comparison data were collected prospectively from age-matched healthy children and extracted from databases.
The comparison group for the absorptiometry measurements consisted of 172 children from an existing dual-energy X-ray absorptiometry (DEXA) comparison database.
All DEXA measurements were performed and analysed by trained staff.
Statistics

• All data were analysed with SPSS.
• The data were not normally distributed</td>
<td>
<table>
<tr><th></th><th>Baseline</th><th>Repeat</th><th>p value</th></tr>
<tr><td>BMC, g</td><td>469 (374 to 632)</td><td>626 (509 to 736)</td><td><0.05</td></tr>
<tr><td>BMC for age SDS</td><td>-2.3 (-3.3 to -1.7)</td><td>-2.5 (-3.6 to -1.7)</td><td>ns</td></tr>
<tr><td>BMC for height SDS</td><td>-0.6 (-1.0 to -0.1)</td><td>-1.1 (-1.5 to -0.3)</td><td>ns</td></tr>
</table>
</td>
<td>checklist (NICE manual 2014)
selection bias = weak
study design = weak
confounders = moderate
blinding = weak
data collection method = strong
withdrawals and drop outs = strong</td>
</tr>
</table>

Study details	Participants	Interventions	Methods	Outcomes and Results	Comments
Study type Prospective cohort. **Aim of the study** To investigate the effect of gastrostomy tube feeding on body protein and bone mineralization in malnourished children with CP. **Study dates** 2000 to 2008. **Source of funding** the study was supported by the National Health and Medical			and were presented as medians with interquartile ranges. A Wilcoxon signed-rank test was used to compare differences between the paired baseline and repeat tests of the body composition parameters.		

Study details	Participants	Interventions	Methods	Outcomes and Results	Comments
Research Council of Australia, the James Fairfax Institute of Paediatric Nutrition, and Nutricia Australia Pty Ltd.					
Full citation Caulton, J. M., Ward, K. A., Alsop, C. W., Dunn, G., Adams, J. E., Mughal, M. Z., A randomised controlled trial of standing programme on bone mineral density in non-ambulant children with cerebral palsy,	**Sample size** 26 children participated in the study. **Characteristics** 14 boys, 12 girls • mean age = 7.32 (1.8) years, range (4.33 - 10.83) • 4 children in the intervention group and 2 in the control group were receiving anticonvulsants during the trial • 1 child in each group was on baclofen **Inclusion criteria**	**Interventions** The authors defined the standing programme as a monitored period of standing in a standing frame while participating in usual classroom activities. Such programmes are administered by a variety of uright and semi-prone standing frames with each child being assisted	**Details** • Subjects were matched into pairs using baseline vTBMD standard deviation scores, calculated using the only available reference data collected in healthy 2-19 years old North American Caucasian subjects. • The trial statistician randomly	**Results** Outcomes of this trial were vertebral and proximal tibial vTBMD, expressed in mg/cm^{3,} which were measured using the Philips medical System 4000 SR Tomoscan spiral quantitative computed tomography (QCT) scanner, in conjunction with the 3D QTC-pro software. The positioning and scanning was carried out with parents/carers and staff assisting each child to lie still, without the need for sedation. • Vertebral TBMD measurements were made at central portion of vertebral bodies, devoid of their cortical envelops and neural arches. • The proximal tibial TBMD was measured at a site rich in trabecular bone, distal to the tibia-fibula junction, just below the tibial plateau away from the growth plate, using an in-house protocol. The mean standing period was expressed as percentage of their baseline or the pre-trial standing period. **Results**	**Limitations** Based on NICE manual (2012) methodology checklist for RCTs. **selection bias - low** • An appropriate method of randomisation was used to allocate participants to treatment group = Unclear • Adequate concealment of allocation = Yes • The groups were

Study details	Participants	Interventions	Methods	Outcomes and Results	Comments
Archives of Disease in Childhood, 89, 131-5, 2004 **Ref Id** 342264 **Country/ies where the study was carried out** United Kingdom **Study type** Pilot randomised controlled trial. **Aim of the study** To determine whether participants in 50% longer periods of standing (in either upright or semi prone standing frames)	• non-ambulant CP children • pre-pubertal (determined by the grading system of Tanner) • already involved in a standing programme • able to tolerate an increased standing duartion **Exclusion criteria** • fracture and immobilising bone or soft tissue release surgery of the lower limbs within 12 months of the start of the trial • informed consent	and secured into the standing frame. The optimum period of standing for each child was determined by their physiotherapist and during the trial, specifically appointed carers assisted physiotherapists to monitor the duration of standing periods. The pre-trial duration of standing was determined for each subject over a six week period prior to the start of the trail and expressed as the mean standing period in minutes per week. intervention = 50% increase in the regular	allocated each child within the pair to either the intervention or the control group. • The standing programme during the trial was specific for each subject: for those randomised to the intervention limb of the trial, the increased standing period was fitted around curriculum activities within each classroom; it was achieved by either increasing the duration during each standing session or the frequency of the standing sessions. • Throughout the trial, each child's daily	• Change in the vertebral vTBMD, mean (95% CI) - intervention versus control group 8.91 mg/cm^3 (2.40 to 15.41); p = 0.007 (this represents a 6% mean increase in the vertebral vTBMD in the intervention group) • Change in the proximal tibial vTBMD, mean (95% CI) - intervention versus control group - 0.85 mg/cm^3 (- 16.83 to 15.13); p = 0.92	comparable at baseline = Yes **performance bias - high** • The comparison groups received the same care apart from the intervention = Yes • Participants receiving the treatment were kept blind to treatment allocation = No • Individuals administering care were kept blind to treatment allocation = No **attrition bias - low** • All groups were followed up for an equal length of time = yes

Study details	Participants	Interventions	Methods	Outcomes and Results	Comments
would lead to an increase in the vertebral and proximal tibial volumetric trabecular bone mineral density (vTBDM) of non-ambulant children with CP. **Study dates** The RCT took place during one school academic year (nine months) between September 1999 and July 2000. **Source of funding** This work was		standing duration control = no increase in the regular standing duration	standing duration was measured using digital timers and recorded in standing diaries. **Blinding:** due to the overt nature of the intervention, only the investigators responsible for measuring and analysing vTBMD were blinded to which children were in the intervention and control groups. **Stats analysis** • Statistical analyses were carried out using Stata version 6.0. • The vertebral vTBMD data from the L2 vertebral body was used in the analysis, as good quality pre- and post-trial		• The groups were comparable for treatment completion = Yes • The groups were comparable with respect to the availability of outcome data = yes **detection bias - low** • The study had an appropriate length of follow up = Yes • The study used a precise definition of outcome = Yes • A valid an reliable method was used to determine the outcome = Yes • Investigators were kept blind to participants' exposure to

Study details	Participants	Interventions	Methods	Outcomes and Results	Comments
supported by a grant from the NHS R&R Programme for People with Physical and Complex Disabilities.			scans were available for this vertebra. • The statistical model included the following individual level covariates: type of CP, baseline standing duration, type of standing, and the baseline average daily calcium intake. • The results were analysed on the basis of ITT.		the intervention = Yes • Investigators were kept blind to other important confounding and prognostic factors = Unclear **Other information** **Indirectness**: does the study match the protocol in terms of • Population = yes • Intervention = yes • Outcomes = yes **Setting** The study subjects were recruited from schools for children with special educational needs in the Greater Manchester area

<table>
<tr><th>Study details</th><th>Participants</th><th>Interventions</th><th>Methods</th><th>Outcomes and Results</th><th>Comments</th></tr>
<tr>
<td>Full citation

Chad,K.E., Bailey,D.A., McKay,H.A., Zello,G.A., Snyder,R.E., The effect of a weight-bearing physical activity program on bone mineral content and estimated volumetric density in children with spastic cerebral palsy, Journal of Pediatrics, 135, 115-117, 1999

Ref Id

75804

Country/ies where the study was carried out</td>
<td>Sample size
18 children with spastic CP.

Characteristics
Intervention group = 6 girls and 3 boys; mean age 9.0 ±2.9 years; 1 independent ambulatory, 3 non-ambulators, 3 ambulators with assistance, 2 independent ambulators with aid.
Control group = 7 girls and 2 boys; mean age 9.0 ±2.7 years; 1 independent ambulator, 3 non-ambulators, 2 ambulators with assistance, 3 independent ambulators with aid.
No difference between groups at baseline in terms of height, weight, dietary calcium, bone mineral content (BMC) or volumetric bone mineral density (vBMD).

Inclusion criteria
Not specified.

Exclusion criteria
Not specified.</td>
<td>Interventions
Intervention group:

• The physical activity program was conducted twice per week for the first 2 months and 3 times per week for the last 6 months.
• The program focused on the facilitation of normal movement with an emphasis on weight-bearing activity.
• Each session consisted of a one-on-one program</td>
<td>Details
Children with spastic CP were randomly assigned to either physical activity or control groups.
Assessment:

• Dual-energy x-ray absorptiometry was used to assess BMC in grams at the proximal femur (total) and the femoral neck at the start and at the end of the 8-month program.
• vBMD (in grams per cubic centimiter) at the femoral neck was also estimated.

Subjects with severe involuntary muscle contractions or uncontrollable</td>
<td>Results
<table>
<tr><td></td><td colspan="3">Physical activity group (n=9)</td><td colspan="3">Control group (n=9)</td><td></td></tr>
<tr><td></td><td>Baseline</td><td>After program</td><td>% Change</td><td>Baseline</td><td>After program</td><td>% Change</td><td>P value</td></tr>
<tr><td>Proximal femur BMC (g)</td><td>8.55 ±1.32</td><td>9.53 ±1.43</td><td>11.5</td><td>6.79 ±0.59</td><td>7.03 ±0.676</td><td>3.5</td><td>0.08</td></tr>
<tr><td>Femoral neck BMC (g)</td><td>1.57 ±0.18</td><td>1.72 ±0.20</td><td>9.6</td><td>1.37 ±0.10</td><td>1.29 ±0.09</td><td>-5.8</td><td>0.03</td></tr>
</table></td>
<td>Limitations
Based on NICE manual (2012) methodology checklist for RCTs.
selection bias - high

• An appropriate method of randomisation was used to allocate participants to treatment group = Unclear
• Adequate concealment of allocation = Unclear
• The groups were comparable at baseline = Yes

performance bias - high</td>
</tr>
</table>

Study details	Participants	Interventions	Methods	Outcomes and Results	Comments
Canada **Study type** Randomised controlled trial. **Aim of the study** to investigate the effect of an 8-month program of load-bearing physical activity on bone mineral accrual in children with spastic CP. **Study dates** Not reported. **Source of funding** Supported by Saskatche		of 20 minutes of exercise with the upper extremities, 20 minutes with the lower extremities, and 20 minutes with the truncal region. Control group: the control group was instructed to maintain their usual life style habits.	movements were sedated with midalozam, 0.7 mg/kg body weight, 15 to 30 minutes before dual-energy x-ray absorptiometry measurements. To minimise operator-related variability, all scans were performed and analysed by the same trained technologist. **Statistics** Absolute and percent changes from baseline were calculated for height, weight, BMC, and vBMD. Analysis of variance was used to compare these changes between groups.	<table><tr><td>Femoral neck vBMD (g/cm^3)</td><td>0.36 ±0.02</td><td>0.38 ±0.03</td><td>5.6</td><td>0.32 ±0.01</td><td>0.30 ±0.02</td><td>-6.3</td><td>0.02</td></tr></table>Values are expressed as mean ±SD.	• The comparison groups received the same care apart from the intervention = No • Participants receiving the treatment were kept blind to treatment allocation = Unclear (probably no given the type of intervention) • Individuals administering care were kept blind to treatment allocation = Unclear (probably no given the type of intervention) **attrition bias - low**

Study details	Participants	Interventions	Methods	Outcomes and Results	Comments
wan Health Services and Utilization Research Committee.					• All groups were followed up for an equal length of time = yes • The groups were comparable for treatment completion = Yes • The groups were comparable with respect to the availability of outcome data = yes **detection bias - low** • The study had an appropriate length of follow up = Yes • The study used a precise definition of outcome = Yes

Study details	Participants	Interventions	Methods	Outcomes and Results	Comments
					• A valid an reliable method was used to determine the outcome = Yes • Investigators were kept blind to participants' exposure to the intervention = Unclear • Investigators were kept blind to other important confounding and prognostic factors = Unclear **Other information** **Indirectness**: does the study match the protocol in terms of • Population = yes • Intervention = yes • Outcomes = yes

<table>
<tr><th>Study details</th><th>Participants</th><th>Interventions</th><th>Methods</th><th>Outcomes and Results</th><th>Comments</th></tr>
<tr><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr>
<td>Full citation

Chen, C. L., Chen, C. Y., Liaw, M. Y., Chung, C. Y., Wang, C. J., Hong, W. H., Efficacy of home-based virtual cycling training on bone mineral density in ambulatory children with cerebral palsy, Osteoporosis International, 24, 1399-406, 2013

Ref Id

360733</td>
<td>Sample size
27 ambulatory children with spastic CP.

Characteristics
<table>
<tr><th>Variables</th><th>hVCT = 13</th><th>Control = 14</th><th>p value</th></tr>
<tr><td>Age (years), mean±SD</td><td>8.7±2.1</td><td>8.6±2.2</td><td>0.804</td></tr>
<tr><td>BMI, mean±SD</td><td>16.5±2.2</td><td>18.6±3.9</td><td>0.103</td></tr>
<tr><td>CP subtypes</td><td></td><td></td><td></td></tr>
<tr><td>spastic diplegic (n)</td><td>10</td><td>9</td><td>0.678</td></tr>
<tr><td>spastic hemiplegic (n)</td><td>3</td><td>5</td><td></td></tr>
</table></td>
<td>Interventions
Intervention:
The hVCT group cycled for 40 minutes per day, three times a week, for 12 weeks. The program consisted in a 5-min warm up exercise, loaded sit-to-stand exercises for 20 times, progressive resistance cycling for 20 min, and cool down</td>
<td>Details
Participants were randomly assigned to the hVCT group or the control group.
All participants underwent a series of tests to assess muscle strength, gross motor function, and bone density. Tests were administered before and immediately after the 12-week intervention. A physical therapist who was not blinded to group allocation, was trained to use an isokinetic dynamometer and the gross motor function measure as a precondition of study participation. Motor severities, GMFCS scores, were graded by the same physiatrist.</td>
<td>Results
All children had good compliance for performing home-based programs except one child of the hVCT group and one child of the control group.
Demographic data did not differ significantly between both groups.
<table>
<tr><td>Variables</td><td colspan="3">Pretreatment</td><td colspan="3">Posttreatment</td></tr>
<tr><td></td><td>hVCT</td><td>control</td><td>p value (t test)</td><td>hVCT</td><td>control</td><td>p value ANCOVA</td></tr>
<tr><td>Lumbar aBMD</td><td>0.578±0.140</td><td>0.574±0.132</td><td>0.945</td><td>0.583±0.136</td><td>0.583±0.140</td><td>0.357</td></tr>
<tr><td>Femur aBMD</td><td>0.720±0.140</td><td>0.739±0.115</td><td>0.668</td><td>0.744±0.097</td><td>0.73±0.124</td><td>0.022</td></tr>
</table>
all values are expressed as mean±SD</td>
<td>Limitations
Based on NICE manual (2012) methodology checklist for RCTs.
selection bias - high
An appropriate method of randomisation was used to allocate participants to treatment group = Unclear
Adequate concealment of allocation = Unclear
The groups were comparable at baseline = Yes</td>
</tr>
</table>

Study details	Participants	Interventions	Methods	Outcomes and Results	Comments
Country/ies where the study was carried out Taiwan **Study type** Randomised controlled trial **Aim of the study** To assess the efficacy of a novel home-based virtual cycling training (hVCT) program on bone density for children with spastic CP using a well designed RCT. **Study dates**	<table><tr><td>GMFCS</td><td></td><td></td><td></td></tr><tr><td>level I (n)</td><td>10</td><td>11</td><td>1.000</td></tr><tr><td>level II (n)</td><td>3</td><td>3</td><td></td></tr></table> **Inclusion criteria** • diagnosed CP • GMFCS levels I-II • age 6-12 years • pre-pubertal stage • ability to walk independently • ability to undergo a motor function and isokinetic muscle test • ability to comprehend commands and cooperate during an examination **Exclusion criteria** • children with recognised chromosomal abnormalities	exercise for 5 min. • At the first time, the therapist determined the loads for sit-to-stand training and adjusted the optimal resistance for cycling training. • The initial cycling resistance was determined by the resistance that allowed children need an effort to cycle for 20 min. • The cycling resistance was adjusted dependin	Participants characteristics, including demographic, growth and clinical data were recorded. **areal Bone mineral density (aBMD)** The aBMD (grams per square centimeter) was measured at the lumbar spine (L1 to L4) and the distal femur of the more affected limb using dual X-ray absorptiometry (DEXA). The lumbar spine was scanned using standard scanning procedures. **Statistics** Descriptive and univariate analyses were conducted using the SPSS software version 12.0. To investigate whether the hVCT group improved more tha the control group at posttreatment, ANCOVA was		**performance bias - high** • The comparison groups received the same care apart from the intervention = No • Participants receiving the treatment were kept blind to treatment allocation = Unclear • Individuals administering care were kept blind to treatment allocation = unclear **attrition bias - low** • All groups were followed up for an equal

Study details	Participants	Interventions	Methods	Outcomes and Results	Comments
Not specified. **Source of funding** The study was supported by the National Science Council, Taiwan.	• children with a progressive neurological disorder or severe concurrent illness or disease that is not typically associated with CP • children with active medical conditions such as pneumonia • children who had undergone any major surgery or nerve block in the preceding 3 months • children with hormonal disturbance • children with poor tolerance for performing the isokinetic test or a poor ability to cooperate during assessment	g on the participant's ability and was progressively increased if the participants found their feet were flying off the pedals. Control: • Participants were encouraged to perform usual and general physical activity at home under parental supervision. • This involved walking, running, jogging, or sports or	applied to each outcome variable.		length of time = yes • The groups were comparable for treatment completion = Yes • The groups were comparable with respect to the availability of outcome data = yes **detection bias - low** • The study had an appropriate length of follow up = Yes • The study used a precise definition of outcome = Yes

Study details	Participants	Interventions	Methods	Outcomes and Results	Comments
		recreational exercises at school or at home for 30-40 min/day, 3 days/wk for 12 weeks. To increase the optimal adherence in the protocol for participants, the participants and caregivers were interviewed about the implementation of the programs by a research assistant via telephone every 1-2 weeks. Furthermore, they were also followed up at the rehabilitation clinic every month.			• A valid an reliable method was used to determine the outcome = Yes • Investigators were kept blind to participants' exposure to the intervention = no • Investigators were kept blind to other important confounding and prognostic factors = Unclear **Other information** **Indirectness**: does the study match the protocol in terms of

<table>
<tr><th>Study details</th><th>Participants</th><th>Interventions</th><th>Methods</th><th>Outcomes and Results</th><th>Comments</th></tr>
<tr><td></td><td></td><td></td><td></td><td></td><td>Population = yes
Intervention = yes
Outcomes = yes</td></tr>
<tr><td>Full citation

Henderson, R. C., Lark, R. K., Kecskemethy, H. H., Miller, F., Harcke, H. T., Bachrach, S. J., Bisphosphonates to treat osteopenia in children with quadriplegic cerebral palsy: a randomized, placebo-controlled</td><td>Sample size
14 children (7 pairs).
Both members of one pair voluntarily withdrew from the study only because of the time commitment involved. This pair has been excluded from the analysis. All the remaining participants completed the 18-month study with the exception of one boy, who completed the treatment phase but died just before the final 18-month evaluation (he had received placebo). Results are reported with his 15-month evaluation substituted for the 18-month evaluation.

Characteristics
All participants were nonambulatory children and adolescents with quadriplegic CP.</td><td>Interventions
Pamidronate or saline placebo was administered daily for 3 consecutive days, and this 3-day dosing session was repeated at 3-month intervals for one year (5 dosing sessions, 15 total doses). Each daily dose was 1 mg pamidronate/kg body weight but not <15 mg or >30 mg.</td><td>Details
One member of each pair was randomly selected to receive the active drug and the other member received placebo.
All subjects received calcium and vitamin supplementation (to ensure uniformly adequate calcium and vitamin intake, all participants</td><td>Results<table><tr><td></td><td colspan="3">Distal femur (%)</td><td>Lumbar spine (%)</td></tr><tr><td></td><td>Region 1</td><td>Region 2</td><td>Region 3</td><td></td></tr><tr><td>Placebo group, Mean ±SE</td><td>9 ±6</td><td>6 ±7</td><td>9 ±5</td><td>15 ±5</td></tr></table></td><td>Limitations
Based on NICE manual (2012) methodology checklist for RCTs.
selection bias - high
An appropriate method of randomisation was used to allocate participants to treatment group = Unclear
Adequate concealment of</td></tr>
</table>

<table>
<tr><th>Study details</th><th>Participants</th><th>Interventions</th><th>Methods</th><th>Outcomes and Results</th><th>Comments</th></tr>
<tr>
<td>clinical trial, Journal of Pediatrics, 141, 644-51, 2002

Ref Id

347873

Country/ies where the study was carried out

USA

Study type
Randomised clinical trial.

Aim of the study
To evaluate the efficacy and safety of intravenous pamidronate to treat osteopenia in nonambulatory children with CP.</td>
<td>Ages of the 7 pairs of subjects ranged from 6 to 16 years.
Three of the pairs were male, three were female, and one pair of 7-year-olds was not gender-matched.
13 of the 14 subjects had previously sustained at least one fracture with minimal trauma, and all had an age normalised BMD Z-score of < -2.0.

Inclusion criteria
See 'characteristics' section.

Exclusion criteria
Not specified.</td>
<td>Each daily dose was administered intravenously over 3 to 4 hours in a volume of 400 mL. The subjects were housed as inpatients continuously throughout each of the 3-day dosing sessions to allow for close monitoring.</td>
<td>were treated with a daily supplement over the 18-month study period).
• Treatment was for 1 year, followed by 6 months of continued monitoring.

Bone mineral density was measured at 3-month intervals throughout the 18-month study period by means of dual energy x-ray absorptiometry (DEXA). Anterior-posterior RX of the distal femur were obtained at 6-month intervals to observe for potential adverse effects of bisphosphonates on bone mineralisation or bone remodeling.

Statistics</td>
<td>
<table>
<tr><td>intervention group, Mean ±SE</td><td>89 ±21</td><td>33 ±6</td><td>21 ±5</td><td>33 ±3</td></tr>
<tr><td>Placebo group vs drug group, p value</td><td>P = 0.01</td><td>P = 0.01</td><td>P = 0.1</td><td>P = 0.01</td></tr>
</table>
</td>
<td>allocation = unclear
• The groups were comparable at baseline = Yes

performance bias - low

• The comparison groups received the same care apart from the intervention = No
• Participants receiving the treatment were kept blind to treatment allocation = Yes
• Individuals administering care were kept blind to treatment</td>
</tr>
</table>

Study details	Participants	Interventions	Methods	Outcomes and Results	Comments
Study dates Not specified. **Source of funding** Supported by a grant from the United Cerebral Palsy Research and Educational Foundation.			• BMD in the distal femur could be reliably measured in all subjects and was the primary outcome variable. Changes in BMD are expressed as percentage of baseline BMD. The mean of paired right/left side measurements was used, and each of the three regions in the distal femur was independently analysed. BMD measures are also expressed as age-, gender-, and race-normalised Z-scores, based on the authors' own series of normal control subjects.		allocation = Yes **attrition bias - low** • All groups were followed up for an equal length of time = yes • The groups were comparable for treatment completion = Yes • The groups were comparable with respect to the availability of outcome data = yes **detection bias - low** • The study had an appropriate length of

Study details	Participants	Interventions	Methods	Outcomes and Results	Comments
			• Lumbar spine bone density measures were included in the analyses as secondary outcome measure. • It was not possible to include BMD in the proximal femur as an outcome variable because flexion contractures or previous surgery precluded reliable measurements in all but 1 subject.		follow up = Yes • The study used a precise definition of outcome = Yes • A valid an reliable method was used to determine the outcome = Yes • Investigators were kept blind to participants' exposure to the intervention = Yes • Investigators were kept blind to other important confounding and prognostic factors = Unclear

Study details	Participants	Interventions	Methods	Outcomes and Results	Comments
					Other information Indirectness: does the study match the review protocol in terms of Population - yes Intervention - yes Outcome - yes
Full citation Iwasaki, T., Takei, K., Nakamura, S., Hosoda, N., Yokota, Y., Ishii, M., Secondary osteoporosis in long-term bedridden patients with cerebral palsy, Pediatrics International, 50, 269-75, 2008 **Ref Id** 347891	**Sample size** 20 patients with CP and secondary osteoporosis. **Characteristics** • 10 boys and 10 girls • aged 1-16 years • mean age: 7.6 years **Inclusion criteria** See 'characteristics' section. **Exclusion criteria** Not specified.	**Interventions** Monotherapy group = alfacarcidol only (vit D) Polytherapy group = alfacarcidol + risedronate (vit D + bisphosphonate)	**Details** • A randomised, double-blind study design has been used to select the patients. • the BMD was measured on dual dual-energy X-ray absorptiometry (DEXA) • For scan locations, BMD was most frequently measured in the anterior part of the lumbar vertebrae, but also in the distal edge of	**Results** **Monotherapy group** the BMD before and after treatment increased significantly, p = 0.003. **Polytherapy group** the BMD before and after treatment increased significantly, p = 0.0035. Authors stated that monotherapy and polytherapy were not able to be compared as a significant difference between the two groups was recognised at pre-treatment assessment (P = 0.0076).	**Limitations** Based on NICE manual (2012) methodology checklist for RCTs. **selection bias - high** • An appropriate method of randomisation was used to allocate participants to treatment group = Unclear • Adequate concealment of allocation = unclear

Study details	Participants	Interventions	Methods	Outcomes and Results	Comments
Country/ies where the study was carried out Japan **Study type** Randomised controlled trial. **Aim of the study** To investigate CP patients with secondary osteoporosis and consider the efficacy, influence and index of treatment. **Study dates** From august 2004 to January 2005.			the radius or the side of the lumbar vertebrae when it was not possible to measure the femur neck due to pronounced scoliosis. • A blood examination, urine analysis and ultrasonography of the kidneys, ureters and bladder were done for all the patients • 20 patients were randomised into 2 groups: monothrapy (alfacarcidol only) and polytherapy group (alfacarcidol + risedronate) **Statistics** Z-score or correlation coefficients, Mann-Whitney U-		• The groups were comparable at baseline = no **performance bias - low** • The comparison groups received the same care apart from the intervention = Yes • Participants receiving the treatment were kept blind to treatment allocation = yes • Individuals administering care were kept blind to treatment allocation = yes

Study details	Participants	Interventions	Methods	Outcomes and Results	Comments
Source of funding Not reported.			test for two different comparisons, and the Wilcoxon test between the two groups to determine the significance of correlation have been used.		**attrition bias - low** • All groups were followed up for an equal length of time = yes • The groups were comparable for treatment completion = unclear • The groups were comparable with respect to the availability of outcome data = unclear **detection bias - high** • The study had an appropriate length of follow up = Yes

Study details	Participants	Interventions	Methods	Outcomes and Results	Comments
					• The study used a precise definition of outcome = no (reporting) • A valid an reliable method was used to determine the outcome = Yes • Investigators were kept blind to participants' exposure to the intervention = Yes • Investigators were kept blind to other important confounding and prognostic factors = Unclear **Other information** Indirectness: does the study match the review protocol in terms of Population - yes Intervention - yes Outcome - yes
Full citation	**Sample size** 23 residents of the Severe Psychosomatic Disorder center in Slovenia.	**Interventions** Fifteen participants were treated	**Details** Informed parental consent was obtained for all	**Results** In intervention group (group A), the general health of 2 participants deteriorated and consequently they were transferred to the hospital	**Limitations** Based on the GATE - effective public health

<table>
<tr><th>Study details</th><th>Participants</th><th>Interventions</th><th>Methods</th><th>Outcomes and Results</th><th>Comments</th></tr>
<tr>
<td>Jekovec-Vrhovsek, M., Kocijancic, A., Prezelj, J., Effect of vitamin D and calcium on bone mineral density in children with CP and epilepsy in full-time care, Developmental Medicine and Child Neurology, 42, 403-5, 2000

Ref Id

347893

Country/ies where the study was carried out

Slovenia

Study type</td>
<td>Characteristics
All participants in the study group had severe learning disability, CP (spastic quadriplegia), were bedridden, and were dependent on assisted feeding.
Each child had epilepsy and received anticonvulsants in various combinations.
Detailed study of their dietary mineral intake was not performed due to difficulties of feeding severely disabled children.

• Age = 6-17 years (median 13.7)
• Anticonvulsants treatment mean duration = 10.6 years (range 2.8 - 15.5)

Inclusion criteria
see 'characteristics' section

Exclusion criteria
Not reported.</td>
<td>with 500 mg elemental calcium and 0.25 µg of calcitrol daily.</td>
<td>participants and the study received approval from the Slovene Ethical Committee for Research in medicine. Fifteen parents gave consent for additional, bone-specific therapy during the study. Therefore, the whole group was divided into 15 treated children (11 boys, 4 girls) and 8 children who underwent observation only (5 boys, 3 girls). The BMD of three lumbar vertebrae (L2 to L4) was determined at the start of the study. Fifteen participants were treated with 500 mg elemental calcium and 0.25 µg of calcitrol daily.
After 9 months, measurements of BMD and serum levels of calcium, phosphate, alkaline phosphatase, AST, ALT</td>
<td>and were not available for control BMD measurements and laboratory examinations.
Laboratory data for one patient in the control group (group B) showed malabsorption syndrome due to gluten enteropathy and the patient was consequently excluded.
Thus 20 participants completed the study.
<table>
<tr><td></td><td>pre-treatment</td><td>post-treatment</td><td>p value</td></tr>
<tr><td>Group A</td><td>0.383 ±0.175 g/cm^2</td><td>0.476 ±0.199 g/cm^2</td><td>p<0.001</td></tr>
<tr><td>Group B</td><td>0.393 ±0.077 g/cm^2</td><td>0.315 ±0.109 g/cm^2</td><td>p = 0.013</td></tr>
</table>
No association between the duration of anticonvulsant therapy and/or combination of anticonvulsant drugs and the BMD gain was found in either group.</td>
<td>practise project checklist (NICE manual 2014)
selection bias = moderate
study design = weak
confounders = moderate
blinding = weak
data collection method = strong
withdrawals and drop outs = strong

Other information</td>
</tr>
</table>

Study details	Participants	Interventions	Methods	Outcomes and Results	Comments
Prospective cohort study. **Aim of the study** To determine the effect of vitamin D and calcium substitution on bone mineral density (BMD) in a group of children with CP in full-time care. **Study dates** not reported. **Source of funding** not reported.			albumin, and parathormone were repeated. BMD was measured by dual-energy X-ray absorptiometry (DEXA). Statistics All statistical analyses were performed using a Statistica software package. The paired t test was used to assess the significance of changes between laboratory data at base and after 9 months in both groups.		

<table>
<tr><th>Study details</th><th>Participants</th><th>Interventions</th><th>Methods</th><th>Outcomes and Results</th><th>Comments</th></tr>
<tr>
<td>Full citation

Ruck, J., Chabot, G., Rauch, F., Vibration treatment in cerebral palsy: A randomized controlled pilot study, Journal of Musculoskeletal Neuronal Interactions, 10, 77-83, 2010

Ref Id

339199

Country/ies where the study was carried out

Canada

Study type
Randomised controlled trial.</td>
<td>Sample size
20 children with CP.

Characteristics
Participants were recruited among the student of a primary school for children with special needs.

• 14 boys, 6 girls
• age 6.2 to 12.3 years

Inclusion criteria
Children of either gender were eligible if

• they were between 5.0 years and 12.9 years old at entry into the study
• had a diagnosis of CP
• were functioning at GMFSC levels II, III, or IV

Exclusion criteria
Patients were ineligible if they had a history of

• recent surgery
• unhealed fractures
• acute inflammatory processes in the lower extremities</td>
<td>Interventions
WBV program:
The patients randomised to receive vibration treatment in addition received one WBV session at the participants' school on each school day (usually 5 days per week) during school hours. The treatment was administered in one-on-one sessions by one of two fully trained physiotherapists. The treatment schedule was adapted from published observational studies that used the same WBV system as the present study to treat children with neuromuscula</td>
<td>Details
Participants were randomised in equal number to either continue the regular physiotherapy program administered by their school or to receive vibration therapy in addition to the physiotherapy program offered by the school.

• The randomisation was stratified according to GMFCS level to ensure similar functional levels in both study groups.
• Following the baseline evaluation of each child, a closed envelope was randomly selected that contained the child's group allocation.</td>
<td>Results
<table><tr><th></th><th>control group</th><th>WBV group</th><th>p value</th></tr><tr><td>lumbar spine areal BMD (mg/cm^2)</td><td>0.010 (0.001 to 0.055)</td><td>0.013 (0.005 to 0.022)</td><td>0.89</td></tr><tr><td>distal femur region 1 areal BMD (mg/cm^2)</td><td>-0.046 (-0.107 to 0.003)</td><td>0.032 (0.003 to 0.099)</td><td>0.11</td></tr><tr><td>distal femur region 2 areal BMD (mg/cm^2)</td><td>0.020 (-0.107 to 0.042)</td><td>-0.002 (-0.041 to 0.024)</td><td>0.41</td></tr><tr><td>distal femur region 3 areal BMD (mg/cm^2)</td><td>0.034 (-0.019 to 0.041)</td><td>-0.026 (-0.076 to -0.015)</td><td>0.03</td></tr></table>Results are expressed as median (IQ range).</td>
<td>Limitations
Based on NICE manual (2012) methodology checklist for RCTs.
selection bias - low

• An appropriate method of randomisation was used to allocate participants to treatment group = Yes
• Adequate concealment of allocation = Yes
• The groups were comparable at baseline = Yes

performance bias - high

• The comparison groups received the same care apart from the intervention = Yes
• Participants</td>
</tr>
</table>

Study details	Participants	Interventions	Methods	Outcomes and Results	Comments
Aim of the study To evaluate the effects of whole-body vibration (WBV) treatment in children with CP. **Study dates** Not reported. **Source of funding** This study was supported by a grant from the Shriners of North America.	• acute thrombosis	r diseases and bone fragility disorders. Each WBV session consisted of the following schedule: 3 minutes of WBV - 3 min rest - 3 minutes of WBV - 3 min rest - 3 minutes of WBV. Thus, one treatment session corresponded to 9 minutes of exposure to WBV. **Control** All patients continued to receive physiotherapy according to the program established at their school, regardless of treatment allocation. The physiotherapy program offered by the school was individualised according to the needs of	• Blinding of study participants and therapists was not possible with the WBV system used, as the vibration produced by the device is easily observable. **Assessments** Study visits at the Shriners Hospital occurred before and after the 6 month WBV treatment period. Each visit included physical examination and anthropometric measurements. Bone densitometry was performed by dual-energy x-ray absorptiometry at baseline and after the 6-month study interval. Areal BMD of the lumbar spine (L1 to L4) was measured in the		receiving the treatment were kept blind to treatment allocation = No • Individuals administering care were kept blind to treatment allocation = No **attrition bias - low** • All groups were followed up for an equal length of time = yes • The groups were comparable for treatment completion = Yes • The groups were comparable with

Study details	Participants	Interventions	Methods	Outcomes and Results	Comments
		each child and comprised one to two therapeutic sessions per week.	anteroposterior direction. Areal BMD at the distal femur was determined as described by Henderson et al. : a lateral scan of the left distal femur region was obtained and areal BMD was determined separately from the three rectangular scan regions, representing metaphyseal bone (region 1), the transition zone from the metaphysis to the diaphysis (region 2), and diaphyseal bone (region 3). **Statistics** All comparisons between treatment groups were based on an as-observed analysis. For group comparisons of continuous variables, U-tests were used, as many results were not normally distributed.		respect to the availability of outcome data = yes **Detection bias - low** • The study had an appropriate length of follow up = Yes • The study used a precise definition of outcome = Yes • A valid an reliable method was used to determine the outcome = Yes • Investigators were kept blind to participants' exposure

Study details	Participants	Interventions	Methods	Outcomes and Results	Comments
			Frequencies of discrete variables were compared using the chi squared test. All tests were two-tailed.		to the intervention = Unclear • Investigators were kept blind to other important confounding and prognostic factors = Unclear **Indirectness**: does the study match the protocol in terms of • Population = yes • Intervention = yes • Outcomes = yes

I.17 Causes of pain, distress, discomfort and sleep disturbance

Study details	Study group	Methods	Results	Comments
Full citation	**Sample size** N= 252 children	**Methodology**	**Results**	**Limitations**

Study details	Study group	Methods	Results	Comments

Penner,M., Xie,W.Y., Binepal,N., Switzer,L., Fehlings,D., Characteristics of pain in children and youth with cerebral palsy, Pediatrics, 132, e407-e413, 2013
 	
Ref Id
 	
306647
 	
Country/ies where the study was carried out
 	
The Netherlands
 	
Study type
Quantitative with a cross-sectional study design.
 	
Aim of the study
To determine the impact of pain on activities and to identify the common physician-identified causes of pain in children and youth ages 3 to 19 years across all levels of severity of CP.
 	
Study dates
No study dates were reported
	Characteristics
	
	• Mean age 9.5 ± 4.2 years.
	• Majority of children GMFCS level III, IV and V.
	
	Inclusion criteria
	No specific inclusion criteria was reported
	
	Exclusion criteria
	No specific exclusion criteria was reported
		• Children and young people and their families were identified and recruited consecutively through outpatient clinics at Holland Bloorview Kids Rehabilitation Hospital, a tertiary rehabilitation center.
		• The primary caregivers and participants (if able) were asked to complete a one-time questionnaire about the presence of pain and pain characteristics if applicable.
		• After assessing the child, the treating physician was asked about the presence or absence of pain and to provide a clinical diagnosis for the pain, if present. The participants' health records were reviewed and their GMFCS levels and age were recorded.
		• The primary measure of pain was the pain attribute of the Health Utilities Index 3 (HUI3), a measure of generic health status and quality of life. The HUI3 pain attribute has 5 levels that describe the
			• Caregivers identified pain in 54% of children
			• Physicians reported pain in 38.7% (n=94) of the participants. Primary **causes of pain** identified by physician:
			  • Hip dislocation/subluxation = 16%
			  • Dystonia = 12%
			  • Musculoskeletal (MSK) deformity = 11%
			  • Focal muscle spasm = 9%
			  • Muscle weakness/overuse/fatigue = 9%
			  • Spascity = 9%
			  • Muscle contractures = 6%
			  • Postoperative MSK oain from orthopaedic surgery =4%
			  • Pain due to falls = 1%
			• Physician identified pain in participants who were experiencing **moderate to severe pain** preventing some or most activities (HUI3 levels 4 and 5; 11.2%, n =28). Of these 28 participants, 25 had physician diagnoses pf pain and the remaining 3 were not identified as having pain by the physician.
			  • Hip dislocation/subluxation =24%
				MODERATE (based on the tool developed and published by Munn et al. 2014)
				
				• 95% confidence intervals not reported
				
				Other information
				
				• MSK deformity excludes hip dislocation/subluxation and muscle contractures and include foot and hand deformity, scoliosis and lumbar lordosis.
				• Focal muscle spasm was identified by physician if the child reported a focal area of tenderness in 1 or 2 muscles
				• 'Other' causes of pain include muscle soreness after massage therapy, seizures, headaches, knee bursitis and osteomyeilitis.
				• 28 children were identified as having severe pain (HUI level 4 and 5). Physician diagnosed pain in 25

Study details	Study group	Methods	Results	Comments
Source of funding Supported by an unrestricted research grant by Allergan Candada.		severity of pain as it relates to disruptions or limitations to normal daily activities. It ranges from 1 "no pain" to 5, "severe pain that prevents most activities". The HUI3 pain attribute was reported by the participants' caregivers. • Caregivers were also asked a yes/no question about the presence/absence of pain in the past 2 weeks, completed a pain location body diagram, and identified any pain medications taken in the last 2 weeks. • If able, the children and youth were asked to complete the Wong-Baker Faces Pain Scale and identify the face that best described how much pain he or she felt over the past 2 weeks. The Wong-Baker Faces Pain Scale has 6 gender-neutral faces that range from no pain (0) to a score of 5, representing the most pain possible. • Data analyses were completed by using SPSS version 19. Descriptive statistics	• Postoperative MSK oain from orthopaedic surgery = 8%	cases and 3 were not identified as having pain • There was significant correlation between HUI3 score and GMFCS level.

Study details	Study group	Methods	Results	Comments
		were used for frequency descriptions of demographic characteristics, percentages and frequencies for the HUI3 and Wong-Baker Faces Pain Scales Scores, and of the common clinical causes of pain in children and youth with CP.		

Full citation
 	
Houlihan, C. M., Hanson, A., Quinlan, N., Puryear, C., Stevenson, R. D., Intensity, perception, and descriptive characteristics of chronic pain in children with cerebral palsy, Journal of Pediatric Rehabilitation Medicine, 1, 145-53, 2008
 	
Ref Id
 	
408261
 	
Country/ies where the study was carried out
 	
United States of America
	Sample size
	Of the 157 children and young people choose at random from a sample of 300, 38 children and young people were included in the study.
	
	Characteristics
	4-18 years old
	
	Inclusion criteria
	
	• Confirmed diagnosis of a static enceophalopathy resulting from injury during the developmental period (from conception to the first birthday)
	• 4 to 18 years of age at the time of enrollment
		Methodology
		
		• The tool used for assessing pain was the adapted version of Pediatric Pain Questionnaire (Varni-Thompson)- parent reported using non-verbal and verbal cues.
		• Children and young people were recruited from a sample of children involved in a longitudinal study of growth in CP at the University of Virginia.
		• Parents were emailed the Varni-Thompson Pediatric Pain Questionnaire, designed to assess three dimensions of pain: sensory (physical aspects), affective
			Results
			
			• Discomforting toothache = 28.2%
			• Pain and GMFCS level:
			  ○ 26% were a GMFCS level 1
			  ○ 6% level II
			  ○ 13% level III
			  ○ 52% level IV
			  ○ 3% level V
				Limitations
				VERY LOW (based on the tool developed and published by Munn et al. 2014)
				
				• 95% confidence interval not provided.
				• Sample below 250 participants.
				• Incomplete data (other severities of toothache including mild, horrible and excruciating not reported).
				
				Other information
				Parent reported using non-verbal and verbal cues.

Study details	Study group	Methods	Results	Comments
Study type Quantitative with a cross-sectional study design. **Aim of the study** To characterise subjective descriptors of chronic pain in children with CP **Study dates** Specific study dates were not reported **Source of funding** Specific source of funding was not reported	• Gross Motor Classification System (GMFCS) level I-V **Exclusion criteria** Specific exclusion criteria was not reported	(emotional response) and evaluative (the combined intensity of the emotional and physical response). Parents assessed their child's pain using non-verbal and verbal cues. • The data was entered into the Statistics Program for Social Science (SPSS) for analysis after the data was observed and cleaned.		
Full citation Parkinson, K. N., Dickinson, H. O., Arnaud, C., Lyons, A., Colver, A., Sparcle group, Pain in young people aged 13 to 17 years with cerebral palsy: cross-sectional, multicentre European study, Archives of Disease in Childhood, 98, 434-40, 2013	**Sample size** 667 (429 self-reported, 657 parent reported) **Characteristics** Participants were 13 to 17-years-olds **Inclusion criteria**	**Methodology** • Cross-sectional questionnaire survey conducted at home visits in 9 regions in 7 European countries. • Participants were drawn from population CP registers in 8 regions and from multiple sources in one region.	**Results** • Total prevalence of self-reported pain = 74% (95% CI: 69%-79%) • Total prevalence parent-reported pain = 77% (95% CI: 73%-81%) • Site of pain in previous week, self reported: ○ Headache = 34% (associated with increased GMFCS level) ○ Stomach = 26% ○ Back = 27%	**Limitations** MODERATE (based on the tool developed and published by Munn et al. 2014) • 95% confidence intervals not reported for site of pain and pain due to physiotherapy.

Study details	Study group	Methods	Results	Comments
Ref Id 339180 **Country/ies where the study was carried out** United Kingdom **Study type** Quantitative study with a cross-sectional study design. **Aim of the study** To determine the prevalence and associations of self- and parent-reported pain in young people with cerebral palsy. **Study dates** January 2009 **Source of funding** Wellcome Trust WT 086315 A1A (UK and Ireland); Medical Faculty of University of Lübeck E40-2009 and E26-2010 (Germany); CNSA, INSERM, MiRe-DREES, IRESP	Children born between 31 July 1991 and 1 April 1997. **Exclusion criteria** No specific exclusion criteria was reported	• Researchers visited families in their homes, if possible when the young people were aged 13 to 17 years. • Young people who could self-report were asked to report their pain. • Measure used in the study: ○ Bodily Pain and Discomfort items of the Child Health Questionnaire: record frequency of pain and severity ○ Site and circumstances of pain (i.e. headaches, stomach, back, circumstances of pain, pain during therapy...) ○ Severity of pain during treatment over the previous year (during physiotherapy, during other therapy, during botulinum injections) ○ Emotional difficulties	○ Hips = 14% ○ Operation sites = 10% (associated with increased GMFCS level) • Pain due to therapy in the past year, self reported: ○ During physiotherapy= 45% ○ During other therapy = 9% ○ During botulinum injections = 26% • Only pain during physiotherapy associated with increased GMFCS levels • Site of pain in previous week, parent reported- all were associated with increased GMFCS levels ○ Headache = 30% ○ Stomach = 32% ○ Hips = 21% ○ Operation sites = 14% • Pain due to therapy in the past year, parent reported: ○ During physiotherapy = 50% ○ During other therapy = 18% ○ During botulinum injections = 29% • Pain during physiotherapy and other therapies associated with increased GMFCS levels.	**Other information** • SPARCLE (Study of PARticipation of Children with CP Living in Europe) is a large European study. SPARCLE1 randomly sampled children from a population-based register aged 8-12 years old. The 818 children who initially entered SPARCLE1 were followed up when aged 13 to 17 years; 73% (n=594) agreed to participate. In order to mantain statistical power for cross-sectional analyses, SPARCLE2 additionally sampled from young people eligible for SPARCLE1 who had not participated in it. 73 agreed to participate and hence the final sample for SPARCLE2 comprised 667 young people, distributed by region. • In multivariate model, only walking ability and emotional difficulties score from Strenghts and Difficulties Questionnaire (SDQ)

Study details	Study group	Methods	Results	Comments
(France); Ludvig and Sara Elsass Foundation (Denmark); The Spastics Society-Vanforefonden (Denmark); Cooperativa Sociale 'Glin Anni in Tasca', Viterbo (Italy); Fondazione Carivit, Viterbo (Italy); Goteborg University-Riksforbundet for Rorelsehindrade barn och Ungdomar; Folke Bernadotte Foundation (Sweden).		score (EDS) from the Strenghts and Difficulties Questionnaire (SDQ) • In order to estimate the prevalence of pain, the severity of pain as none/any (from very mild to very severe) was dichotomised. For all other statistical analysis, pain was not dichotomised; proportional odds ordinal regression was used which retained all six categories of severity and frequency of pain. Associations between pain and covariates (impairments, sociodemographic characteristics, EDS, total stress score), stratifying by region. For analysis of trend, walking ability was treated as continuous; for all other analyses, covariates were treated as categorical. Four models, corresponding to young people's and parents responses were developed. Univariate analyses were first performed, relating pain to each covariate in turn. Forwards stepwise		were associated with pain. • Parent and self-reported pain were significantly correlated, but parents tended to overstimate their child's pain if self-reported pain was infrequent or mild and understimate it if self-reported pain was frequent or severe.

Study details	Study group	Methods	Results	Comments
		regression was then performed, followed by backwards steps, to select covariates to include in a multivariate model. A p value for entry of covariates was set at p<0.05 and, to lessen the probability of chance findings due to multiple hypotheses testing, a p value of 0.01 was set. The p values were derived from the likelihood ratio test statistic. A check for an interaction between significant covariates was set. Sensitivity analyses were performed for a) limiting the sample to young people who had responded to SPARCLE1 and for whom sampling weights that reflected the sampling design were available; and b) retaining the entire sample but additionally adjusting for factors associated with non-response. Stata V.12 was used for analyses.		
Full citation	**Sample size** 230 children	**Methodology**	**Results** Pain and GMFCS level	**Limitations**

Study details	Study group	Methods	Results	Comments

Doralp,S., Bartlett,D.J., The prevalence, distribution, and effect of pain among adolescents with cerebral palsy, Pediatric Physical Therapy, 22, 26-33, 2010
 	
Ref Id
 	
316024
 	
Country/ies where the study was carried out
 	
Canada
 	
Study type
Quantitative
 	
Aim of the study
To describe the prevalence, distribution and intensity of pain and determine the relationship between pain intensity and effect on daily activities in adolescents with cerebral palsy.
 	
Study dates
No specific study dates were reported
	Characteristics
	
	• Mean ages 14.7 (SD= 1.7) and 14.8 (SD=1.7 years) at the study onset.
	• 104 girls and 126 boys included
	
	Inclusion criteria
	No specific inclusion criteria was reported
	
	Exclusion criteria
	No specific exclusion criteria was reported
		• Participants were assessed with a self-developed questionnaire
		• The data reported here were obtained from the first data collection point of a retrospective cohort study called the Adolescent Study of Quality of Life, Mobility and Exercise (ASQME).
		• Participants were classified using the GMFCS
		• Adolescents provided data on pain either independently or through proxy by parental report.
		• No difference in the proportion of the sample reporting pain or the effect on daily activities between the adolescents who completed the questionnaire either independently or with physical help from parents, and those who required parents to respond in their behalf because of their cognitive limitations.
		• Frequency distributions were used to describe the prevalence of pain and its presence in
			• Pain intensity and impairment worsened with increasing physical impairment of the child as assessed by their GMFCS level
			• Overall pain prevalence = 63% in females and 49% in males.
			• Pain prevalence by GMFCS level:
			  ○ GMFCS I= 40.7% females, 50% males
			  ○ GMFCS II: 66.7% females, 58.8% males
			  ○ GMFCS III: 75% females, 47.1% males
			  ○ GMFCS IV: 66.7% females, 51.5% males
			  ○ GMFCS V: 82.4% females, 45.8% males
				VERY LOW (based on the tool developed and published by Munn et al. 2014)
				
				• 95% confidence intervals not reported
				• Musculoskeletal pain prevalence (for example, lower back pain) was not reported as percentage
				• Condition not measured reliably: self-developed questionnaire.
				
				Other information
				
				• Location of pain (ankle and foot, calf, knee, lower back) was reported in figures.
				• The Adolescent Study of Quality of Life, Mobility and Exercise (ASQME) is a 5 year follow-up of the 5 year-long Ontario Motor Growth (OMG) study that followed a stratified random sample of 567 children with CP from a population-based cohort obtained between 1996 and 2001. For the OMG study, participants

Study details	Study group	Methods	Results	Comments
Source of funding • Grant support: The Canadian Institutes of Health Research (CIHR MOP-53258) • Samantha Doralp was a PhD Candidate in the Rehabilitation Sciences Preogram in the Faculty of Health Sciences at The University of Western Ontario at the time this study was completed.		various body regions. Chi-square analysis determined the differences in frequency of pain by gender and GMFCS level. Medians and ranges were used to describe the intensity of pain.		were recruited through 19 publicly funded children's rehabilitation centers in the province of Ontario.
Full citation Elsayed, R. M., Hasanein, B. M., Sayyah, H. E., El-Auoty, M. M., Tharwat, N., Belal, T. M., Sleep	**Sample size** 100 children with CP subdivided in 2 groups: pre-school (N= 52) age group and school age group (N = 48)	**Methodology** • Patients were recruited from the pediatric neurology outpatient clinic, at the period from	**Results** • Early insomnia: preschool group = 46% (n=24) ,school group = 25% (n=12)	**Limitations** LOW (based on the tool developed and published by Munn et al. 2014)

Study details	Study group	Methods	Results	Comments
assessment of children with cerebral palsy: Using validated sleep questionnaire, Annals of Indian Academy of Neurology, 16, 62-5, 2013 **Ref Id** 408277 **Country/ies where the study was carried out** Egypt **Study type** Quantitative study with a cross-sectional design. **Aim of the study** To asses sleep of children with cerebral palsy, using a validated sleep questionnaire. **Study dates** Specific study dates were not reported **Source of funding** Nil	**Characteristics** **CP subtype and median age:** Pre-school group: mean age 2.4 years, 26% (n=13) diplegic, 25% (n=12) hypotonic, 24% (n= 12) hemiplegic, 16% (n=8) quadriplegic, 12% (n=6) dyskinetic/dystonic School group: mean age 10.2 years, 25% (n=12) diplegic, 16.7% (n=8) hypotonic, 25% (n= 12) hemiplegic, 15% (n=7) quadriplegic, 8% (n=4) dyskinetic/dystonic **GMFCS levels:** • Preschool group: ○ GMFCS level I: 20% (n=11) ○ GMFCS level II : n= 12 ○ GMFCS level III: n = 11 ○ GMFCS level IV: n = 5 ○ GMFCS level level V: n = 13 • School group: • ○ GMFCS level I: n=6 ○ GMFCS level II : n= 8 ○ GMFCS level III: n = 15 ○ GMFCS level IV: n = 5 ○ GMFCS level level V: n = 14	June 2011 to January 2012 • Questionnaires used: Paediatric day time sleepiness scales (PDSS), paediatric sleep evaluation questionnaire (PSEQ), paediatric sleep evaluation questionnaire (PSEQ), and paediatric sleep questionnaire (PSQ). Unclear which questions were obtained from which questionnaire. • Full neurological assessment was done to determine the clinical subtype of CP. • All neurological and functional assessments were performed by a single pediatric neurologist. • All the patients underwent full psychiatric evaluation by a psychiatrist. • Examination for associated visual or hearing impairment was also performed. • IBM SPSS was used for data analysis. Data were expressed as Mean ±SD for quantitative parametric measures, in addition to Median Percentiles for	• Interrupted sleep: preschool group = 34.6% (n=18), school group = 37.5% (n=18) • Difficulty morning awakening: preschool group: 11.5% (n=6), school group = 25% (n=12) • Sleep disordered breathing: preschool group = 38.6% (n=20), school group = 50% (n=24) • Periodic limb movement disorder/ restless leg syndrome: preschool group= 42.3% (n=22), school group = 50% (n=24) • Excessive daytime sleepiness: preschool group = 50% (n=26), school group = 62.5% (n=30)	• 95% confidence intervals not reported. • Unclear if condition was measured reliably. **Other information** Combination of 3 questionnaires was used and unclear which domains or questions are from which questionnaires

Study details	Study group	Methods	Results	Comments
	Inclusion criteria Specific inclusion criteria was not reported **Exclusion criteria** • Children with co-morbid severe chronic health problems (renal, hepatic, and cardiac impairment) • Cases of specific genetic syndromes • Cases with hypognathia or cephalometric craniofacial abnormality.	quantitative non-parametric measures and both number and percentage for categorised data.		
Full citation Newman,C.J., O'Regan,M., Hensey,O., Sleep disorders in children with cerebral palsy, Developmental Medicine and Child Neurology, 48, 564-568, 2006 **Ref Id** 316712	**Sample size** 173 children with CP **Characteristics** • Mean age 8 years 10 months. • 100 males (57.8%) and 73 females (42.2%; mean age 8y 10mo [SD 1y 11mo]; range 6y-11y 11mo) • 83 (48%) children had spastic diplegia, 59 (34.1%) congenital hemiplegia, 18 (10.4%)	**Methodology** • Clinical diagnoses based on the predominant type of motor impairment had previously been established and recorded by an in-house medical consultant • GMFCS levels had been recorded by an in-house physical therapist.	**Results** Seizures: • 30 (17.3%) children were reported to have epilepsy and were all receiving antiepileptic medication. 20 of those (11.6%) had no recent seizure and 10 (5.8%) had experienced at least 1 recent seizure during the preceding month. Total with pathological sleep = 22.5% • Difficulty initiating and maintaining sleep = 24.3%	**Limitations** MODERATE (based on the tool developed and published by Munn et al. 2014) • 95% confidence intervals not reported **Other information** • Pathological sleep was significantly associated with presence of active epilepsy, being the

Study details	Study group	Methods	Results	Comments
Country/ies where the study was carried out Ireland **Study type** Quantitative **Aim of the study** To determine the frequency and predictors of sleep disorders in children with cerebral palsy and to identify factors associated with these problems by analyzing parents' responses to a validated sleep disturbance questionnaire. **Study dates** Specific study dates were not reported **Source of funding** The first author was supported by grants from the Swiss National Science Foundation, CEREBRAL (Swiss Foundation for Children with Cerebral	spastic quadriplegia, and 13 (7.5%) dystonic/dyskinetic CP. GMFCS levels: • 73 (42.2%) of children presented with a GMFCS level 1 • 33 (19.1%) in Level II • 30 (17.3%) in Level III • 23 (13.3%) in Level IV • 14 (8.1%) in Level V **Inclusion criteria** Children aged 6 to 12 years with a diagnosis of CP and a documented GMFCS level **Exclusion criteria** Specific exclusion criteria was not reported	• Parents completed the Sleep Disturbance Scale for Children • General characteristics of the study population were analyzed by frequencies and cross-tabulations. • The total sleep score and each sleep disturbance factor score were converted into a binary variable based on normative data: a T-score of more than 70 (>95th percentile) was regarded as pathological and a score of 70 or less was taken as the normal range. • Frequencies of pathological scores were established for total sleep problems and individual sleep disturbance factors. • Analyses were performed with SPSS (version 10.0) $p \leq 0.05$ was considered significant.	• Sleep-wake transition disorder = 17.9% • Sleep related breathing disorders = 14.5% • Excessive somnolence = 11% • Disorders of arousal = 8.1% • Sleep hyperhydrosis = 5.8% Percentage with one or more sleep disorder: • 1 disorder = 20.8% • 2 disorder = 13.9% • 3 disorders = 6.4% • Between 4 and 6 disorder = 2.9%	child of a single parent and sleeping with parents. • Epilepsy affected 7/83 (8.4%) of children with diplegia, 9/59 (15.3%) of those with hemiplegia, 9/18 (50%) who had spastic quadriplegia, and 5/13 children with dyskinetic CP (38.5%). • Difficulty maintaining sleep was significantly associated with spastic quadriplegia dyskinetic CP and severe visual impairment and bed sharing. • Disorders of excessive somnolence were associated with active epilepsy. • Disorders of arousal occurred less in females and more in children with single parents.

Study details	Study group	Methods	Results	Comments
Palsy), and the Swiss Paraplegics Foundation.				
Full citation Adiga, D., Gupta, A., Khanna, M., Taly, A. B., Thennarasu, K., Sleep disorders in children with cerebral palsy and its correlation with sleep disturbance in primary caregivers and other associated factors, Annals of Indian Academy of Neurology, 17, 473-6, 2014 **Ref Id** 357637 **Country/ies where the study was carried out** India **Study type** Quantitative with a prospective cross-sectional study design. **Aim of the study**	**Sample size** N = 50 **Characteristics** • Age range 6.5-15 years. • 27 females, 23 males • 84% (n=42) spastic CP, 10% (n=5) mixed CP, 6% (n=3) dyskinetic CP. 15/42 with spastic CP were hemiplegic, 14 were diplegic, 4 were triplegic, and 9 were tettraplegic CP. • 40% (n=20) children were in GMFCS level- I, 28% (n=14) were in level II, 12% (n=6) were in level III, 2% (n=1) were in level IV and 18% (n=9) were in level V. • All the cases of hemiplegic, dyskinetic CP, and the majority of the diplegics (71%) were in level I and II. Majority of the tetraplegic (55.6%) and mixed CP (60%) were in level V. • CYP had presence of documented delay in	**Methodology** • Study conducted in Neurological Rehabilitation department of a University tertiary research hospital in India • SD assessed using Sleep Disturbance Scale for Children (SDSC). Total score and scores of individual sleep disorders were categorised into pathological and normal based on the normative data of the scale. A T-score more than 70 (>95 percentile) was regarded as pathological and T-score of 70 or less was taken as the normal range • Gathered data were tabulated and analyzed using the SPSS version 19. General characteristics of the study population were analyzed by	**Results** Prevalence of children with pathological (abnormal) score in SDSC • Disorders of initiating and maintaining sleep = 50% • Sleep breathing disorders = 12% • Disorders of arousal = 8% • Sleep wake transitions disorders = 26% • Disorders of esxcessive somnolence = 10% • Sleep hyperhydrosis = 6%	**Limitations** MODERATE (based on the tool developed and published by Munn et al. 2014) • 95% confidence intervals not reported **Other information** Pittsburgh sleep quality index (PSQI) was used to assess sleep disorders in carers of these children with CP. These results were not extracted.

Study details	Study group	Methods	Results	Comments
To observe the prevalence of sleep disturbance (SD) in cerebral palsy (CP) children in a specific age-group and its correlation with SD in primary caregivers and other associated factors. **Study dates** January-June 2013. **Source of funding** Nil	motor milestones , no regression of acquired milestones of progression of the symptoms, with presence of abnormal findings on neurological examination like spasticity, dystonia, brisk deep tendon reflexed, rigidity, cerebellar signs, and presence of abnormal movements or persistence of primitive reflexed were included. **Inclusion criteria** • CP children with age between 6.5-15 years. • Primary caregiver present with patient and able to provide detailed antenatal and perinatal history. • Patients on stable dosage of antiepileptic, antispastic, or any other drugs, which can cause sedation, in last month. • Those who consented (patient or caregiver) to participate on the study. **Exclusion criteria** • Hypotonic/floppy child • Unreliable history	frequencies and cross tabulations.		

Study details	Study group	Methods	Results	Comments
	• Comorbid health problems, like cardiorespiratory or any other illness, which may alter sleep pattern • CP children and caregivers with diagnosed depression, other psychiatric or other chronic medical illness. Etc which may alter sleep pattern.			
Full citation Romeo, D. M., Brogna, C., Quintiliani, M., Baranello, G., Pagliano, E., Casalino, T., Sacco, A., Ricci, D., Mallardi, M., Musto, E., Sivo, S., Cota, F., Battaglia, D., Bruni, O., Mercuri, E., Sleep disorders in children with cerebral palsy: neurodevelopmental and behavioral correlates, Sleep Medicine, 15, 213-8, 2014 **Ref Id**	**Sample size** 165 children **Characteristics** • Age range 6-16 years, mean age 11 years • 99 boys and 66 girls • There were 38 children who presented diplegia (25 boys; 13 girls), 56 presented with hemiplegia (37 boys, 19 girls), 64 presented with quadriplegia (33 boys; 31 girls), and 7 presented with	**Methodology** • For the statistical analysis, data were presented as mean values (standard deviations [SDs]) for continuous normally distributed variables, median (interquartile range) for continuous variables, and numbers and percentages for categorical variables.	**Results** • Total with pathological sleep = 19% • Disorders of initiating and maintaining sleep = 22% • Sleep breathing disorders = 14% • Disorders of arousal = 10% • Sleep-wake transition disorders = 15% • Disorders of excessive somnolence = 13% • Sleep hyperhydrosis = 7%	**Limitations** MODERATE (based on the tool developed and published by Munn et al. 2014) • 95% confidence intervals not reported **Other information** • To have a homogeneous cohort, only children qith no parental history of a severe or chronic medical condition (e.g., dtroke, diabetes

Study details	Study group	Methods	Results	Comments
339194 **Country/ies where the study was carried out** Italy **Study type** Quantitative **Aim of the study** To estimate the frequency of sleep disorders in children with CP using the Sleep Disturbance Scale for Children (SDSC). **Study dates** Specific study dates were not reported **Source of funding** Source of funding was not reported	dyskinesia (4 boys; 3 girls). **GMFCS level:** • Of the CYP with **diglegia**, 15 presented with GMFCS level 1, 12 with GMFCS level 2, 11 with GMFCS level 3 and any of the children presented with GMFCS level 4 or 5. • Of the CYP with **hemiplegia**, 52 presented with GMFCS level 1, 4 with GMFCS level 2 and any of the children presented with GMFCS level 3, 4 or 5. • Of the CYP with **quadriplegia**, 1 presented with GMFCS level 1,2 with GMFCS level 2, 8 with GMFCS level 3, 15 with GMFCS level 4 and 38 with GMFCS level 5 • Of the CYP with **dyskinesia**, any presented with GMFCS level 1, 2 presented with level 2, any presented with GMFCS level 3, 2 with GMFCS level 4 and 3 with GMFCS level 5. **Inclusion criteria** • Children with a diagnosis of CP between the ages of			mellitus) or a psychologic disorder were included. • Sleep wake transition disorders more associated with dyskinetic CP ($p<0.05$) and sleep hyperhidrosis ($p<0.01$) than hemiplegia, quadriplegia or diplegia • Multivariate analysis (adjusting for IQ, active epilepsy, Child Behaviour Checklist (CBCL) scores and GMFCS level 5. Abnormal SDCS score associated only CBCL scores, both internalising and externalising ($p<0.01$)) • Age range in the inclusion criteria was based on the choice of some assessments performed in the study, for which validation studies and normative data are available from the age of years. • CP was defined as a group of disorders in the development of movement and posture, causing activity limitation attributed to nonprogressive disturbances occurring

Study details	Study group	Methods	Results	Comments
	6 and 16 years with a detailed cognitive and motor assessment. **Exclusion criteria** Specific exclusion criteria was not reported			in the developing fetal or infant brain.
Full citation Alriksson-Schmidt, A., Hagglund, G., Pain in children and adolescents with cerebral palsy: a population-based registry study, Acta Paediatrica, 105, 665-70, 2016 **Ref Id** 451533 **Country/ies where the study was carried out** Sweden **Study type** Cross-sectional	**Sample size** n=2777 **Characteristics** 57% were male, children and young people had a median age of 7 years old (SD=3.6). Of the total number of participants, 43% presented with GMFCS level I, 17% GMFCS level II, 9% GMFCS level III, 15% GMFCS level IV and 16% GMFCS level V. **Inclusion criteria** All children born between 2000 and 2012 who were reported to the CPUP (cerebral palsy follow-up study) in 2013-2014.	**Methodology** CP diagnosis was determined by a neuropaediatrician according to the Surveillance Of Cerebral Palsy Network in Europe. In CPUP, children at GMFCS level I are examined by their physiotherapist annually up to 6 years of age and then every second year. Those at GMFCS levels II–V are examined twice a year up to 6 years, then once a year. In addition to a physical assessment, the physiotherapist completes a general survey that asks whether the child or their parents have stated that the child is in pain. If the answer is yes, a follow-up question is asked about where it hurts. If the child is able to communicate, he or she will answer, if not the parent or legal guardian answers the question.	**Results** Data on the site or sites of pain were available for 829 of the 900 children (92.1%) who experienced pain and 175 children (19.4%) experienced pain at multiple sites: • 5.8% of the total population at GMFCS I, • 6.3% at GMFCS II, • 9.3% at GMFCS III • 6.3% at GMFCS IV • 5.9% at GMFCS V. Pain sites: • 325 (36.1%) reported pain in the feet,	**Limitations** MODERATE (based on the tool developed and published by Munn et al. 2014) • Site of pain was not measured reliably (subject to reporting bias as an standardised measure was not used) • 95% CI intervals not reported for sites of pain **Other information** Missing data on the site of the pain were coded as no in the analyses; results were reported in graphs.

Study details	Study group	Methods	Results	Comments
Aim of the study To investigate the presence of pain, the site or sites of pain and how these related to gender, gross motor function and age. **Study dates** Not reported (but data were reported to the registry in 2013-2014) **Source of funding** Not reported	**Exclusion criteria** not reported	Pain was dichotomised as present or not present. The site or sites of pain were recorded as head, neck, back, arms, hands, hips, knee, feet, teeth, stomach, pressure, skin wound or other. For the purposes of our analyses these categories were reclassified by combining the head and neck, the arms and hands, the thighs and hips and the lower legs and feet. Whether the participant experienced pain in one or multiple sites was also recorded. Statistical analyses: Raw numbers and percentages were calculated on all variables. Logistic regression was used to regress age, gender and the GMFCS level on the presence of pain. An adjusted logistic regression on the GMFCS level and presence of pain, adjusted for age and gender, was also performed. We used 95% confidence intervals (95% CIs) to assess statistical significance among GMFCS groups on pain sites	• 193 (21.4%) reported knee pain, • 263 (29.2%) reported pain in the hips, • 97 (10.8%) had pain in the abdomen, • 84 (9.3%) reported back pain, • 83 (9.2%) in the head/neck, and • 81 (9%) had pain in the arms/hands.	

I.18 Assessment of pain, distress, discomfort and sleep disturbances

Bibliographic details	Number of Participant & Participant Characteristics	Test/Outcome characteristics	Results	Reviewer comment
Authors Hunt, A., Goldman, A., Seers, K., Crichton, N., Mastroyannopoulou, K., Moffat, V., Oulton, K., Brady, M. **Year of publication** 2004 **Country of publication** United Kingdom **Ref Id** 407369 **Sub-type** Population-based study	**Cohort population** 140 children with severe neurological and cognitive impairments, recruited from 5 health care centres across the UK. • 78 females • mean age 9 years 11 mo., SD 4 years 7 mo., range 1 to 18 years • Unable to communicate through speech or augmentative communication. **Demographics - Total** 140 **Statistical method** • Sample size for the study was based on a power calculation for proportion. • Tests were performed using SPSS to assess the scale's concurrent and face validity. **Diagnostic criteria** baseline assessments: A structured interview took place during which the parents' assessment of the child's communication, socialization, daily living, and motor skills were recorded using the Vineland Adaptive Behavior Scales. During the interview, the child's pain history was recorded. In addition, the parents retrospectively rated on the PPP scale their child's behavior both when their child was 'at their best' or	**Reference Test** The Pediatric Pain Profile (PPP) is a 20-item behavior rating scale designed to assess pain in children with severe neurological disability.	**Results** Inter-rater reliability • ICC: 0.74 • ICC in analgesic subgroup: 0.89 PPP vs. VRS score: $p<0.001$ Significant difference in scores pre- and post-analgesia ($p<0.001$)	**Funding** The study was founded by The health Foundation. **Quality Items** Limitations of the study: • Analysis of data from the postoperative group was complicated by the variety and number of analgesia given • Observers could rewind videotapes (used to blind observers), which would not be possible under normal circumstances when using the tool.

Bibliographic details	Number of Participant & Participant Characteristics	Test/Outcome characteristics	Results	Reviewer comment
	'on a good day' and when they suffered any current or recurring pain.			
Authors Voepel-Lewis, T., Merkel, S., Tait, A. R., Trzcinka, A., Malviya, S. **Year of publication** 2002 **Country of publication** United States **Ref Id** 408056 **Sub-type** Population-based study	**Cohort population** 79 children aged 4-18 years with varying degrees of cognitive impairment were studied after painful orthopedic or general surgery. **Demographics - Total** 79 **Statistical method** The total FLACC scores of each observer were correlated with the parent VAS pain scores by using Spearman's p test. Pain scores obtained before and after analgesics were compared by using Wilcoxon's signed rank tests for paired data. The total FLACC scores and categorical scores assigned by the blinded observers at two separate viewings were compared by using Sperman's p and k statistics. **Diagnostic criteria** Each child was evaluated for his or her ability to self-report pain by using either the simple Faces Scale or a 0-10 numbers scale. Testing was conducted only in children who were deemed able, by parent interview, to perform simple ordinal ranking tests, such as putting blocks in order from smallest to largest.	**Reference Test** FLACC score = face, legs, activity, cry, consolabilty observational tool. • 5 behavioural categories scored 0-2 with option for caregiver to add behaviours • Scoring = 0-10 • Higher scores indicate more pain Observation time = 5 min	**Results** Inter-rater reliability • Correlation between observers for total score, r = 0.51 to 0.77 • Exact agreement = 35-94% for Face, Cry, Consolability Exact agreement = 17-77% for Legs decrease in FLACC scores after analgesic administration, p<0.001	**Funding** The study was supported by a research award from Sigma Theta tau, Rho Chapter. **Quality Items** Limitations: Videotape assessments were used to blind one set of observers to the administration of analgesia **Other information**

Bibliographic details	Number of Participant & Participant Characteristics	Test/Outcome characteristics	Results	Reviewer comment
	After recovery from general anesthesia and before the administration of an IV analgesic, patients were observed and scored for pain behaviors by using the FLACC pain tool. Observations were made while the child was awake and in the presence of a parent or guardian whenever available. The patient's bedside nurse observed the patient's behaviors for 2-3 min and assigned a FLACC pain score while the patient was videotaped. Analgesics were administered at the discretion of the bedside nurse in accordance with the physician orders. 15 to 30 min later, patients were observed, videotaped, and scored for pain behaviors by using the same methods.			
Authors Malviya, S., Voepel-Lewis, T., Burke, C., Merkel, S., Tait, A. R. **Year of publication** 2006 **Country of publication** United States **Ref Id** 408090 **Sub-type** Population-based study	**Cohort population** 52 children with cognitive impairment scheduled for elective surgery. **Statistical method** Spearman's p and ICC wree used to determine the strenght of association and measure the chance-correct agreement between scores. Exact agreement between FLACC scores was determined using % agreement with kappa statistic. **Diagnostic criteria** The FLACC was revised to include specific descriptors and parent-identified, unique behaviors for individual children. The child's ability to self-report pain was evaluated.	**Reference Test** FLACC (face, legs, activity, cry, consolability scale) · 5 behavioural categories scored 0-2 with option for caregiver to add behaviours · Scoring = 0-10 · Higher scores indicate more pain Observation time = 5 min	**Results** Inter-rater reliabilty • ICC: 0.90 (95% CI 0.87-0.92); k = 0.44-0.57 decrease in FLACC scores after analgesic administration Proved criterion validity (correlations between FLACC, parent, and child scores)	**Funding** This study was supported by a NIH grant. **Quality Items** Limitations • Videotape assessments were used to blind one set of observers to the administration of analgesia **Other information**

Bibliographic details	Number of Participant & Participant Characteristics	Test/Outcome characteristics	Results	Reviewer comment
	Postoperatively, 2 nurses scored pain using the revised FLACC scale before and after analgesic administration, and children sel-reported a pain score, if able. Observations were videotaped and later viewed by experienced nurses blinded to analgesic administration.			
Authors Solodiuk, J. C., Scott-Sutherland, J., Meyers, M., Myette, B., Shusterman, C., Karian, V. E., Harris, S. K., Curley, M. A. **Year of publication** 2010 **Country of publication** United States **Ref Id** 408197 **Sub-type** Population-based study	**Cohort population** 50 nonverbal children with severe intellectual disability scheduled for surgery. • aged 6-18 years **Demographics - Total** 50 **Diagnostic criteria** The parent, bedside nurse and research assistant triad then simultaneously yet independently scored the patient's post-operative pain using the INRS for a maximum of two sets of pre/post paired observations.	**Reference Test** INRS (individualised numeric rating scale) - a personalised pain assessment tool for nonverbal children with intellectual disability based on the parent's knowledge of the child. · Parents recall past pain behaviours and score them 0-10. Word anchors “no pain” and “worst possible pain” · Scoring = 0-10 · Higher scores indicate more pain Observation time = 1 min	**Results** Inter-rater reliabilty • ICC: 0.65 - 0.80 Decrease in INRS scores 1 hr after a pain management intervention) Modest correlations between INRS and NCCPC-PV	**Funding** Not specified. **Quality Items** Limitations • Data were collected over a period of several years • Sample size did not allow for extensive subgroup analysis **Other information**
Authors Breau, L. M., Finley, G. A., McGrath, P. J., Camfield, C. S. **Year of publication**	**Cohort population** 24 children with severe cognitive impairment aged 3 to 10 years. **Demographics - Total**	**Reference Test** NCCPC-PV (non-communicating child’s pain checklist – post-operative version)	**Results** Inter-rater reliability ICC: 0.82 before surgery ICC: 0.78 after surgery · Caregiver and researcher scores were significantly greater after surgery	**Funding** **Quality Items** Limitations

Bibliographic details	Number of Participant & Participant Characteristics	Test/Outcome characteristics	Results	Reviewer comment
2002 **Country of publication** **Ref Id** 408201 **Sub-type** Population-based study	24 **Diagnostic criteria** The psychometric properties of the scale were evaluated among caregivers, researchers, and nurses. All three groups rated pain intensity with the visual analog scale (VAS); only the caregivers and researchers also rated pain intensity with the NCCPC-PV.	· 27 items, 6 categories (Vocal, Social, Facial, Activity, Body, Physiological), scored 0-3 · Scoring = 0-81 · Score ≥ 11 indicate moderate to severe pain Observation time = 10 min	(paired t-test p=0.003 and p=0.01)	• Scarce information on sampling methodology • Small sample size **Other information** • Nurses did not use the scale in this trial • Positive correlations with the VAS

I.19 Management of pain, distress and discomfort

No studies were identified for this review.

I.20 Management of sleep disturbances

Study details	Participants	Interventions	Methods	Outcomes and Results	Comments
Full citation Dodge, N. N., Wilson, G. A., Melatonin for treatment of sleep disorders in children with developmental disabilities, Journal of Child Neurology, 16, 581-4, 2001 **Ref Id**	**Sample size** 20 children with developmental disabilities aged 1-12 **Characteristics** Age at enrolment: 13 mo - 15 yr (mean 89 mo). N=20 CP n=15	**Interventions** Participants received melatonin or placebo each during 6 weeks. Dosage of melatonin was fixed at 5 mg per day.	**Details** Packaging of the melatonin and placebo capsules and randomization were performed by research pharmacy peronnel at Indiana University.	**Results** • sleep latency in minutes, mean difference (95% CI) = -30.00 [-71.13, 11.13] • total sleep time in minutes,	**Limitations** Low risk of bias. **Other information**

Study details	Participants	Interventions	Methods	Outcomes and Results	Comments
406899 **Country/ies where the study was carried out** United States. **Study type** cross-over double-blind and placebo-controlled **Aim of the study** To explore the safety and efficacy of synthetic melatonin in the treatment of sleep problems in 20 children with developmental disabilities, in a randomised, double-blind, placebo-controlled 6 week trial of melatonin versus placebo. **Study dates** not specified. **Source of funding** not specified.	**Inclusion criteria** • age range 1-12 years • Moderate to severe developmental disability as defined by spastic quadriparesis, mental retardation, or global developmental delay with an IQ or developmental quotient less than or equal to 50, or autism. • sleep problems a major presenting complaint **Exclusion criteria** • behavioural interventions had not been adequately tried • history of physical examination suggested a medical cause for the sleep problems, such as gastroesophageal reflux	Time of administration of the intervention was fixed at 8 pm.		mean difference (95% CI) = 18.00 [-39.67, 75.67] • number of wakes per night, mean difference (95% CI) = 0.20 [-0.23, 0.63]	
Full citation Coppola, G., Iervolino, G., Mastrosimone, M., La Torre, G., Ruiu, F., Pascotto, A., Melatonin in wake-sleep	**Sample size** 32 patients enrolled, 25 completed both the melatonin and placebo phases.	**Interventions** Melatonin was initiated at the daily dose of 3 mg, at noctural bedtime.	**Details** Each patient enrolled into the study was randomised to oral synthetic fast-release melatonin or placebo,	**Results** • sleep latency, minutes, mean difference (95%	**Limitations** Low risk of bias.

Study details	Participants	Interventions	Methods	Outcomes and Results	Comments
disorders in children, adolescents and young adults with mental retardation with or without epilepsy: a double-blind, cross-over, placebo-controlled trial, Brain & Development, 26, 373-6, 2004 **Ref Id** 406903 **Country/ies where the study was carried out** Italy **Study type** A randomised double-blind, placebo-controlled cross-over trial. **Aim of the study** To verify the clinical efficacy of melatonin in children, adolescent and young adults with wake-sleep disorders and mental retardation, most of them on chronic anticonvulsant therapy for epileptic seizures, by means of a randomised double-blind, placebo-controlled cross-over trial. **Study dates** Not specified.	**Characteristics** aged 3.6 to 26 years (mean = 10.5 years) **Inclusion criteria** • mental retardation with or without epilectic seizures • age more than 12 months • diagnosis of sleep disorder • exclusion of medical issues such as gatroesophageal reflux, pain, or epileptic seizures mimicking sleep disorders • persisting sleep disturbances despite maintaining appropriate sleep hygiene • Informed consent by parents or caregivers. **Exclusion criteria** • progressive neurological and/or systemic diseases • age < 12 months • Poor compliance from parents/caregivers with the study requirements before trial entry.	In case of inefficacy, melatonin dose could be titrated up to 9 mg the following 2 weeks in increments of 3 mg/week, unless the patient was unable to tolerate it.	and then entered phase 1 (melatonin or placebo) that lasted 4 weeks. After a cross-over period of 1 week, each patient entered phase 2 that also lasted 4 weeks.	CI) = -24.00 [-55.96, 7.96] • total sleep time, minutes, mean difference (95% CI) = 54.00 [-7.71, 115.71] • number of wakes per night, mean difference (95% CI) = -0.60 [-1.51, 0.31]	**Other information**

Study details	Participants	Interventions	Methods	Outcomes and Results	Comments
Source of funding Not specified.					
Full citation Wasdell, M. B., Jan, J. E., Bomben, M. M., Freeman, R. D., Rietveld, W. J., Tai, J., Hamilton, D., Weiss, M. D., A randomized, placebo-controlled trial of controlled release melatonin treatment of delayed sleep phase syndrome and impaired sleep maintenance in children with neurodevelopmental disabilities, Journal of Pineal Research, 44, 57-64, 2008 **Ref Id** 407040 **Country/ies where the study was carried out** The Netherlands **Study type** Randomised, placebo-controlled, double-blind, crossover trial. **Aim of the study** To determine the efficacy of controlled-release (CR)	**Sample size** 51 children entered the randomised crossover trial, but 50 completed the trial as one patient withdrew from the study due to an acute illness. **Characteristics** mean age at baseline = 7.38 years (range 2.05 - 17.81) **Inclusion criteria** • age between 2 and 18 years • multiple neurodevelopmental disabilities • chronic delayed sleep phase syndrome or impaired sleep maintenance (longer than 1.5 yr) **Exclusion criteria** • mild sleep difficulty • sleep difficulty not associated with daytime symptoms of insomnia	**Interventions** CR-melatonin 5 mg a day.	**Details** The crossover trial consisted of 10 days of treatment, followed by a placebo washout for 3-5 days, followed by 10 days of the alternate treatment. Patients were randomly assigned by the hospital pharmacy to receive either melatonin or placebo first. A blocked randomization method was employed in which every four patients had equal probability of receiving either the two treatment sequences.	**Results** • sleep latency, measured by sleep diaries in minutes, mean difference (95% CI) = -32.70 [-46.75, -18.65] • sleep latency, measured by actigraphy in minutes, mean difference (95% CI) = -24.26 [-37.84, -10.68] • total sleep time, measured by sleep diaries in minutes, mean difference (95% CI) = 31.17 [-2.92, 65.26] • total night sleep measured by actigraphy in minutes, mean difference (95% CI) =23.72 [-9.88, 57.32] • number of wakes per night, mean difference (95% CI) = -0.04 [-0.47, 0.39] • number of wakes per night, mean difference (95% CI) = 0.45 [-1.56, 2.46]	**Limitations** Low risk of bias. **Other information**

Study details	Participants	Interventions	Methods	Outcomes and Results	Comments
melatonin in the treatment of delayed sleep phase syndrome and impaired sleep maintenance in children with neurodevelopmental disabilities. **Study dates** September 2002 to May 2004. **Source of funding** this study was sponsored as an investigator-initiated trial by Circa Dia BV.	• had a progressive degenerative neurologic disorders, or life-threatening illness				
Full citation Lloyd, Claire, Logan, Stuart, McHugh, Camilla, Humphreys, Ginny, Parker, Sallie, Beswick, Donna, Beswick, Mark, Rogers, Morwenna, ThompsonCoon, Joanna, Morris, Christopher, Wyatt, Katrina, Sleep positioning for children with cerebral palsy, Cochrane Database of Systematic Reviews, 2014 **Ref Id** 342687	**Sample size** 2 cross-over trials with a total of 21 participants were included (Hill 2009; Underhill 2012). **Characteristics** Both studies were conducted in Southern England and used a randomised order of treatment. 21 children with cerebral palsy aged 5 to 16 years · 12 boys, 9 girls · GMFCS levels III to V Established users of sleep positioning systems **Inclusion criteria**	**Interventions** Overnight use of any commercially manufactured whole body sleep positioning system, applied in any setting.	**Details** Hill 2009 measured outcomes in relation to sleep quality using polysomnography and video recording. Underhill 2012 assessed sleep quality by Actigraph and pain by parent-report using the PPP.	**Results** <u>Sleep latency</u> No statistically significant difference whether sleeping in the sleep positioning system or not. <u>Sleep efficiency</u> No statistically significant difference whether sleeping in the sleep positioning system or not.	**Limitations** The review includes cross-over trails, both with high risk of bias, given by unclear random sequence generation, no information on blinding of assessors, reporting bias. **Other information**

Study details	Participants	Interventions	Methods	Outcomes and Results	Comments
Country/ies where the study was carried out **Study type** Systematic review **Aim of the study** to determine whether commercially-available sleep positioning systems, compared with usual care, reduce or prevent hip migration in children with CP. Secondary objectives included to determine the effect of sleep positioning systems on sleep patterns and quality. **Study dates** databases were searched on 13 June 2012, 13 may 2014, and 3 December 2014. **Source of funding**	**Exclusion criteria**				
Full citation Appleton,R.E., Jones,A.P., Gamble,C., Williamson,P.R., Wiggs,L., Montgomery,P., Sutcliffe,A., Barker,C., Gringras,P., The use of	**Sample size** A total of 275 children were screened to enter the trial at T–4W; 263 (96%) children were registered and completed the 4- to 6-week behaviour therapy period and 146 (56%) of these children were	**Interventions** The active compound (melatonin, Alliance Pharmaceuticals) and the placebo (matching in package and appearance) were	**Details** At randomisation, children were allocated to receive either active melatonin (Alliance Pharmaceuticals) or matching placebo	**Results** • Total night-time sleep, measured by sleep diaries, mean (95% CI) = 27.91 [4.09, 51.73]	**Limitations** Low risk of bias.

Study details	Participants	Interventions	Methods	Outcomes and Results	Comments
melatonin in children with neurodevelopmental disorders and impaired sleep: A randomised, double-blind, placebo-controlled, parallel study (mends), Health Technology Assessment, 16, 1-239, 2012 **Ref Id** 324109 **Country/ies where the study was carried out** United Kingdom **Study type** health technology assessment **Aim of the study** The primary outcome was to determine whether or not immediate-release melatonin is beneficial compared with placebo in improving total sleep time in children with neurodevelopmental problems. **Study dates** The first patient registered was on 11 December 2007, the first patient randomised was on 28 January 2008, the last patient registered was on	randomised at T0W, of whom 110 (75%) contributed data for the primary outcome. **Characteristics** Participants ranged in age between 37 and 186 months, with the mean age being slightly lower in the placebo group. **Inclusion criteria** • Children aged from 3 years to 15 years and 8 months at screening. • Children with a neurodevelopmental disorder diagnosed by a community paediatrician, paediatric neurologist or paediatric neurodisability consultant. • Children with an Adaptive Behaviour Assessment System (ABAS) questionnaire score with a percentile rank <7. • Children with a reported minimum 5-month history of impaired sleep at screening as defined by: – not falling asleep within 1 hour of 'lights off ' or 'snuggling down to sleep' at ageappropriate times for the child in three nights out of five and/or – Less than 6 hours of continuous sleep in three nights out of five. • Children whose parents were likely to be able to use the actigraph and complete sleep diaries. • Children who were able to comply with taking the study drug.	administered 45 minutes before the child's usual bedtime; whenever possible, this time remained the same throughout the study.	capsules in doses of 0.5mg, 2mg, 6mg and 12mg for a period of 12 weeks. The starting dose was 0.5mg and the dose could be escalated through 2mg and 6mg to 12mg at weekly intervals during the first 4 weeks at the end of which the child was maintained on that dose. The decision to increase the dose was based on a review of set criteria. The dose could also be reduced if the patient's parents/carers felt that the child was experiencing any unwanted side effects from the medication.	• Total night-time sleep, measured by actigraphy, mean (95% CI) = 7.37 [-22.22, 36.96] • sleep latency, measured by sleep diaries, mean (95% CI) = -37.44 [-58.78, -16.10] • sleep latency, measured by actigraphy, mean (95% CI) = -54.61 [-82.99, -26.23] • night wakes, measured by CDSI score, mean (95% CI) = -1.17 [-2.06, -0.28]	**Other information**

Study details	Participants	Interventions	Methods	Outcomes and Results	Comments
7 May 2010 and the last patient randomised was on 4 June 2010. **Source of funding** Funding for this study was provided by the Health Technology Assessment programme of the National Institute for Health Research.	• Families who were English speaking. **Exclusion criteria** • Children treated with melatonin within 5 months of screening. • Children who had been taking a benzodiazepine (other than as the child's rescue or emergency medication for epilepsy) or other psychoactive drug for < 2 months • Children receiving a beta-blocker (minimum of 7 days' washout required). • Children receiving a sedative or hypnotic drug, including choral hydrate, triclofos and alimemazine tartrate (Vallergan®, Sanofi-Aventis) (minimum of 14 days' washout required). • Children with a known allergy to melatonin. • Children with a regular consumption of alcohol (more than three times per week). • Children for whom there are suggestive symptoms of obstructive sleep apnoea syndrome (OSAS) (such as combinations of snoring, gasping, excessive sweating or stopping breathing during sleep), physical signs supportive of OSAS (such as very large tonsils/very small chin) or results of investigations suggesting OSAS (such as overnight pulse oximetry or polysomnography), for which the child should be referred to appropriate respiratory or ear, nose and throat				

Study details	Participants	Interventions	Methods	Outcomes and Results	Comments
	colleagues for specific assessment and treatment. • Girls or young women who were pregnant at the time of screening (T–4W). • Children who are currently participating in a conflicting clinical study or who have participated in a clinical study involving a medicinal product within the last 3 months.				

I.21 Assessment of mental health problems

<table>
<tr><th>Bibliographic details</th><th>Number of participants and participants characteristics</th><th>Test characteristics</th><th>Results</th><th>Comments</th></tr>
<tr>
<td>Full citation

Beckung,E., White-Koning,M., Marcelli,M., McManus,V., Michelsen,S., Parkes,J., Parkinson,K., Thyen,U., Arnaud,C., Fauconnier,J., Colver,A., Health status of children with cerebral</td>
<td>Sample size
N= 818

Characteristics

• 10.4 years, 1.5 SD, range 7.7-13.6
• 59% (n=483) were male; 41% (n=334) were female
• Severity of functional disability-GMFCS
levels: 31% (n=271) level I, 20% (N=</td>
<td>Details

• CHQ is a measure of the physical and psychological health of children 5 years of age and older.

• The conceptual framework of the CHQ is that health is constructed from two unique yet complementary dimensions of physical and psychosocial well-being and deficits in either dimension.</td>
<td>Results
Univariate analysis of association between the domain scores and gross motor function (GMFCS)
<table>
<tr><td>CHQ

Dimension</td><td>GMFCS I</td><td>II</td><td>III</td><td>IV</td><td>V</td><td>P</td></tr>
<tr><td>Physical

functioning</td><td>94</td><td>94</td><td>100</td><td>78</td><td>46</td><td>0.0001</td></tr>
<tr><td>Bodily

pain</td><td>80</td><td>70</td><td>70</td><td>60</td><td>60</td><td>0.0001</td></tr>
</table>
</td>
<td>Limitations

Other information
Authors were concerned that questions from the Physical Functioning scale (limitations in walking a distance in one block, playing soccer and riding a bike) might be inappropriate to families with children with very severely impaired mobility skills. They explained that in advance for the</td>
</tr>
</table>

<table>
<tr><th>Bibliographic details</th><th>Number of participants and participants characteristics</th><th>Test characteristics</th><th>Results</th><th>Comments</th></tr>
<tr>
<td>palsy living in Europe: a multi-centre study, Child: Care, Health and Development, 34, 806-814, 2008

Ref Id

75762

Country/ies where the study was carried out

Sweden

Aim of the study
To describe the health status of children with cerebral palsy (CP) of all severities in Europe using the Child Health Questionnaire (CHQ).

Study dates
Not reported</td>
<td>164) level II, 17% (n=139) level III, 14% (n= 113) level IV, 18% (n=145) level V
• IQ: 23% (N=186) between 50 and 70: 30% (n=242) <70.
• Communication difficulties: 16% (n= 133) problems, but speech; 11% (n=98) alternative formal and 15% (n=123) no formal communication

Inclusion criteria
Not reported

Exclusion criteria
Not reported</td>
<td>• CHQ assesses physical functioning, behaviour, mental health, general health, social and family functioning, family cohesion, self-esteem, pain and the impact of health issues on parental time and emotions.

• Comprises 13-single and multi-item child health scales and was developed for children in the general population and for children with chronic conditions.

Scoring the physical and psychosocial measures involves three steps:

• The 10 domain scales are standardised using means and standard deviations from the combined general US population and 6 clinical samples.

• The scales are aggregated using weights (factor score coefficients) from the same normative and clinical datasets.

• The aggregate scores are standardised using a linear T-score transformation (mean of 50 and SD of 10)

Statistical method</td>
<td>
<table>
<tr><td>Behaviour</td><td>73</td><td>73</td><td>73</td><td>77</td><td>79</td><td>0.002</td></tr>
<tr><td>Mental health</td><td>75</td><td>75</td><td>75</td><td>75</td><td>75</td><td>0.96</td></tr>
<tr><td>Self-esteem</td><td>75</td><td>75</td><td>75</td><td>79</td><td>75</td><td>0.74</td></tr>
<tr><td>General Health</td><td>68</td><td>64</td><td>64</td><td>63</td><td>47</td><td>0.0001</td></tr>
<tr><td>Parent Impact-emotional</td><td>75</td><td>75</td><td>71</td><td>75</td><td>67</td><td>0.95</td></tr>
<tr><td>Parent impact-time</td><td>94</td><td>89</td><td>78</td><td>89</td><td>78</td><td>0.0001</td></tr>
<tr><td>Family activities</td><td>88</td><td>79</td><td>75</td><td>75</td><td>71</td><td>0.0001</td></tr>
<tr><td>Physical summary scale</td><td>51</td><td>47</td><td>49</td><td>41</td><td>32</td><td>0.0001</td></tr>
<tr><td>Psychosocial summary scale</td><td>49</td><td>49</td><td>50</td><td>52</td><td>52</td><td>0.04</td></tr>
</table>
</td>
<td>parents. The researcher was present when the parent filled out the questionnaire and could answer any questions about the meaning of any item.</td>
</tr>
</table>

<table>
<tr><th>Bibliographic details</th><th>Number of participants and participants characteristics</th><th>Test characteristics</th><th>Results</th><th>Comments</th></tr>
<tr><td>Source of funding
The study was funded by the European Union Research Framework 5 Programme. The German region joined later, funded by Bundersministerium für Gesundheit/German Ministry of Health and Stiftung für das Behinderte Kind/Foundation for the Disabled Child.</td><td></td><td>Statistical analyses were performed with Stata software (version 9.2) and the glamm program (Rabe-Hesketh). As the domain scores were not normally distributed, medians and inter-quartile ranges were reported and the Kruskal-Wallis non-parametric test was used to test for significant associations with impairment variables.</td><td></td><td></td></tr>
<tr><td>Full citation

Bjorgaas,H.M., Elgen,I., Boe,T., Hysing,M.,</td><td>Sample size
Of the 56 children in the present study, 47 completed the SDQ.</td><td>Details

• The SDQ consists of 25 items, of which four record problem domains, each including 5 items,</td><td>Results

SDQ and Psychiatric Disorder<table><tr><td></td><td>Sensitivity</td><td>Specificity</td><td>PPV</td><td>NPV</td></tr></table></td><td>Limitations
Limitations of the study as reported by the authors:</td></tr>
</table>

<table>
<tr><th>Bibliographic details</th><th>Number of participants and participants characteristics</th><th>Test characteristics</th><th>Results</th><th>Comments</th></tr>
<tr>
<td>Mental health in children with cerebral palsy: does screening capture the complexity?, Thescientificworldjournal, 2013, 468402-, 2013

Ref Id

315768

Country/ies where the study was carried out

Norway

Aim of the study

• To assess mental health problems in children with CP compared to population-based controls and to assess frequency and</td>
<td>Characteristics

• Mean age was 7 years and 3 months (87.6 months, SD 6.5)
• 64% (N=30) were boys
• Cerebral palsy subtype: 53% (N=25) bilateral, 38% (N=18) unilateral, 9% (N=4) ataxia/dyskinesia.
• GMFCS level: 81% (N=38) level I-II, 19% (N=9) level III-IV.
• 21% (N=10) presented with an intellectual disability.

Inclusion criteria
Inclusion criteria was not reported

Exclusion criteria
Exclusion criteria was not reported.</td>
<td>and one prosocial domain (scale) including 5 items. Each item can be answered with "not true", "somewhat true", or "certainly true" rated 0-2 for negatively worded items, and inversely 2-0 for positively worded items. The problem domains are hyperactivity problems, conduct problems, emotional problems and peer problems. Prosocial behaviour consists of items such as being helpful and kind. Combining the four problem subscales (0-10) computes the Total Difficulties Score (TDS) (0-40). The SDQ also includes a impact score (IS) which measures the impact of mental health problems. For each of the subscales, a score at or above the 90th percentile of the controls was defined as screened positive and a TDS at or above the 90th percentile as risk of having psychiatric disorder.

• The Schedule for Affective Disorders and Schizophrenia for School-Age Children (Kiddie-SADS) is a semistructured child psychiatric diagnostic interview designed to unveil psychiatric symptoms within the following groups of disorders: affective, anxiety, psychotic, eating, attention/hyperactivity, oppositional defiant, conduct, tics, substance abuse, and posttraumatic stress disorders, as</td>
<td>
<table>
<tr><td>Emotional symptoms
versus
emotional disorders</td><td>1.00</td><td>0.79</td><td>0.36</td><td>1.00</td></tr>
<tr><td>Conduct problems
Versus
conduct disorder/ODD</td><td>0.50</td><td>0.67</td><td>0.13</td><td>0.93</td></tr>
<tr><td>Hyperactivity problems
versus
ADHD/ADD</td><td>0.13</td><td>0.87</td><td>0.50</td><td>0.49</td></tr>
<tr><td>Total Difficulties Score
versus
any psychiatric disorder</td><td>0.85</td><td>0.55</td><td>0.71</td><td>0.73</td></tr>
<tr><td>Peer problems
versus
any psychiatric disorder</td><td>1.0</td><td>0.25</td><td>0.63</td><td>1.0</td></tr>
<tr><td>Impact score versus any psychiatric disorder</td><td>0.74</td><td>0.65</td><td>0.74</td><td>0.65</td></tr>
</table>
NPV= Negative Predictive Value, PPV = Positive Predictive Value, ADHD= Attention Deficit Hyperactivity Disorder, ADD = Attention Deficit Disorder.
</td>
<td>• The version of Kiddie-SADS used in the present study did not contain a section on austism spectrum disorder (ASD), which is a weakness since all children diagnosed with a psychaitric disorder were screen positive for peer problems.
• The SDQ algorithm for predicting psychiatric disorders was not used as they only had a single informant.
• Population included in the study was reduced.
• Children with GMFCS V and intellectual disability were not included.

Methodological limitations assessed using a critical appraisal of outcome measures checklist (Jerosch-Herold, 2005):

• The purpose of the study was clearly defined and focused on examining the measurement properties.
• The instrument is described ans there is a standard protocol for</td>
</tr>
</table>

Bibliographic details	Number of participants and participants characteristics	Test characteristics	Results	Comments
coexistence of symptoms. • To assess the ability of a mental health screening instrument (The Strenghts and Difficulties Questionnaire [SDQ]) to sufficiently detect prevalence and coexistence of mental health problems in children with CP, comparing SDQ findings to results from a diagnostic psychiatric interview (the Kiddie SADS) **Study dates** Study dates were not reported.		well as encopresis and enuresis. Diagnostic conclusions were drawn from the Diagnostic and Statistical Manual of Mental Disorders (DSM-IV). A psychiatric disorder was ascertained if criteria listed in the DSM-IV for each specific diagnosis were fulfilled, including severity and duration of specific symptoms. **Statistical method** • Sensitivity, specificity, PPV and NPV above 80% were regarded as high. Cross-tabulations and 90th percentile cutoff were used to calculate these parameters. • Screening efficiency of the SDQ-TDS in children with CP was assessed by comparing SDQ screen positives with children meeting criteria for a psychiatric disorder according to the Kiddie-SADS. • Mental health problems recorded using the SDQ were compared to psychiatric disorders (DSM-IV criteria) for the following symptom-disorder pairs: SDQ-emotional problems compared to emotional disorders, SDQ-hyperactivity problems compared to ADHD/ADD, and SDQ-conduct		administration and scoring is fully described • Not relevant whether the observers/testers are appropriately trained or certified. • The data were collected on an appropriate manner but may only be representative of the Norwegian population. • Power of the study was not reported, but sample size is estimated to be reduced. • The measure makes intrinsic sense. The measure sample the content/domain adequately. • No evidence of the test's construct validity in the CP population • No evidence of the test-retest reliability in the CP population. • The instrument captures clinical change. Overall quality based on methodological limitations: **low-moderate** **Other information**

Bibliographic details	Number of participants and participants characteristics	Test characteristics	Results	Comments
Source of funding The first author has received a research grant from the Western Health Region of Norway.		problems were compared to ODD and conduct disorders. The SDQ-TDS, SDQ- peer problems, and SDQ-impact scores were compared to psychiatric disorder.		• This study used a control group from The Bergen Child Study (BCS); which consisted of a large longitudinal population-based study involving all children (9155) with matching parent SDQ obtained from 6297 children. This data were collected when children were 7-9 years old. • The study also reported on the mental health for children with CP using mean scores of the SDQ compared with controls and the coexistent mental health symptoms in children with CP meeting criteria for a psychiatric disorder according to DSM-IV criteria assessed by Kiddie-SADS.
Full citation Parkes,J., White-Koning,M., Dickinson,H. O., Thyen,U., Arnaud,C.,	**Sample size** N=818 **Characteristics**	**Details** • The Strengths and Difficulties Questionnaire (SDQ) is a behavioural screening. It functions well at detecting emotional,	**Results** <u>Validation of the SDQ instrument:</u> • The coefficients were generally satisfactory (mean .69) and all coefficients were similar to the author's validation study (Goodman's, 2001) with the exceptions of the conduct domain which was lower (.46	**Limitations** Methodological limitations assessed using a critical appraisal of outcome measures checklist (Jerosch-Herold,2005):

Bibliographic details	Number of participants and participants characteristics	Test characteristics	Results	Comments
Beckung,E., Fauconnier,J., Marcelli,M., McManus,V., Michelsen,S.I., Parkinson,K., Colver,A., Psychological problems in children with cerebral palsy: a cross-sectional European study, Journal of Child Psychology and Psychiatry and Allied Disciplines, 49, 405-413, 2008 **Ref Id** 321782 **Country/ies where the study was carried out** United Kingdom	Children's age ranged between 8-12 years old. **Inclusion criteria** Children with a diagnosis of cerebral palsy, born 31 July to 1 April 1997 and resident in one of the geographical areas, were eligible to take part. **Exclusion criteria** Not reported.	conduct, attention deficit hyperactivity disorders. • The SDQ is suitable for children aged 4-16 years and the reference period for this standard version is 'the last six months of this school year'. • Contains 25 items based on four symptom scales (conduct, hyperactivity, emotion and peer problems) yielding a 'Total Difficulties Score' (TDS). This score represents the extent of behavioural and emotional symptoms and was dichotomised using established cut-offs into normal/borderline (TDS≤16) versus abnormal (TDS >16). Scores in this abnormal range provide a reasonable estimate of 'symptom caseness', although it should be noted that is not the same as 'psychiatric caseness'. • Additionally, there is a prosocial scale (not included in the total score) which reflects social competence and maturity. There is also an 'Impact supplement' (IS) which evaluates the overall, everyday distress experienced by the child and family related to the child's mental health problems. • It is possible to compute an 'impact score' using established cut-offs where a score of two or	compared to .63) and the prosocial behaviour domain which was higher (.81 compared to .65). • Convergent and divergent validity were checked using correlations between and within domains. All items were more strongly correlated to their own domain (scores calculated omitting the item under study) than to other domains of the SDQ, with three exceptions: item 5 '*often has temper tantrums or loses temper'* correlated more strongly with the Prosocial and Hyperactivity domain than its own domain (Conduct); item 7 '*generally obedient, usually does what adults request '* correlated more strongly with the Prosocial and Hyperactivity domain than with its own domain (Conduct); and item 11 *'has at least one good friend'* correlated more strongly with the prosocial domain than its own domain (Peer problems). • Confirmatory factor analysis then established that the main factors identified in the study data were consistent with the domains used. All 25 items loaded strongly onto the predicted factors, with only 2 items loading better onto additional factors: item 7 'generally obedient, usually does what adults request' loads more strongly onto the Prosocial and Hyperactivity factor than onto the Conduct factor (of which is part); and item 11 'has at least one good friend' loads more strongly onto the Prosocial factor than onto the Peer Problems factor (of which is part).	• The main purpose of the study was not to examine the measurement properties of the questionnaire. • Instrument is described and there is a standardise protocol for administration and scoring, which is fully described. • No relevant whether observer/tester were appropriately trained or certified. • Data were collected in an appropriate way and is representative of the population. • Sample size is adequate. • Measure makes intrinsic sense. • The measure samples the content/domain adequately. • Construct validity was reported using factor analysis.

Bibliographic details	Number of participants and participants characteristics	Test characteristics	Results	Comments
Aim of the study To describe the prevalence, type and severity of behavioural and emotional symptoms in 8-12-year-old children with cerebral palsy; to investigate predictors of these symptoms and to report in their impact on the child and family. **Study dates** Research Associates interviewed families at home during 2004-2005. **Source of funding**		more is indicative of significant social impairment. **Statistical method** • Validation of the SDQ was undertaken by examining **internal consistency** within countries and overall using **Cronbach's alpha.**		• Test-retest reliability was not reported. • Intertester reliability doesn't apply. • Instrument captures clinical change. Overall quality based on limitations: **moderate** **Other information** • Results of the study suggest that children and young people with greater functional impairment had a lower risk of presenting psychological problems. This may be partly an artefact due to the lack of sensitivity of the SDQ to psychological problems in more severely impaired children. Possible explanations for this suggest that children with more severe motor impairment may be less able to participate in poor behaviours and so are at a lower risk of conduct of hyperactivity disorders; or also that differences in functional ability are more

Bibliographic details	Number of participants and participants characteristics	Test characteristics	Results	Comments
M.White-Koning was funded by a research grant from APETREIMC-Foundation Motrice. The SPARCLE Study was funded by a grant from the European Union Framework 5. The German region joinded later, funded by Bundisministerium für Gesinshait/German Ministry of Health (GRR-58640-2/14) and stiftuing für das Behndarte kind/Foundation for the Disabled Clinic.				stressful for children with milder forms of cerebral palsy if they are more similar to they able-bodied peer than when these differences are greater, as in children with severe cerebral palsy. • This study used the same population as McCollough, 2009 and McCollough, 2008

<table>
<tr><th>Bibliographic details</th><th>Number of participants and participants characteristics</th><th>Test characteristics</th><th>Results</th><th>Comments</th></tr>
<tr>
<td>Full citation

McCullough, N., Parkes, J., White-Koning, M., Beckung, E., Colver, A., Reliability and validity of the Child Health Questionnaire PF-50 for European children with cerebral palsy, Journal of Pediatric Psychology, 34, 41-50, 2009

Ref Id

422879

Country/ies where the study was carried out

United Kingdom

Aim of the study
To evaluate the data quality, reliability</td>
<td>Sample size
A total of 1174 children were identified as potentially elegible; of these 85% (n=993) were traced and approached, and 70% (n=818) families participated.

Characteristics

• Children were between 8 and 12 years old
• 59% (n=484) were boys
• 31% (n=257) had GMFCS level I, 20% (n=164) had GMFCS level II, 17% (n=139) had GMFCS level III, 14% (n=113) had GMFCS level IV and 18% (n=145) had GMFCS level V.
• 47% (n=385) had none/ mild intellectual impairment (IQ>70), 23% (n=186) had a moderate intellectual imapirment (IQ 50-70) and 30%</td>
<td>Details

• The CHQ-PF50 has 13 single and multi-item scales that assess child health status over "the last four weeks", and a further global item assessing change in health "over the last year".Assess both physical and psychosocial well-being.

• Scales in the physical domain include physical funtioning, role/physical-social limitations, general health perceptions, and bodily pain.

• Scales in the psychosocial domain include role/social-emotional-behavioural, self-esteem, mental health, general behaviour, parental impact-time, and the family activities scale. It also includes a single item that assesses family cohesion.

• Responses are scored for each domain, producing a figure between 0 and 100, with higher scores indicating better health and well-being. Scales generate two summary scores, representing physical (PhS) health and psychosocial (PsS).</td>
<td>Results
Reliability

• Scale internal consistency

For the total sample, 3 scales had a α-value below the .70 threshold. In relation to "behaviour", internal consistency declined by GMFCS levels, being adequate for children in levels I and II, but decreasing to 0.32 for children in Level V. 5 scales had α-values .80 or higher. These scales were relatively stable across all levels of the GMFCS.

<table>
<tr><td>CHQ domain</td><td colspan="6">Scale reliability by GMFCS level</td></tr>
<tr><td></td><td>I</td><td>II</td><td>III</td><td>IV</td><td>V</td><td>Total sample</td></tr>
<tr><td>Mental health</td><td>0.77</td><td>0.63</td><td>0.70</td><td>0.76</td><td>0.69</td><td>0.72</td></tr>
</table>

Construct validity</td>
<td>Limitations
Limitations as reported by the study authors':

• The study included parent report alone. Child self-report (where possible) may have produced different findings.
• It is unknown the extent to which some parents have responded to the CHQ interpreting questions about the child's "health" to mean the same as their child's "disability", whereas other may have perceived and reported on these concepts separately leading to a lower response rates, inconsistencies in reporting and ultimately factors failing to emerge in the final analysis.
• 37% of the families traced did not take part in the study (a total of 24% actually refused). There was significant heterogeneity between regions in terms of response rates, but authors were unable to record other individual or</td>
</tr>
</table>

Bibliographic details	Number of participants and participants characteristics	Test characteristics	Results	Comments
(scale internal consistency), and factor structure of the CHQ (parent form 50 items; PF50) in a representative sample of children with CP living in Europe, with a particular focus on how its performance varies by gross motor function. **Study dates** Families were interviewed between May 2004 and August 2005 **Source of funding** Study funded by the European Union Research	(n=242) presented with severe intellectual impairment (IQ<50). There was missing data for 0.6% (n=5) of the participants. **Inclusion criteria** • Children who were born in the designated geographical areas (North England, West Sweden,Northern Ireland, South East France, South West Ireland, East Denmark, Central Italy, South West France, North West Germany). • Children with date of birth between 31/07/1991 and 01/04/1997 (children over 8 years and under 12 years). **Exclusion criteria**	**Statistical method** • **Data quality** (missing item response, floor, and ceiling effects) was examined for both individual items and subscales with GMFCS level and for the sample overall. Percentile values were used to describe the extent of children with below and above average (25th and 75th percentile, respectively) physical and psychosocial summary scores. • **Scale internal consistency** was evaluated for all multi-item subscales of the CHQ by each level of the GMFCS, and for the total sample using Cronbachs ∝ coefficient, with a ∝-value of .70 or higher defined as an acceptable level. • An **exploratory factor analysis** (EFA) was conducted to identify a measurement model of the CHQ-PF50, were entered into a principle axis factor analysis using varimax rotation. Orthogonal rotation was chosen as in the original EFA. • **Factor analyses** were run for models with 6-13 factors, in order to determine if the 11 factor model as hypothesised by Landgraf,	• **Exploratory analysis for total CP sample** The exploratory factor analysis, based on the total sample, revealed a 32-item, seven-factor solution. Original factors that remained included "*physical functioning*"; "*role emotional behaviour*"; "*bodily pain"*; "*behaviour*"; "*self-esteem*"; "*general health*" and "*family activitie*s". Whilst the items that loaded onto these factors were consistent with the author, certain factors gained additional items whilst others lost items. The physical functioning scale gained an additional item "*limited in the kind of activity*" from the original *"role social physica*l" scale. The "*family activities*" factor also included a new item that originated from the "*parental impact time*" scale "*your child's emotional well-being or behaviour*". The "*family activities*" factor also lost 2 items "*caused tension and conflict*" and "*source of disagreements and arguments*". The "*behaviour*" factor lost 2 original items "*concentrate*" and "*stole*" and the "*general health*" factor lost one original item "*never seriously ill*". Factors that failed to emerge included "*role physical*", "*mental health*", "*parental impact-emotion*" and "*parental impact-time*". • **Confimatory factor analysis (CFA) and Subgroup Comparisons** CFA showed that the initial model identified in the EFA was an excellent fit across the total sample (X^2 = 705.024, df= 121, p<.001; CFI = 0.966, TLI = 0.986, RMSEA = 0.077), and confirmed a seven-factor structure. Fitting this initital model (M0) across the total sample without constraining any of the parameters to be equal was undertaken (X2 = 647.288, df= 201, p <.001; CFI =0.979, TLI =0.990, RMSEA = 0.074) followed by a nested other model (M1), but this time constraining factor loadings to be equal. This revealed that the model was not the same across ambulant and nonambulant groups (X^2 test for difference = 52.812, df=17, p <.001). Separate EFAs for both the ambulant and nonambulant groups did indeed have different factor structures, and subsequent CFAs confirmed the separate factor structures for children in the 2 groups. Both final CFA models showed an excellent fit as indicated by the TLI and CFI scores and an acceptable fit based on the RMSEA indices	societal factors associated with refusal to take part in the study. Methodological limitations assessed using a critical appraisal of **outcome measures checklist** (Jerosch-Herold,2005): • The main purpose of the study was to examine the measurement properties of the questionnaire. • Instrument is described and there is a standardise protocol for administration and scoring, which is fully described. • Not relevant whether observer/tester were appropriately trained or certified. • Data were collected in an appropriate way and is representative of the population. • Sample size is adequate. • Measure makes intrinsic sense. • The measure samples the content/domain adequately. • There is evidence of construct validity assessed by the groups-method, whereby scores

Bibliographic details	Number of participants and participants characteristics	Test characteristics	Results	Comments
Framework 5 Programme. The German region joined later, funded by Bundesministerium für Gesunsheit/German Ministry of health (GRR-58640-2/14) and Stifung für das Behinderte Kind/Foundation for the Disabled Child. *Conflicts of interest:* Dr Melanie White-Koning was privately engaged as a statistical consultant and received payment from The School of Nursing and Midwifery Research Unit Queens University Belfast.	• Born outside the specific dates of birth • Over 6 months. outside the specified age range on the interview date.	2006 had the cleanest factor structure. • The item loadings were then examined to identify problem items that were common across each of these 8 models. Items with primary factor loadings <.40, and secondary factor loadings > .30 were removed one at a time, with the factor analysis being rerun for 6-13 factors after each item removal. This procedure was carried out until a clean solution with primary loadings ≥.40 and secondary loadings ≤.30 was found.	(ambulant X^2 =316.984 df = 108, p <.001, CFI = 0.970, TLI = 0.987, RMSEA = 0.059 ; nonambulant X^2 = 431.463, df = 95, p< .0001, CFI = 0.982, TLI = 0.992, RMSEA = 0.066. 6 factors were consistently identified across both groups, with the additional factors "behavior" emerging uniquely among ambulant children and "parent-impact time" among non ambulant children. Nested models were used to test for measurement invariance to determine whether the final model found for the ambulant group might fit in the nonambulant group and whether the final model found for the nonambulant group might fit the ambulant group. For this purpose, the X^2 difference test between the model constraining factor loadings to be equal across groups and MA0 was statistically significant (X^2- test for difference = 74.254, df= 17, p <.0001) demonstrating measurement variance across groups. A similar conclusion was reached concerning the nonambulant model MNA0 with statitically significant X^2 difference test between the unconstrained and the constrained models (X^2-test for difference = 45.805, df= 15, p <.0001). Hence, neither the ambulant nor the nonambulant model can be used across both groups.	of the test are able to differentiate between groups of individuals (i.e. GMFCS levels) and assessed by factor analysis • There is no evidence of rest-retest reliability • Intertester reliability is not relevant for this questionnaire (i.e. is a self-administered questionnaire) • Instrument captures clinical change Overall quality based on limitations: **high** **Other information** • Data were available from the SPARCLE study (Colver, 2006), the aim of which is to establish the influence of environmental factors (social, attitudinal and physical) on participation and quality of life in 8- to 12- year old children with CP. • Inclusion and exclusion criteria and study dates were extracted in Dickinson, 2006

Bibliographic details	Number of participants and participants characteristics	Test characteristics	Results	Comments
				(http://www.ncbi.nlm.nih.gov/pmc/articles/PMC1636041/pdf/1471-2458-6-273.pdf) • **Floor and ceiling effects:** Overall, for the total sample was little evidence of floor effects. By GMFCS levels, floor effects were observed for children in level V, with 27% and 22% of children scoring the lowest possible score in the "physical functioning" and "role-physical" scales respectevely. Ceiling effects were present in a number of scales of the total sample. A consistently high proportion of the study sample exhibited floor and ceiling effects for the summary scales, not only evident among the total sample but also by GMFCS levels. For the physical summary score, the proportion of children exhibiting floor effects decreased as GMFCS levels increased; there was no evidence for a similar trend for the ceiling effects. Children with GMFCS levels I-III were "ambulant CP" and children with GMFCS

Bibliographic details	Number of participants and participants characteristics	Test characteristics	Results	Comments
				levels IV and V were "nonambulant CP" • **Data quality:** 40 items on the CHQ had <5% of missing responses, and 1 items had missing responses that ranged from 5% to 10%. The proportion of missing data for the summary scores increased by GMFCS level and was lowest for children in Level I and highest for children in level V (p ≤.001). On the psychosocial summary score, remarkably similar proportions of children exhibited floor and ceiling effects (around 40% and 55% respectively) for the overall sample and by GMFCS levels. • The sample included in this study is the same as in Parkes,2008 and McCollough, 2009
Full citation	**Sample size** n=1229	**Details** The **CHQ (PF50)** has 13 single- and multi-item scales across a	**Results**	**Limitations** Methodological limitations assessed using a critical

<table>
<tr><th>Bibliographic details</th><th>Number of participants and participants characteristics</th><th>Test characteristics</th><th>Results</th><th>Comments</th></tr>
<tr>
<td>McCullough, N., Parkes, J., Use of the child health questionnaire in children with cerebral palsy: a systematic review and evaluation of the psychometric properties, Journal of Pediatric Psychology, 33, 80-90, 2008

Ref Id

422910

Country/ies where the study was carried out

The systematic review was carried out in the United Kingdom. 10 of the included studies were</td>
<td>Characteristics

• 2-18 years
• The majority of children were described as having "moderate" to "severe"
• More than half of the subjects were male
• Most studies used the Gross Montor Function Classification System (GMFCS) to group children by severity (Fung et al, 2002; Houlihan et al 2004; Liptak et al, 2001; Samson-Fang, 2002; Schneider et al, 2001; Vargus-Adams, 2005,2006; Wake et al, 2003)

Inclusion criteria

• English-language studies</td>
<td>number of domains relating to "the last four weeks" with an additional global item assessing changes in health "over the last year". The CHQ PF-50 produces two summary scores that represent physical (PhS) and psychosocial (PsS) and responses are scored for each domain producing a figure betwen 0-100, with lower scores indicating poorer health and well-being.
The physical domain includes:

○ physical functioning scale (PF): assesses the presence and level of physical limitations due to ill health, the role/social limitations.
○ physical scale (RP): measures limitations in school and friend related activities as a consequence of physical health problems.
○ general health perceptions scale (GH): provides and overall subjective measure of health and illness
○ bodily pain scale (BP): evaluates the intensity of general pain.

The psychosocial domain of the CHQ includes:</td>
<td>
<table>
<tr><td>Study</td><td>Statistic</td><td></td><td></td></tr>
<tr><td>Reliability</td><td></td><td>MH</td><td>PsS</td></tr>
<tr><td>Internal consistency</td><td></td><td></td><td>-</td></tr>
<tr><td>McCarthy et al 2002</td><td>Cronbach ∝</td><td>0.81</td><td>-</td></tr>
<tr><td>Morales et al 2006</td><td>Cronbach ∝</td><td>0.60</td><td>-</td></tr>
<tr><td>Wake et al 2003</td><td>Cronbach ∝</td><td>∝ reported as ranging 0.75-0.97 across all scales</td><td></td></tr>
<tr><td>Validity</td><td></td><td></td><td></td></tr>
<tr><td>Concurrent</td><td></td><td></td><td></td></tr>
<tr><td>Vargus Adams, 2005</td><td>Kendalls'</td><td>-0.01</td><td>0.09</td></tr>
<tr><td>McCarthy et al 2002</td><td>Spearman partial (GMFM)</td><td>-0.12</td><td>-</td></tr>
</table>
</td>
<td>appraisal of outcome measures checklist (Jerosch-Herold,2005):

• The main purpose of the study was to examine the measurement properties of the questionnaire.

• Instrument is described and there is a standardise protocol for administration and scoring, which is fully described.

• No relevant whether observer/tester were appropriately trained or certified (self-administered questionnaire).

• Data were collected in an appropriate way and is representative of the population.

• Sample size is adequate.

• Measure makes intrinsic sense
• The measure samples the content/domain adequately.

• Construct validity was not reported.</td>
</tr>
</table>

<table>
<tr><th>Bibliographic details</th><th>Number of participants and participants characteristics</th><th>Test characteristics</th><th>Results</th><th>Comments</th></tr>
<tr>
<td>based in the US, 2 in Australia, and 1 in Brazil.

Aim of the study
To review the published studies that have applied the Child Health Questionnaire (CHQ) in children with CP and to evaluate the psychometric performance of the instrument in the CP population. The CHQ was employed as a measurement tool to describe children's health status (Liptak et al, 2001; Vargus-Adams, 2005, 2006; Wake et al, 2003); to explore the nature of the</td>
<td>• Papers applied exclusively to children with CP.

Exclusion criteria

• Studies which integrated children with a range of chronic conditions</td>
<td>• the role/social limitations-emotional/behavioural scale (REB): assesses restrictions in school and friend-related activities as a consequence of emotional/behavioural difficulties
• the self-esteem scale (SE): assesses satisfaction with school and athletic ability, looks/appearance, ability to get along with other and family and life overall
• the mental health scale (MH): assesses positive and negative states such as anxiety and depression
• general behaviour scale (BE): measures overt behaviour, etc.,
• parental impact-emotional (PE) and parental impact-time (PT) scales: assess parents level of distress and the reduction of personal time as a consequence of the child's illness
• the family activities scale (FA): considers the extent which the child's illness disrupts normal family activities.

There are 4 version of the CHQ. 6 studies used the CHQ (PF50 version) (Morales et al, 2006; Piripis & Graham, 2004; Vargus-Adams, 2005, 2006; Wake et al 2003; Wallen et al, 2004) All researchers used the parent form</td>
<td>
<table>
<tr><td></td><td>(PEDI) Mobility</td><td>-0.03</td><td>-</td></tr>
<tr><td></td><td>Self care</td><td>0.03</td><td>-</td></tr>
<tr><td></td><td>Scocial functioning</td><td>0.17</td><td>-</td></tr>
<tr><td></td><td>(PODCI) Mobility</td><td>-0.02</td><td>-</td></tr>
<tr><td></td><td>Arm func.</td><td>0.10</td><td>-</td></tr>
<tr><td></td><td>Pain</td><td>0.27</td><td>-</td></tr>
<tr><td>Morales et al 2006</td><td>Pearson's</td><td>-0.13</td><td>0.00</td></tr>
<tr><td>Discriminant</td><td></td><td></td><td>-</td></tr>
<tr><td>McCarthy et al 2002</td><td>MANOVA (F) (Physical)</td><td>3.2*</td><td>-</td></tr>
<tr><td></td><td>Cognitive</td><td>0.6</td><td>-</td></tr>
<tr><td>Morales et al 2006</td><td>MANOVA (F) (Physical)</td><td></td><td>-</td></tr>
<tr><td>Wake et al 2003</td><td>Independent t-test (p)</td><td>0.64</td><td>0.52</td></tr>
<tr><td></td><td>Epilepsy</td><td>0.14</td><td>0.15</td></tr>
<tr><td></td><td>Severity</td><td>0.67</td><td>0.33</td></tr>
</table>
*p<0.05; MH= mental health, PsS= psychosocial summary score.
</td>
<td>• Test-retest reliability was not reported.

• Intertester reliability doesn't apply to this questionnaire (is self-administered).

• Instrument captures clinical change.

Overall quality based on limitations: high

Other information

• This study used the same population as McCollough, 2009 and Parkes, 2008</td>
</tr>
</table>

Bibliographic details	Number of participants and participants characteristics	Test characteristics	Results	Comments
relationships between characteristics of CP and health status (Fung et al, 2002; Houlihan et al 2004; Samson-Fang et al,2002); to assess the outcomes of interventions (Wallen et al, 2004); to validate alternative questionnaires (McCarthy et al, 2002; Pirpiris & Graham , 2004; Schneider et al, 2001; Vitale et al, 2005); and to explore the psychometric performance of the CHQ in a CP population (McCarthy et al, 2002; Morales et al, 2006; Wake et al, 2003).		of the CHQ; and 6 administered the PF28 (Fung et al, 2002; Houlihan et al, 2004; Liptak et al, 2001; Vitale et al, 2005). A further study had utilised the PF98 version of the CHQ in conjuction with the Infant Toddler Health Questionnaire (ITHQ) (McCarthy et al, 2002), designed for young children. All researchers had used the parent form of the CHQ. **Statistical method** A literature search was carried out to identify studies that had utilised some or all domains of the CHQ in children with CP. Databases were searched between (January 1993-January 2007). Papers were also identified by hand-searching the reference lists of published papers <u>Statistical analysis used by the independent studies are as follows:</u> • Cronbach's alpha (∝) to report the internal consistency of the CHQ (McCarthy et al, 2002; Morales et al, 2006; Wake et al, 2003). • Spearman partial (McCarthy et al, 2002), Pearsons (Morales et al, 2006) and Kendall's (Vargus		

Bibliographic details	Number of participants and participants characteristics	Test characteristics	Results	Comments
Study dates Evidence last searched on January 2007. **Source of funding** Not reported		Adams, 2005) to report the concurrent validity of the tool. • MANOVA (McCarthy at al, 2002 and Morales et al, 2006), independent t-test (Wake et al, 2003) for reporting on the discriminant validity. • Pearson's (Morales et al, 2006) and revised multitrait analysis (%) (Wake et al 2003).		

I.22 Management of mental health problems

Study details	Participants	Interventions	Methods	Outcomes and Results	Comments
Full citation Whittingham, K., Sanders, M., McKinlay, L., Boyd, R. N., Child quality of life and parent psychological adjustment can be improved with Stepping	**Sample size** N= 67 parents of children with CP. **Characteristics** •Of the total number of parents, 97% were mothers	**Interventions** •Intervention SSTP (n=20): consisted of 6 (2 hour) group sessions plus 3 (30 minute) telephone consultations and was delivered by psychologists with accreditation in SSTP. SSTP sessions included strategies for building a positive parent-	**Details** <u>Design:</u> This 2-phase RCT had 3 groups (SSTP,SSTP+ACT, WL control). The first phase involved a comparison among all groups at postintervention. After postintervention assessment, the WL group was offered SSTP for ethical reasons. If WL	**Results** **ANCOVAS between the three groups at postintervention** / **Improvements SSTP + ACT (Linear contrasts SSTP + ACT and WL)** Child functional performance PEDI mobility scale / F=3.59, P=0.03 / -	**Limitations** **<u>NICE guidelines manual 2012: Appendix C: Methodology checklist: randomised controlled trials</u>** <u>A Selection bias</u> A1 - Was there appropriate randomisation - yes A2 - Was there

Study details	Participants	Interventions	Methods	Outcomes and Results	Comments
Stones Triple P and ACT: An RCT, Developmental medicine and child neurology, 56, 75, 2014 **Ref Id** 425077 **Country/ies where the study was carried out** Australia **Study type** RCT **Aim of the study** To investigate, via an RCT, whether the parenting intervention, Stepping Stones Triple P (SSTP) and parent Acceptance and Commitment Therapy (ACT) improves child functional performance,	(mean age 38.7 ± 7.1 years) •Among children, 64.2% were boys (mean age 5.3 ± 3 years). •GMFCS levels: I = 22% (N=15) ; II = 27% (N=18); III = 18% (N=12); IV= 27% (N=18), V= 6% (N=4) **Inclusion criteria** •Children with a diagnoses of CP (children with additional diagnoses were still considered) •Parents who must self-identify as having the potential to benefit from a parenting intervention. Any of the following are considered good reasons to participate in a parenting intervention: (1)	child relationship, encouraging desirable behaviour, teaching new skills and behaviours, managing misbehaviour, and managing high-risk situations. Parents made specific goals for change and were supported in enacting plans for managing challenging parenting situations. •Intervention SSTP + ACT (n=23): the ACT sessions (two 2-hour group sessions) preceded SSTP. ACT sessions included indentifying values, mindfulness, cognitive defusion (distancing from thoughts), acceptance of emotions, and making specific goals for acting on values. •Waiting list (WL) (n=22)	families completed SSTP, then they also completed additional post-intervention assessment, along with 6-month follow up assessment. The second phase of the study examined effects at follow-up and included a pre-post design component, examining the retentions effect from post-intervention to 6-month follow-up, as well as comparison between families who received SSTP and families who received SSTP with ACT at 6-month follow-up. Sample size calculations: Were based on the primary outcome: child behaviour. An effect size of 0.25 was assumed because it is consistent with a clinically important difference of 0.5 SD and is comparable to the effect size for SSTP obtained with families of children with ASD, n2 = 0.27. This leads to a total sample size of 98 (power 0.8, 2-tailed, P = 5) and 110	CP-QOL acceptance: F=3.35, P=0.04; -9.01, P=0.03 CP-QOL functioning: F=3.20, P=0.05; -8.72, p= 0.015 DASS depression: F=3.08, P=0.05; 5.33, p = 0.017 DASS stress: F=3.53, P=0.03; 5.50, p=0.014	adequate concealment - yes A3 - Were groups comparable at baseline - yes Level of bias: Low B Performance bias B1 - Did groups get same level of care - yes B2 - Were participants blinded to treatment allocation- unclear B3 - Were individuals administering care blinded to treatment allocation - unclear Level of bias: **unclear/unknown risk** C Attrition bias C1 - Was follow-up equal for both groups - Yes C2 - Were groups comparable for dropout - Yes C3 - Were groups comparable for missing data -yes Level of bias: Low D Detection bias D1 - Was follow-up appropriate length - Yes (6 months) D2 - Were outcomes defined precisely - yes

Study details	Participants	Interventions	Methods	Outcomes and Results	Comments
child quality of life and parental psychological adjustment in families of children with Cerebral Palsy (CP). **Study dates** Not reported. **Source of funding** This work was supported by a National Health and Medical Research Council postdoctoral fellowship to Dr. Whittingham; a National Health and Medical Research Council career development fellowship to Dr. Boyd and a Smart State Fellowship to Dr. Boyd.	to learn how to manage behaviour problems, (2) to learn how to manage developmental issues, (3) to learn assertive discipline, (4) to develop a closer relationship to their child, (5) to learn how to teach their child new skills and behaviours, (6) to build parenting confidence or (7) to better manage parenting stress. **Exclusion criteria** •Families where the parental role is only temporary (e.g. short-term foster placements) •Families where the CP diagnosis is still being sought were excluded		accounting for attrition. This was not obtained. <u>Randomisation method:</u> Randomisation process was completed by computerised sequence generation with block randomization to ensure equal (or near equal) allocation of participants to groups. The group allocations were placed inside sealed, and numbered envelopes by a staff member not involved in the study. On enrolment of a family, the study coordinator opened the next envelope in sequence. Each study participant was randomised to 1 of 3 groups. <u>Outcomes:</u> •Child functional performance as measured by the Paediatric Evaluation of Disablity Inventory (PEDI)		D3 - Was a valid and reliable method used to assess outcome - Yes D4 - Were investigators blinded to intervention - unclear D5 - Were investigators blinded to confounding factors - unclear Level of bias: unclear/unknown risk Indirectness Does the study match the review protocol in terms of: •Population: yes (but only few participants with severe CP). •Intervention: yes (intervention delivered as per protocol in all sessions with the exception that in 8.19% of sessions some aspect of the SSTP DVD was not played owing to technical difficulties or time management. In all circumstances, the content of the SSTP DVD was still deliveres verbally). Protocol delivery was rated by a second therapist for 50.81% of sessions with 100% agreement with the primary therapist. •Outcomes: yes

Study details	Participants	Interventions	Methods	Outcomes and Results	Comments
Potential conflicts of interest: Stepping Stones Triple P is owned by the University of Queensland and sublicensed to Uniquest, the University of Queensland's Technology Transfer Company. As co-author of the Stepping Stones Triple P program, Dr. Sanders receives royalty payments from Triple P International, in accordance with the University of Queensland Intellectual Property Policy; the other authors have indicated they have no financial relationships relevant to this article to disclose.	until the diagnoses was confirmed		•Parental psychological adjustment measured by the Depression Anxiety Stress Scale (DASS) •Child quality of life as measured by the the Cerebral Palsy Quality of Life Scale (CP-QOL, parent report) Statistical analysis: A series of ANCOVAS with linear contrasts were conducted (SPSS 17). Follow-up: 6-month follow-up		•Indirectness: **Other information** •Data extraction done with a structured abstract. Full version not available. •Whittingham 2014 and the present study used the same population and intervention, but not the same outcome measures thus results vary. •Information regarding source of funding, details about interventions and inclusion and exclusion criteria was obtained from Whittingham, 2014 and Whittingham, 2013 (protocol of Whittingam, 2014) . Whittingham, 2014 was also necessary to assess the risk of bias. •Only significant results were reported

<table>
<tr><th>Study details</th><th>Participants</th><th>Interventions</th><th>Methods</th><th>Outcomes and Results</th><th>Comments</th></tr>
<tr><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr>
<td>Full citation

Whittingham, K., Sanders, M., McKinlay, L., Boyd, R. N., Interventions to reduce behavioral problems in children with cerebral palsy: An RCT, Pediatrics, 133, e1249-e1257, 2014

Ref Id

422831

Country/ies where the study was carried out

Australia

Study type
RCT

Aim of the study
To test the efficacy of Stepping Stones Triple</td>
<td>Sample size
N= 67 parents of children with CP.

Characteristics

•Of the total number of parents, 97% were mothers (mean age 38.7 ± 7.1 years)
•Among children, 64.2% were boys (mean age 5.3 ± 3 years)
•GMFCS levels: I = 22% (N=15) ; II = 27% (N=18); III = 18% (N=12); IV= 27% (N=18), V= 6% (N=4)

Inclusion criteria

•Children with a diagnoses of CP (children with additional</td>
<td>Interventions

•Intervention SSTP (n=20): consisted of 6 (2 hour) group sessions plus 3 (30 minute) telephone consultations and was delivered by psychologists with accreditation in SSTP. SSTP sessions included strategies for building a positive parent-child relationship, encouraging desirable behaviour, teaching new skills and behaviours, managing misbehaviour, and managing high-risk situations. Parents made specific goals for change and were supported in enacting plans for managing challenging parenting situations.
•Intervention SSTP + ACT (n=23): the ACT sessions (two 2-hour group sessions) preceded SSTP. ACT sessions included indentifying values, mindfulness,</td>
<td>Details
<u>Design:</u>
This 2-phase RCT had 3 groups (SSTP,SSTP+ACT, WL control). The first phase involved a comparison among all groups at postintervention. After postintervention assessment, the WL group was offered SSTP for ethical reasons. If WL families completed SSTP, then they also completed additional post-intervention assessment, along with 6-month follow up assessment. The second phase of the study examined effects at follow-up and included a pre-post design component, examining the retentions effect from post-intervention to 6-month follow-up, as well as comparison between families who received SSTP and families who received SSTP with ACT at 6-month follow-up.</td>
<td>Results
Linear contrasts identifying group differences at postintervention between WL and SSTP, WL and SSTP + ACT, and SSTP + ACT and Omnibus ANCOVA at 6-month Follow-up.
<table>
<tr><th>Variable</th><th>Mean Difference between WL and SSTP</th><th>Mean Difference between WL and SSTP+ACT</th><th>Mean Difference between SSTP and SSTP + ACT</th><th>F SSTP and SSTP + ACT at 6 Month Follow-up</th></tr>
<tr><td>ECBI Intensity</td><td>15.43 (0.78 to 30.08) P=.04</td><td>24.12 (10.22 to 38.03) P=.003*</td><td>8.69 (-5.65 to 23.04) P=.23</td><td>2.61, P=.12</td></tr>
<tr><td>SDQ Emotional symptoms</td><td>1.33 (0.45 to 2.21) P=.004*</td><td>0.37 (-0.46 to 1.21) P=.371</td><td>-0.95 (-1.81 to - 0.09) P=.03</td><td>0.00, P=.93</td></tr>
<tr><td>SDQ Conduct Problems</td><td>0.85 (-0.23 to 1.72) P=.056</td><td>0.43 (-0.41 to 1.26) P=.310</td><td>-0.42 (-1.28 to 0.44) P=.332</td><td>0.00, P=.93</td></tr>
<tr><td>SDQ Hyperactivity</td><td>0.73 (-0.40 to 1.86) P=.203</td><td>1.66 (0.55 to 2.77) P=.004*</td><td>0.93 (-0.17 to 2.04) P=.097</td><td>7.29, P=.012*</td></tr>
<tr><td>SDQ Peer problems</td><td>0.77 (-0.10 to 1.65) P= .083</td><td>0.64 (-0.18 to 1.46) P= .122</td><td>-0.13 (-0.98 to 0.61) P=.754</td><td>1.58, P= .22</td></tr>
<tr><td>SDQ Prosocial</td><td>-0.44 (-1.68 to 0.78) P=.470</td><td>-0.16 (-1.33 to 0.78) P=.784</td><td>0.29 (-0.91 to 1.49) P=.634</td><td>1.19, P=.28</td></tr>
<tr><td>SDQ Impact</td><td>0.67 (-1.14 to 2.50) P=.230</td><td>1.00 (-0.66 to 2.67) P=.230</td><td>0.33 (-1.42 to 2.07) P=.707</td><td>1.43, P=.25</td></tr>
</table>
</td>
<td>Limitations
<u>NICE guidelines manual 2012: Appendix C: Methodology checklist: randomised controlled trials</u>:

<u>A Selection bias</u>

A1 - Was there appropriate randomisation - yes
A2 - Was there adequate concealment - yes
A3 - Were groups comparable at baseline - yes
Level of bias: Low

<u>B Performance bias</u>

B1 - Did groups get same level of care - yes
B2 - Were participants blinded to treatment allocation- unclear
B3 - Were individuals administering care blinded to treatment allocation - unclear
Level of bias: unclear/unknown risk

<u>C Attrition bias</u>

C1 - Was follow-up</td>
</tr>
</table>

Study details	Participants	Interventions	Methods	Outcomes and Results	Comments
P (SSTP), with and without Acceptance and Commitment Therapy (ACT), in targeting child behavioural and emotional problems and dysfunctional parenting in families of children with CP. **Study dates** Not reported **Source of funding** This work was supported by a National Health and Medical Research Council postdoctoral fellowship to Dr. Whittingham; a National Health and Medical Research Council career	diagnoses were still considered) •Parents who must self-identify as having the potential to benefit from a parenting intervention. Any of the following are considered good reasons to participate in a parenting intervention: (1) to learn how to manage behaviour problems, (2) to learn how to manage developmental issues, (3) to learn assertive discipline, (4) to develop a closer relationship to their child, (5) to learn how to teach their child new skills and behaviours, (6) to build parenting confidence or (7) to better manage parenting stress.	cognitive defusion (distancing from thoughts), acceptance of emotions, and making specific goals for acting on values. •Waiting list (WL) (n=22)	<u>Sample size calculations:</u> Were based on the primary outcome: child behaviour. An effect size of 0.25 was assumed because it is consistent with a clinically important difference of 0.5 SD and is comparable to the effect size for SSTP obtained with families of children with ASD, $n^2 = 0.27$. This leads to a total sample size of 98 (power 0.8, 2-tailed, P = 5) and 110 accounting for attrition. This was not obtained. <u>Randomisation method:</u> Randomisation process was completed by computerised sequence generation with block randomization to ensure equal (or near equal) allocation of participants to groups. The group allocations were placed inside sealed, and numbered envelopes by a staff	PS Laxness: 0.39 (-0.14 to 0.93) P=.14; 0.42 (-0.09 to 0.92) P=.10; 0.02 (-0.49 to 0.54) P=.14; **4.83, P=.038*** PS Overreactivity: 0.27 (-0.18 to 0.72) P=.24; **0.60 (0.16 to 1.04) p =.008***; 0.33(-0.10 to 0.77) P=.13; 1.11, P=.30 PS Verbosity: 0.50 (-0.03 to 1.04) P=.06; **0.68 (0.17 to 1.20) P=0.1***; 0.18 (-0.36 to 0.72) P=.51; **10.70, P=.003*** Values are MD (CI); *, significant	equal for both groups - Yes C2 - Were groups comparable for dropout - Yes C3 - Were groups comparable for missing data -yes Level of bias: Low <u>D Detection bias</u> D1 - Was follow-up appropriate length - Yes (6 months) D2 - Were outcomes defined precisely - yes D3 - Was a valid and reliable method used to assess outcome - Yes D4 - Were investigators blinded to intervention - unclear D5 - Were investigators blinded to confounding factors - unclear Level of bias: unclear/unknown risk Indirectness Does the study match the review protocol in terms of ○Population: yes (but only few participants with severe CP).

Study details	Participants	Interventions	Methods	Outcomes and Results	Comments
development fellowship to Dr. Boyd and a Smart State Fellowship to Dr. Boyd. Potential conflicts of interest: Stepping Stones Triple P is owned by the University of Queensland and sublicensed to Uniquest, the University of Queensland's Technology Transfer Company. As co-author of the Stepping Stones Triple P program, Dr. Sanders receives royalty payments from Triple P International, in accordance with the University of Queensland Intellectual Property Policy; the other authors have indicated they have no	**Exclusion criteria** •Families where the parental role is only temporary (e.g. short-term foster placements) •Families where the CP diagnosis is still being sought were excluded until the diagnoses was confirmed		member not involved in the study. On enrolment of a family, the study coordinator opened the next envelope in sequence. Each study participant was randomised to 1 of 3 groups. Outcomes: •Child behavioural and emotional problems as measured by the Eyberg Child Behaviour Inventory (ECBI), which produces 2 scales (the intensity and the problem scales) and the Strenghts and Difficulties Questionnaire (SDQ), which produces 5 subscales (emotional symptoms, conduct problems, innatention/hyperactivity, peer problems, and prosocial behaviour). •Parenting style as measured by the Parentig Scale (PS), which is a measure of		○Intervention: yes (intervention delivered as per protocol in all sessions with the exception that in 8.19% of sessions some aspect of the SSTP DVD was not played owing to technical difficulties or time management. In all circumstances, the content of the SSTP DVD was still deliveres verbally). Protocol delivery was rated by a second therapist for 50.81% of sessions with 100% agreement with the primary therapist. ○Outcomes: yes ○Indirectness **Other information** •Information about inclusion and exclusion criteria was extracted from "Stepping Stones Triple P and Acceptance and Commitment Therapy for Parents of Children with Cerebral Palsy: Trial Protocol" (Whittingham et al 2013).

Study details	Participants	Interventions	Methods	Outcomes and Results	Comments
financial relationships relevant to this article to disclose.			3 dysfunctional discipline styles laxness, overreactivity, and verbosity. <u>Statistical analysis:</u> •In the first phase of the study, ANCOVAs were used for comparing all groups at postintervention, with preintervention scores as a covariate. Significant results were followed-up with linear contrasts examining group-by-group differences. A Bonferroni correction was applied to linear contrasts to correct for multiple comparisons, resulting in a P value of .0167. A sensitivity analysis was conducted with the last observation carried forward for all participants who failed to complete the postintervention assessment. •In the second phase of the study, a pre-post examination of the retention of the intervention effect		

Study details	Participants	Interventions	Methods	Outcomes and Results	Comments
			from postinterventio to 6-moth follow-up was tested with a series of t-tests. A comparison between families who received and families who received SSTP+ACT at 6-month follow-up was conducted via a series of ANCOVAs with preintervention scores as a covariate. All WL families received SSTP alone except 1 that received SSTP with ACT. Follow-up: 6-month follow-up		

I.23 Management of sensory and perceptual difficulties

Study details	Participants	Interventions	Methods	Outcomes and Results	Comments
Full citation Bumin,G., Kayihan,H., Effectiveness of two different	**Sample size** N= 41. Children were randomly divided into 3 groups. The first group, in which the	**Interventions** Group and individual SPM training was applied according to the treatment protocol: (1)	**Details** The total number of children were randomly assigned to the different groups considering their date of	**Results** **Statistical analyses for SCSIT test for IND group** (mean differences, SD); P; (ES): DTS (-2.50 ± 3.31); P= 0.009; ES= 4.66 ; LTS (total) (6.77± 4.73); p= 0.00; ES = -6.98; GRA (total) (-3.38 ± 2.03); P= 0.00; ES= 4.17; KIN (total) (.17.72 ± 13.75); P=0.00;ES=13.90; FI (-1.19± 1.64); P=0.011; ES=2.22; MFP (-0.13 ± 0.50); P=0.33; ES=0.68;	**Limitations** **Methodological limitations assessed using the Quality Assessment Tool for Quantitative studies (Effective**

Study details	Participants	Interventions	Methods	Outcomes and Results	Comments
sensory-integration programmes for children with spastic diplegic cerebral palsy, Disability and Rehabilitation, 23, 394-399, 2001 **Ref Id** 75794 **Country/ies where the study was carried out** Turkey **Study type** Quantitative study with pre/post-test design **Aim of the study** To compare the effects of individual	training was delivered individually, had 16 participants (IND), the second group, in which the training was provided in groups (GRP), had 16 participants. The third group was determined as a control group (n=9). **Characteristics** • All children were diagnosed with spastic diplegic CP. • IND group; mean age = 7.06; SD =1.88; 50% (n=8) of participants were female. • GRP group; mean age = 7.68; SD = 1.70;	sensory systems input activities (wheelbarrow, hand walk, swimming/drying off); 2) activities for body awareness (window game, body pushing); 3) vestibular system activities (swing, jumping on a trampoline, climbing the wall bar); 4) tactile system activities (sterognosis training, textured road); motor planning activities (statue spinning, mystery writing); 6) balance and postural responses activities (balance activities used were: two kneed and two hands, two hand and one foot, two elbows and one knee,	admittance to the clinic. SPM training was applied with each child individually to the first group (IND). In the second group (GRP), children were grouped into 4 subgroups, each of which composed of 4 children. The third group was selected as the control group in order to evaluate the efficiency of individual and group therapy. All children were assessed individually with the following measures: • The Ayres Southern California Sensory Integration Test (SCSIT) was used to assess sensory integration problems. Position in space (PS), design	DC (-2.13± 1.71); P=0.00; ES=2.51 ; PS (-1.81± 1.22); P=0.00; ES=2.15; IP (-2.44± 2.06); P=0.00; ES=2.76; MAC (10.15± 17.42); P=0.03; ES= -5.42; RLD (-2.94± 3.30); P=0.003; ES= 3.50 **Statistical analyses for PAT test for IND group** (mean differences, SD); P; (ES): PAT (-11.25± 24.30); P=0.008; ES=7.05 **Statistical analyses for SCSIT test for GRP group** (mean differences, SD); P; (ES)**:** DTS (-1.50 ± 2.34); P= 0.002; ES= 7.06 ; LTS (total) (5.48± 6.09); p= 0.003; ES = -4.91; GRA (total) (-3.13 ± 1.50); P= 0.00; ES= 3.53; KIN (total) (6.04 ± 11.64); P=0.05;ES=5.17; FI (-2.63± 3.42); P=0.008; ES=4.41; MFP (-0.19 ± 0.54); P=0.18; ES=0.41; DC (-2.19± 2.10); P=0.001; ES=3.37 ; PS (-2.19± 2.90); P=0.009; ES=2.42; IP (-3.06± 1.48); P=0.00; ES=3.45; MAC (14.63± 15.07); P=0.001; ES= -7.93 RLD (-1.69± 2.00); P=0.004; ES= 1.97 **Statistical analyses for PAT test for GRP group** (mean differences, SD); P; (ES)**:** PAT (-3.94± 3.55); P=0.000; ES=2.57 **Statistical analyses for SCSIT test for the control group** (mean differences, SD); P; (ES)**:** DTS (-0.78 ± 1.20); P= 0.009; ES= 0.76 ; LTS (total) (-1.83± 4.49); p= 0.26; ES = 1.10; GRA (total) (-0.44 ± 0.53); P= 0.04; ES= 0.34; KIN (total) (4.24 ± 9.60); P=0.22;ES=-1.88; FI (-0.89± 0.78); P=0.01; ES=1.03; MFP (-0.11 ± 0.33); P=0.35; ES=0.22; DC (-0.11± 0.33); P=0.35; ES=0.13 ; PS (0.00± 0.71); P=1.00; ES=2.11; IP (-0.67± 0.87); P=0.05; ES=0.57; MAC (-10.37± 33.21); P=0.38; ES= 4.16 RLD (0.22± 1.79); P=0.72; ES= 0.21 **Statistical analyses for PAT test for the control group** (mean differences, SD); P; (ES)**:** PAT (-2.44± 1.33); P=0.000; ES=1.38	**Public Health Practice Project, EPHPP)** **A) Selection bias: a1)are individuals selected to participate in the study likely to be representative of the target population?** somewhat likely **a2) What percentage of selected individuals agreed to participate?** 60-70% agreement **Global rating:** moderate **B) Study design: b1) Indicate the study design:** pre-post **; b2) was the study randomised?:** yes**; b3) was the method of randomization described?** yes**; b4) Was the method appropriate?** no **Global rating:** weak **C) Confounders: c1) were there important differences**

Study details	Participants	Interventions	Methods	Outcomes and Results	Comments
and group sensory-perceptual-motor (SPM) training on patients with cerebral palsy (CP) **Study dates** Not reported **Source of funding** Not reported	50% (N=8) of participants were female. • Control group; mean age= 7; SD= 1.22. 44% (N=4) were female. **Inclusion criteria** Not reported **Exclusion criteria** Not reported	two knees and a kneel hand push); 7) postural responses and ocular control activities (ball catch, two person ball catch, ball foot toss, throwing a ball into a basket and a target); 8) bilateral motor co-ordination and motor planning; 9) visual spatial perception (matching the geometric shapes, puzzle activities); 10) fine motor skills and motor planning (beads stringing, pegboard activities, writing at different positions, tear art on knee position, button up, knotting, design copying); 11) right-left discrimination training; 12)	copying (DC), kinaesthesia (KIN), double tactile stimuli perception (DTS), manual form perception (MFP), finger identification (FI), graphesthesia (GRA), localization of tactile stimuli (LTS), imitation of posture (IP), motor accuracy (MAC), right-left discrimination (RLD) and subtests of SCIT were used. • Physical Ability Test (PAT): This test was used to assess the activities of daily living according to age groups. Assessment was done according to the following categorization: 1) The test was not performed, 2) unable to perform any movement related to activity, 3) able to perform some movements or		**between groups prior to the intervention?:** can't tell **; c2) Indicate the percentage of relevant confounders that were controlled (either in the design or analysis):** can't tell **Global rating:** weak **D) Blinding: d1) Were outcome assessors aware of the intervention or expousure status of participants?:** can't tell**; d2) were the study participants aware of the research question?:** can't tell **Global rating:** weak **E) Data collection methods: e1) were data collection tools shown to be valid?:** yes**; e2) were data collection tools shown to be reliable?:** no

Study details	Participants	Interventions	Methods	Outcomes and Results	Comments
		standing and walking training.The SPM programme was applied 1.5 hours a day, 3 days per week for 3 months. The control group received a home programme. All children were assessed at the beginning and at the end of the intervention.	tries to perform but unable to accomplish, 4) performs the movement slowly or moderately; and 5) good (performs the movement with sufficient speed and endurance). Descriptive statistics and effect size was applied to gained scores in order to compare the three groups. Estimates of effect sizes were calculated for individual, group and control treatments. This process calculated the absolute value of the difference between the pre-test mean and the post-test mean and divided it by the pooled standard deviation of the subjects' scores. SPSS was used for statistical analysis.		**Global rating:** weak **F) Withdrawals and drop-outs: f1) Were withdrawals and drop-outs reported in terms and/or reasons per group?:** no; **f2) indicate the percentage of participants completing the study:** 60-70% **Global rating:** weak **G) Intervention integrity: g1) what percentage of participants received the allocated intervention or expousure of interest?:** 80-100%**; g2) was the consistency of intervention measured?:** no**; g3) is it likely that subjects received an unintended intervention (contamination or co-intervention) that may influence the results?:** can't tell **Global rating:** weak

Study details	Participants	Interventions	Methods	Outcomes and Results	Comments
					H) Analyses: h1) Indicate the unit of allocation: organization/institution**; h2) Indicate the unit of analysis:** not reported**; h3) are the statistical methods appropriate for the study design?:** yes**; h4) is the analysis performed by the intervention allocation status (i.e. intention to treat) rather than the actual intervention received?:** no **Global rating:** weak **GLOBAL RATING FOR THIS PAPER**: weak **Other information**
Full citation Law,M.C., Darrah,J., Pollock,N.,	**Sample size** N=128: n=71 in child-focused approach and n= 57 in the	**Interventions** Children received either the child-focused or context-focused	**Details** A randomised controlled trial cluster research design was used to recruit children	**Results** **Mean scores (SDs) across all outcome measures comparing a child-focused with a context-focused intervention approach**	**Limitations** NICE guidelines manual 2012: Appendix C: Methodology checklist:

<table>
<tr><th>Study details</th><th>Participants</th><th>Interventions</th><th>Methods</th><th>Outcomes and Results</th><th>Comments</th></tr>
<tr>
<td>Wilson,B., Russell,D.J., Walter,S.D., Rosenbaum,P., Galuppi,B., Focus on function: a cluster, randomized controlled trial comparing child- versus context-focused intervention for young children with cerebral palsy, Developmental Medicine and Child Neurology, 53, 621-629, 2011

Ref Id

158780

Country/ies where the study</td>
<td>context-focused approach

Characteristics
<u>Participants in the child-focused approach:</u> n=50 (70%) were male. Mean age = 3.53 (SD= 1.43). GMFCS levels: I n=24 (34%); II n=11 (15%); III n=11 (15%); IV n= 8 (11%); V n= 17 (24%).
<u>Participants in the context-focused approach:</u> n=29 (51%) were male. Mean age = 3.92 (SD= 1.42). GMFCS levels: I n=13 (23%); II n=12 (21%); III n=10 (18%); IV n= 13 (23%); V n= 9 (16%). All participants had a</td>
<td>approach for 6 months (frequency set at 18-24 sessions). All children returned to their regular therapy schedule and approach between assessments at 6 and 9 months. Parents in both groups received general information and education about their child's disability as well as specific strategies of practice at home that fitted with each treatment approach.
<u>Child-focused approach group</u>: therapists identified the impairments underlying a functional limitation and provided therapy to remediate those.Therapists chose their</td>
<td>from children's rehabilitation centers. Therapists from 19 children's rehabilitation centers in Ontario and Alberta, Canada, were stratified by discipline (occupational therapists or physical therapists). Randomization was performed for all study therapists at the same time by the study research coordinator who was unaware of the exact randomization sequence.
<u>Outcome measures:</u> (1) Capability and performance of functional tasks as measured by the PEDI, (2)The Gross Motor Function Measure (GMFM-66); used to evaluate motor abilities, (3) The Family Empowerment</td>
<td>
<table>
<tr><th></th><th>Baseline-Child</th><th>Baseline-Context</th><th>6mo-Child</th><th>6mo-Context</th><th>9mo-Child</th><th>9mo-context</th></tr>
<tr><td>PEDI Self-care FSS</td><td>47.34 (17.00)</td><td>46.09 (14.80)</td><td>51.54 (18.20)(p<0.001)</td><td>49.05 (14.96)</td><td>51.88 (18.65)</td><td>51.77 (17.75)</td></tr>
<tr><td>PEDI Mobility FSS</td><td>49.46 (25.87)</td><td>47.64 (22.87)</td><td>55.02 (26.37)(p<0.001)</td><td>53.85 (22.34)</td><td>56.72 (26.81)</td><td>55.20 (23.81)</td></tr>
<tr><td>PEDI Self-care CAS</td><td>37.80 (24.92)</td><td>35.56 (22.16)</td><td>42.31 (26.18)(p<0.02)</td><td>42.89 (23.51)</td><td>43.57 (27.22)</td><td>42.29 (24.98)</td></tr>
<tr><td>PEDI Mobility</td><td>44.75 (29.</td><td>44.94 (25.55)</td><td>52.11 (30.75)(</td><td>51.69 (27.23)</td><td>53.62 (31.54)(</td><td>50.44 (28.57)(</td></tr>
</table>
</td>
<td>randomised controlled trials
A Selection bias
A1 - Was there appropriate randomisation - yes
A2 - Was there adequate concealment - yes
A3 - Were groups comparable at baseline - yes
Level of bias: low

B Performance bias
B1 - Did groups get same level of care - yes
B2 - Were participants blinded to treatment allocation- no
B3 - Were individuals administering care blinded to treatment allocation - no
Level of bias: high

C Attrition bias
C1 - Was follow-up equal for both groups - yes
C2 - Were groups comparable for dropout - yes
C3 - Were groups comparable for missing data - yes</td>
</tr>
</table>

Study details	Participants	Interventions	Methods	Outcomes and Results	Comments
was carried out Canada **Study type** RCT **Aim of the study** To evaluate the efficacy of a context-focused approach compared with a child-focused approach in improving performance of functional tasks and mobility, and increasing participation in everyday activities in you children who have cerebral palsy (CP).	diagnosis of cerebral palsy **Inclusion criteria** Children at all levels of GMFCS were included. Children who were regularly receiving botulinum toxin type A injections were eligible, but parents were asked not to start a botulinum toxin type A regime during the study period. **Exclusion criteria** Children were excluded if there were planned surgical or medication changes during the 6-month study period that	treatment strategies from interventions such as: maintaining range of motion and joint alignment through stretching, casting, and splinting, strength training, sensorimotor training and stimulation, bilateral isokinematic training, weight-bearing through the hands, and facilitation of normal movement patterns and postural control through physical handling and practice of functional activities. Context-focused approach: a primary therapist was assigned for each child and conducted	Scale (family total score), (4) Participation in everyday activities by children and (5) Assessment of Preschool Children's Participation. Analysis: outcomes were summarised for each treatment group and descriptive statistics calculated for all demographic variables. To test the effects of interventions, difference between the means for the context-focused and child-focused groups were evaluated.An intention-to-treat analysis was used. Missing values were imputed using specific recommendations for each outcome measure. For each outcome measure, the	CAS 60) p<0.02) p<0.03) p<0.03) GMFM-66 Score 53.31 (15.80) 52.14 (11.93) 55.82 (15.45)(p<0.001) 54.26 (11.99)(p<0.001) 56.84 (15.42) 54.11 (13.73) FES Family 4.38 (0.47) 4.21 (0.63) 4.37 (0.49) 4.30 (0.47) 4.36 (0.43) 4.21 (0.50) ACPC Play 3.64 (1.50) 3.60 (1.50)(p<0.04) 3.90 (1.53) 3.82 (1.49) 3.78 (1.44) 3.96 (1.55) ACPC Social activities 2.21 (1.14) 2.16 (1.03) 2.34 (1.07) 2.34 (1.02) 2.32 (0.99) 2.30 (1.00) ACPC Skill develo 2.67 (1.42) 2.57 (1.20) 2.73 (1.23) 2.78 (1.09) 2.87 (1.12) 2.85 (1.07)	Level of bias: low D Detection bias D1 - Was follow-up appropriate length - yes (9 months) D2 - Were outcomes defined precisely - yes D3 - Was a valid and reliable method used to assess outcome - yes D4 - Were investigators blinded to intervention - unclear D5 - Were investigators blinded to confounding factors - unclear Level of bias: moderate Does the study match the review protocol in terms of • Population: yes • Intervention: yes • Outcomes: yes

Study details	Participants	Interventions	Methods	Outcomes and Results	Comments
Study dates Study recruitment took place between September 2006 and June 2008, with the final assessments completed by April 2009. **Source of funding** Study supported by a grant from the National Institutes of Health, USA. MLC holds the John and Margaret Lillie Chair in Childhood disability research. SDW holds a National health	might have affected motor function.	the intervention for that child (with other therapist providing consultation).Parents identified motor-based tasks that their child was initiating, trying to modify, or showing an interest in doing (but having difficulty accomplishing) by using the Canadian Occupational Performance Measure. Each child was videotaped at least once to record the child performing the tasks identified in the goals. For each identified task or goal, factors were identified in the task, environment, and/or child that were hindering the child's performance. Working with the parents, the	differences in change scores between treatment arms from baseline to 6 and 9 months were estimated. Linear mixed-effect models were fitted using time and treatment as fixed effects and participant as a random effect, to reflect the repeated measures on each participant.	<table><tr><td>pment</td><td></td><td></td><td></td><td></td><td></td><td></td></tr><tr><td>Active physical activities</td><td>2.60 (1.37)</td><td>2.58 (1.18) (p<0.001)</td><td>2.93 (1.27)</td><td>2.86 (1.17)</td><td>2.63 (1.41)</td><td>2.54 (1.34)</td></tr></table>PEDI= pediatric evaluation of disability inventory, FSS = functional skill scale, CAS= caregiver assisstance scale, GMGM= Gross Motor Function Measure, FES= family empowerment scale, ACPC= assessment of preschool children's participantion	• Indirectness: no **Other information** In this study, p-values were only reported for significant results.

<table>
<tr><th>Study details</th><th>Participants</th><th>Interventions</th><th>Methods</th><th>Outcomes and Results</th><th>Comments</th></tr>
<tr><td>Scientist Award from Health Canada, PR holds a Canada Research Chair from the Canadian Institutes of Health Research, and DJR receives support through the McMaster Child Health Research Institute.</td><td></td><td>therapist identified these constraints through an analysis of observed task performance.</td><td></td><td></td><td></td></tr>
<tr><td>Full citation

James, S., Ziviani, J., Ware, R. S., Boyd, R. N., Randomized controlled trial of web-based multimodal therapy for unilateral cerebral</td><td>Sample size
N=270 individuals were screened and n=102 children were randomised to Mitii (n=51) or waitlist control (n=51).

Characteristics</td><td>Interventions
‘Move it to improve it’ (Mitii) (Mitii Development A/S, Copenhagen, Denmark) is a web-based multimodal therapy programme that is delivered in the home environment. It</td><td>Details
Participants were matched in pairs based on age (within 12mo age bands), gender, and Manual Ability Classification System level and were randomised in pairs to intervention (Mitii for 20 weeks) or standard waitlist</td><td>Results
Baseline and 20 week scores for Mitii/comparison groups and regression results.
AMPS
<table>
<tr><th></th><th>Mitii group</th><th>Comparison group</th><th>Mean difference</th><th>95% CI</th><th>p value</th></tr>
<tr><td>Motor scale (range -3 to 4) Baseline (Mean, SD)</td><td>1.06 (0.56)
1.38 (0.44)</td><td>1.14 (0.50)
1.11 (0.78)</td><td>0.28</td><td>0.17,0.39</td><td><0.001</td></tr>
</table></td><td>Limitations
NICE guidelines manual 2012: Appendix C: Methodology checklist: randomised controlled trials
A Selection bias
A1 - Was there appropriate randomisation - yes
A2 - Was there adequate concealment - yes</td></tr>
</table>

<table>
<tr><th>Study details</th><th>Participants</th><th>Interventions</th><th>Methods</th><th>Outcomes and Results</th><th>Comments</th></tr>
<tr>
<td>palsy to improve occupational performance, Developmental Medicine & Child Neurology, 57, 530-8, 2015

Ref Id

432999

Country/ies where the study was carried out

Australia

Study type
RCT

Aim of the study
To examine the effects of Mitii on occupational performance, upper limb function,</td>
<td>Intervention group: mean age was 11 years and 8 months (SD= 2 years and 4 moths). N=26 male (51%). GMFCS level I N=20 (39.2%). GMFCS level II N= 31 (60.8%). Intellectual ability: FSIQ ‹ 80 (below average) N= 4 (7.8%). Control group: mean age was 11 years and 10 months (SD= 2 years and 5 moths). N=25 male (50%). GMFCS level I N=25 (50%). GMFCS level II N= 50 (50%). Intellectual ability: FSIQ ‹ 80 (below average) N= 7 (14%). All participants presented with unilateral cerebral palsy.</td>
<td>comprises upper limb, cognitive, visual perceptual, and physical activity training. The Mitii system detects and tracks bodily movements by a web-camera using green tracking bands worn on the hands, knee or head. Programmes were individualised according to the child's baseline assessment scores. Mitii was ideally completed for 20 to 30 minutes, 6 days per week for 20 weeks, providing a maximum potential of 60 hours. Therapists remotely monitored the participant's programme and adjusted modules weekly by increasing speed,</td>
<td>control (standard care for 20 weeks) using a computer-generated list of random numbers placed in concealed envelopes and opened by non-study personnel.
<u>Outcome measures:</u> (1) Assessment of Motor and Process Skills (AMPS); which is an observational evaluation of ADL motor and processing skills involving participants selecting and performing a minimum of 2 ADL tasks in a naturalistic environment.(2) Canadian Occupational Performance Measure (COPM). The COPM evaluates self-perceived occupational performance in five areas identified identified by child</td>
<td>
<table>
<tr><td>20 weeks</td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>Process Skills (range -4 to 3) Baseline (Mean, SD)
20 weeks</td><td>1.05 (0.48)
1.39 (0.34)</td><td>1.15 (0.54)
1.08 (0.53)</td><td>0.30</td><td>0.19, 0.41</td><td><0.001</td></tr>
</table>
COPM-P (range 0-10)
<table>
<tr><td></td><td>Mitii group</td><td>Comparison group</td><td>Mean difference</td><td>95% CI</td><td>p value</td></tr>
<tr><td>Baseline (Mean, SD)</td><td>4.15 (1.37)</td><td>4.22 (1.29)</td><td>1.29</td><td>0.73, 1.85</td><td><0.001</td></tr>
<tr><td>20 weeks</td><td>6.26 (1.69)</td><td>4.98 (1.39)</td><td></td><td></td><td></td></tr>
</table>
TVPS - 3; Overall score (range 55-145), Domain scores (range 0-16)
<table>
<tr><td></td><td>Mitii group</td><td>Comparison group</td><td>Mean difference</td><td>95% CI</td><td>p value</td></tr>
<tr><td>Overall - Baseline (mean, SD);</td><td>85.20 (16.07); 92.55 (17.60)</td><td>84.54 (17.70); 83.72 (18.48)</td><td>6.79</td><td>2.80, 10.78</td><td>0.001</td></tr>
</table>
</td>
<td>A3 - Were groups comparable at baseline - yes
Level of bias: Low

B Performance bias
B1 - Did groups get same level of care - yes
B2 - Were participants blinded to treatment allocation- unclear
B3 - Were individuals administering care blinded to treatment allocation - no
Level of bias: unclear/unknown risk

C Attrition bias
C1 - Was follow-up equal for both groups - Yes
C2 - Were groups comparable for dropout - Yes
C3 - Were groups comparable for missing data -yes
Level of bias: Low

D Detection bias
D1 - Was follow-up appropriate length - Yes (20 weeks/5 months)</td>
</tr>
</table>

Study details	Participants	Interventions	Methods	Outcomes and Results						Comments
and visual perception in children with unilateral cerebral palsy (UCP). The primary hypothesis was that Mitti would enhace ADL motor and processing skills and reduce upper limb activity limitations (improve bimanual performanc e and unimanual capacity compared with standard care. Secondarily , it was hypothesis ed that children would have increased attainment in	**Inclusion criteria** (1) Manual Ability Classification System (MACS) levels I to III and Gross Motor Function Classification System (GMFCS) levels I or II, (2) ages 8 to 18 years with sufficient cooperation and cognitive understanding to perform required tasks, (3) Internet access at home. **Exclusion criteria** (1) Received upper- or lower-limb surgery in the previous 6 months, (2) unstable epilepsy, (3) a	accuracy, repetitions, and/ or task complexity. Standard care was defined for this study as 'care as usual' so that participants in the comparison group were not disadvantaged in any way. It typically involved consultative sessions with medical and allied health professionals. Children were not provided with any concomitant treatments including upper limb therapy, splinting, or casting.	or caregivers. (3) Test of Visual Perceptual Skill (non-motor) 3rd edition (TVPS-3). Evaluates visual perception across 7 domains (visual discrimination, spatial relations, visual memory, form constancy, sequential memory, figure ground discrimination, and visual closure). Each subscale has a maximum score of 16; scoring involves converting raw scores into scaled, standard, and centile scores. Statistical analyses: descriptive statistics were used to calculate participant demographic, social and clinical characteristics of participants in the intervention and comparison groups.	20 weeks (mean, SD)						D2 - Were outcomes defined precisely - yes D3 - Was a valid and reliable method used to assess outcome - Yes D4 - Were investigators blinded to intervention - unclear D5 - Were investigators blinded to confounding factors - unclear Level of bias: unclear/unknown risk Does the study match the review protocol in terms of • Population : yes • Interventio n: yes • Outcomes : yes • Indirectne ss: no **Other information**
				Visual Discrimina tion - Baseline (mean, SD); 20 weeks (mean, SD)	7.59 (3.35); 9.38 (3.51)	7.90 (3.37); 8.29 (3.60)	1.41	0.26,2. 55	0.0 17	
				Visual Memory- Baseline (mean, SD); 20 weeks (mean, SD)	9.71 (3.34); 10.72 (3.70)	9.52 (3.86); 9.31 (4.89)	1.21	-0.29, 2.71	0.1 13	
				Spatial relations - Baseline (mean, SD); 20 weeks (mean, SD)	11.10 (4.04); 12.36 (3.35)	10.46 (4.68); 10.33 (4.25)	1.53	0.37, 2.69	0.0 10	
				Form Constancy - Baseline (mean, SD);	7.06 (3.64); 8.32 (3.86)	6.50 (4.04); 6.69 (4.02)	1.15	- 0.10,2. 39	0.0 71	

<table>
<tr><th>Study details</th><th>Participants</th><th>Interventions</th><th>Methods</th><th>Outcomes and Results</th><th>Comments</th></tr>
<tr>
<td>occupational performance goals and visual perceptual skills.

Study dates
From April 2012 to March 2014

Source of funding
Project supported by a Foundation for Children Grant and Smart Futures Co-Investment Program Grant. SJ is supported by an Australian Postgraduate Award and Queensland Government Smart</td>
<td>respiratory, cardiovascular, or other medical condition that would prevent them participating safely in the Mitii programme.</td>
<td></td>
<td>Differences between intervention groups were examined using linear regression models, where treatment group and baseline score were entered into the model as main effects. Linear regression assumptions were tested and not violated. Regression results are presented as mean difference and 95% confidence interval. A p value < 0.05 (two tailed) was defined as being statistically significant, and missing data were accommodated by case-wise deletion. Analyses were on an intention-to-treat basis using Statistical Package for Social Sciences. Secondary</td>
<td>
<table>
<tr><td>20 weeks (mean, SD)</td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>Sequential memory-Baseline (mean, SD); 20 weeks (mean, SD)</td><td>8.28 (3.66); 9.92 (3.33)</td><td>8.78 (3.94); 8.91 (3.85)</td><td>1.14</td><td>-0.07,2.36</td><td>0.065</td></tr>
<tr><td>Figure ground discrimination-Baseline (mean, SD); 20 weeks (mean, SD)</td><td>7.80(4.00); 8.72 (4.57)</td><td>7.88 (4.43); 7.56 (4.37)</td><td>1.23</td><td>-0.10, 2.55</td><td>0.070</td></tr>
<tr><td>Visual Closure-Baseline (mean, SD); 20 weeks (mean, SD)</td><td>6.65 (4.42); 8.40(4.31)</td><td>6.44 (4.31); 6.69 (4.87)</td><td>1.34</td><td>0.14,2.55</td><td>0.030</td></tr>
</table>
</td>
<td></td>
</tr>
</table>

<table>
<tr><th>Study details</th><th>Participants</th><th>Interventions</th><th>Methods</th><th>Outcomes and Results</th><th>Comments</th></tr>
<tr><td>Futures PhD Scholarship. RNB is supported by a National Health and Medical Research Council Career Development Fellowship. The authors have stated that they have no interests that could be perceived as posing a conflict or bias.</td><td></td><td></td><td>analyses examined the effect of therapy dose on primary outcome measures using fractional polynominal regression to account for the possible nonlinearity in dose-therapy effect.</td><td></td><td></td></tr>
<tr><td>Full citation

Kuo, H. C., Gordon, A. M., Henrionnet, A., Hautfenne, S., Friel, K. M.,</td><td>Sample size
N=20; HABIT + T (n=4 in New York, n=6 in Brussels); HABIT (n=4 in New York, n=6 in Brussels).</td><td>Interventions
HABIT (hand-arm intensive manual therapy) is a form of intensive bimanual training for children with USCP using</td><td>Details
One bimanual training was conducted in New York city and the other one was conducted in Brussels. In each site, participants were randomised</td><td>Results
Results for the more-affected hand<table><tr><th></th><th>Pretest (95%CI)</th><th>Immediate posttest (95%CI)</th><th>Change score (pretest to immediate posttest [95%CI])</th><th>Test session effect p value (partial n2)</th><th>Interaction p value (partial n2)</th><th>Power (1 - ß)</th></tr></table></td><td>Limitations
NICE guidelines manual 2012: Appendix C: Methodology checklist: randomised controlled trials

A Selection bias</td></tr>
</table>

<table>
<tr><th>Study details</th><th>Participants</th><th>Interventions</th><th>Methods</th><th>Outcomes and Results</th><th>Comments</th></tr>
<tr>
<td>Bleyenheuft, Y., The effects of intensive bimanual training with and without tactile training on tactile function in children with unilateral spastic cerebral palsy: A pilot study, Research in Developmental Disabilities, 49, 129-39, 2016

Ref Id

432703

Country/ies where the study was carried out

Belgium and USA

Study type</td>
<td>Characteristics
HABIT + T: mean age = 8.9 (SD=2.6), n=4 male
HABIT: mean age= 8 (SD=1.1), n=6 male
Control group: mean age= 8.2 (SD=1.1), n=4 male
All children presented with unilateral cerebral palsy

Inclusion criteria
(1) Age 6 to 18 diagnosed with congenital USPC, (2) the ability to lift the more-affected arm 15 cm above a table surface and grasp light objects, (3) cognition level defined as mainstreamed in school (Kaufman Brief</td>
<td>motor learning principles. Children are engaged using both hands in bimanual play and functional activities. The more-affected hand is treated as the assisting hand (active assist or stabiliser) in the context of task practice. Motor learning principles of whole-task and part-task practice are applied.
All participants received 82h of standardised intensive bimanual training within 3 weeks by trained interventionists. In both sites, an additional 8h of treatment was provided in a separate room with a different interventionist (specifically trained). During those 8 hours,</td>
<td>offsite using concealed allocation stratified by their baseline tactile discrimination thresholds (measured by Grating Orientation Task) and baseline unilateral dexterity (measured by Jebsen-Tayor Test of Hand Function) of the more-affected hand.
Participants were randomly assigned to the different groups.
Participants were evaluated directly prior to treatment (pre-test) and withing 2 days after treatment (post-test) by one physical therapist blinded to group allocation.
<u>Outcome measures:</u> (1) Grating Orientation Task (GOT), which measures tactile spatial resolution, (2) Sterognosis,</td>
<td>
<table>
<tr><td>GOT
HABIT +T</td><td>4.23 (3.89, 4.58)</td><td>3.87 (3.06,4.68)</td><td>-0.36 (-0.99, -0.27)</td><td>-</td><td>-</td><td>-</td></tr>
<tr><td>GOT HABIT</td><td>4.35(3.99,4.72)</td><td>3.53 (2.68,4.38)</td><td>-0.82 (-1.48,-0.16)</td><td>-</td><td>-</td><td>-</td></tr>
<tr><td>GOT (mean)</td><td>4.29(4.04,4.54)</td><td>3.70 (3.11,4.29),p=0.028</td><td>-0.59 (-1.05,-0.14)</td><td>0.028 (0.253)</td><td>0.501 (0.027)</td><td>1.00</td></tr>
<tr><td>Stereognosis
HABIT+T</td><td>6.5(4.19,8.81)</td><td>7.00 (5.14,8.87)</td><td>0.50 (-0.88,1.88)</td><td>-</td><td>-</td><td>-</td></tr>
<tr><td>Stereognosis HABIT</td><td>5.22(2.79,7.66)</td><td>6.89 (4.92,8.86)</td><td>1.67 (0.21,3.12)</td><td>-</td><td>-</td><td>-</td></tr>
<tr><td>Stereognosis (mean)</td><td>5.86(4.18,7.54)</td><td>6.94(5.59,8.30), p=0.063</td><td>1.08(0.08,2.08)</td><td>0.063 (0.188)</td><td>0.522 (0.025)</td><td>0.99</td></tr>
<tr><td>TPD thumb (mm)
HABIT + T</td><td>8.9(5.2,12.60)</td><td>8.6 (5.02,12.18)</td><td>-0.30 - 1.40(0.80,)</td><td>-</td><td>-</td><td>-</td></tr>
<tr><td>TPD thumb (mm)
HABIT</td><td>9.22(5.32,13.12)</td><td>8.89 (5.12,12.66)</td><td>-0.33 (0.80,0.13)</td><td>-</td><td>-</td><td>-</td></tr>
<tr><td>TPD thumb (mm) (mean)</td><td>9.06(6.37,11.75)</td><td>8.74 (6.14,11.35)</td><td>-0.32 (-0.98,0.35)</td><td>0.413 (0.04)</td><td>0.479 (0.03)</td><td>0.99</td></tr>
<tr><td>SWM
HABIT + T</td><td>6.30(4.50,8.10)</td><td>5.40 (3.50,7.30)</td><td>-0.90 - 2.16(0.36,)</td><td>-</td><td>-</td><td>-</td></tr>
</table>
</td>
<td>A1 - Was there appropriate randomisation - yes
A2 - Was there adequate concealment - yes
A3 - Were groups comparable at baseline - yes
Level of bias: Low

B Performance bias
B1 - Did groups get same level of care - yes
B2 - Were participants blinded to treatment allocation- unclear
B3 - Were individuals administering care blinded to treatment allocation - unclear
Level of bias: unclear/unknown risk

C Attrition bias
C1 - Was follow-up equal for both groups - n/a
C2 - Were groups comparable for dropout - yes
C3 - Were groups comparable for missing data - unclear</td>
</tr>
</table>

Study details	Participants	Interventions	Methods	Outcomes and Results	Comments
RCT **Aim of the study** To compare the efficacy of intensive bimanual training (hand-arm bimanual intensive therapy, HABIT) vs. intensive bimanual training that includes tactile training (HABIT + T) on modifying tactile function in children with USPC. We hypothesised that tactile function could be enhanced after HABIT due to the enriched environmen	Intelligence test score › 70), (4) demonstrated ability to follow instructions and complete testing. **Exclusion criteria** (1) Health problems unrelated to UCP, (2) uncontrolled seizures, (3) visual problems interfering with intervention/testing, (4) severe muscle tone at any joint (Modified Ashworth score >3.5), (5) orthopedic surgery on the more-affected hand withing one year, and (6) botulim toxin therapy in the upper limb within the last 6 months or intended treatment	children received either tactile training or control training. Children's regular interventionists were not allowed in this training room. During that time, the HABIT + T group received tactile stimulating materials. The HABIT group received the same dosage/schedule of controlled training with the same material but without specific tactile-directed training. In addition, regular interventionists (for the 82 h standardised HABIT) were trained at a pre-intervention session on procedures common to the 2 groups, such as strategies to engage children	measured with the Manual Form Perception Test, Two-points discrimination TPD performed by using Disk-criminator, (3) Semmes-Weinstein monofilaments (SWM) for measuring tactile perception, (4) The Jebsen-Taylor Test of Hand Function (JTTHF), which is a standardised test quantifying unilateral dexterity as the movement time (in seconds) to complete motor tasks, (5) the Assisting Hand Assessment (AHA), which quantifies the effectiveness of the more-affected hand use in bimanual activities. Statistical analyses: performed using SPSS. A 2 (group) x 2 (test session) ANOVA	<table><tr><td>SWM HABIT</td><td>5.78 3.88(7.68,)</td><td>6.00 (3.99,8.00)</td><td>0.22 (-0.85,1.29)</td><td>-</td><td>-</td><td>-</td></tr><tr><td>SWM (mean)</td><td>6.04(4.73,7.35)</td><td>5.70 (4.32,7.08)</td><td>-0.34 (-1.24,0.56)</td><td>0.228 (0.084)</td><td>0.106 (0.146)</td><td>0.97</td></tr></table>GOT= grating orientation task; HABIT= hand-arm intensive bimanual therapy; HABIT + T = HABIT with additional tactile training; TPD = two-point discrimination; SWM = Semmes-Weinstein monofilaments. **Changes in hand function after training as measured by the JTTHF:** 42s (19.7%) and 148s (39.1%) decrease for the HABIT + T and the HABIT groups, respectively (p<0.001). No significant Group x Test session interaction effect, indicating both groups did not improved in a significantly different way (p=0.053). **Changes in hand function as measured by the AHA:** there was a 6.7 and a 4.9 AHA-unit improvement for the HABIT+ T group and the HABIT group, respectively (test session, p=0.002). There was no Group x Test session interaction effect for the AHA, indicating both groups improved similarly (p=0.56). These improvements were clinically meaningful for the HABIT + T group, and borderline clinically meaningful for the HABIT group.	Level of bias: unclear/unknown risk D Detection bias D1 - Was follow-up appropriate length - no follow-up D2 - Were outcomes defined precisely - yes D3 - Was a valid and reliable method used to assess outcome - Yes D4 - Were investigators blinded to intervention - unclear D5 - Were investigators blinded to confounding factors - unclear Level of bias: unclear/unknown risk Does the study match the review protocol in terms of • Population: no • Intervention: yes • Outcomes: yes

Study details	Participants	Interventions	Methods	Outcomes and Results	Comments
t created by exposure to objects of varied textures, and tactile function could be further enhanced with additional tactile training. **Study dates** July 2012 **Source of funding** HK & KF. AH received a student scholarship from the Universite catholique de Louvain.	withing the study period.	actively involving the use of both hands and safety. The 2 camps had the same supervisor to ensure the uniformity of the intervention. HABIT + T: specific training components encompassed tactile discrimination and matching. Training was primarily administered with the child blindfolded or exploring objects in bags. Instruction and knowledge of results were given with each vision. Both hands were required to engage in the task. HABIT: children in this group did not receive tactile training. During the control training,	with repeated measures on test sessions was performed on each measure for the more- and the less-affected hand. This design was to test efficacy of training on tactile and motor function and to examine if treatment efficacy differed depending on group assignment.As many of the measures violated assumptions of normal distributions, the raw data was logarithm-transformed using log base 10. As the ANOVA results on raw data and logarithm-transformed data were qualitatively similar, the log-transformed data was reported. T-Tests were performed to test group differences		• Indirectness: no **Other information** In this study, p-values were only reported for some results. For changes measured by the JTTHF and AHA, results regarding change score (pretest to immediate posttest [95%CI]), test session effect p value, interaction p value (partial n^2) and power (1 - ß) were not reported.

Study details	Participants	Interventions	Methods	Outcomes and Results	Comments
		the received standardised HABIT by playing with the same materials (full vision) in the same environment (same room/interventionist) as those provided to the HABIT + T group. Control training was applied in the same schedule and frequency as those in the HABIT + T group. Intervention materials were applied in the context of play and functional activities in this group.	at baseline. Pearson coefficient correlations were performed to examine the predictors of changes in function. P-values under 0.05 were set as statistical significant.		

I.24 Other comorbidities in cerebral palsy

Study Details	Participants	Diagnosis	Outcomes	Comments
Full citation Surman,G., Hemming,K., Platt,M.J., Parkes,J., Green,A., Hutton,J., Kurinczuk,J.J., Children with cerebral palsy: severity and trends over time, Paediatric and Perinatal Epidemiology, 23, 513-521, 2009 **Ref Id** 131880 **Country/ies where the study was carried out** UK **Study dates** Births between 1960 to 1999 **Source of funding** Partially by MRC grant	**Sample size** n = 5019 with CP between 1976 and 1999 Assessed for cognition: n = 3884 (Scottish registry excluded) Assessed for vision: n = 4492 Assessed for hearing: n = 4566 **Characteristics** Severity of motor impairments was defined as: • MIG1 = neither upper nor lower limb function severely impaired • MIG2 = upper OR lower limb function severely impaired • MIG3 = upper AND lower limb function	**Definition of CP** Definition was agreed by Surveillance of CP in Europe (SCPE). 1. CP is a group of disorders which are permanent but not unchanging 2. the condition involves a disorder of movement and/or posture and of motor function 3. The condition is due to a non-progressive interference, lesion or abnormality of the developing immature brain. **Results** Cognitive impairment: 1848/3884 (48%, 95% CI 46 - 49) Severe cognitive impairment: 1025/3826 (27%, 95% CI 25 - 28) Hearing impairment: 356/4566 (8%, 95% CI 7 - 9)	**Comorbidities** <u>Cognitive impairment:</u> Defined as either IQ < 70 or moderate or worse developmental delay/learning difficulty. Severe cognitive impairment: observed behavioural responses of the child or where measured an IQ < 50. <u>Hearing impairment</u> Assessed by audiometric testing or by clinical judgement based on behavioural responses of the child. Profound or severe hearing loss, by testing: < 70 dB loss in the better ear or clinical judgement. <u>Visual impairment</u> The presence of any visual impairment. Severe visual impairment was defined bySevere corrected visual acuity of 6/60 or worse in the better eye or a clinical judgement of sever impairment or blindness where testing was not possible.	**Limitations** Critical appraisal using Munn et al 2014: 1. Was the sample representative of the target population? Yes 2. Were study participants recruited in an appropriate way? Yes - using regional registries. Random sampling is not reported. 3. Was the sample size adequate? Yes - national registry (sample size calculation not required) 4. Were the study subjects and the setting described in detail? Study subjects - No: distribution of motor disorders, severity by GMFCS levels and type not reported. Setting: yes. 5. Was the data analysis conducted with sufficient coverage of the identified sample? N/A 6. Were objective, standard criteria used for the measurement of the condition? Yes 7. Was the condition measured reliably? Yes

Study Details	Participants	Diagnosis	Outcomes	Comments
G9900630 for setting up UKCP. For regional registries: Department of Health National Institute for Health Research (NIHR), Policy research programme of the Department of Health in England, Northern and Yorkshire region and primary hralth care trusts, Department of Health and Social services and Public safety, the charities: Cerebra supported by Capability Scotland.	severely impaired Nearly 70% of children with CP were in least severe motor impairment group (MIG1). 10% were in MIG2 and 21% in MIG3. The proportion in MIG3 group increased with increasing birthweight from 15% weighing < 1000 g to 23% of those born weighing > or equal to 2500 g. 59% of children in MIG3 group were born with normal birthweight. **Inclusion criteria** UK Network of Cerebral Palsy Registers (UKCP) in 1999 with pooled data from 5 regions of UK: • Northern Ireland • Scotland • Merseyside and Cheshire • North of England	Severe hearing impairment: 104/4536 (2%, 95% CI 2 - 3) Vision impairment: 1929/4492 (43%, 95% CI 42 - 44) Severe vision impairment: 425/4204 (10%, 95% CI 9 - 11)		(although details on diagnosis process not provided) 8. Was there appropriate statistical analysis? Yes - confidence intervals provided. 9. Are all important confounding factors/subgroups/differences identified and accounted for? N/A 10. Were subpopulations identified using objective criteria? No - GMFCS not used for severity. **Other information**

Study Details	Participants	Diagnosis	Outcomes	Comments
	• 4 counties in the south of England **Exclusion criteria** Scottish registry were excluded for cognitive impairment because the data was less complete compared to other registries.			
Full citation Shevell, M. I., Dagenais, L., Hall, N., Repacq Consortium, Comorbidities in cerebral palsy and their relationship to neurologic subtype and GMFCS level, Neurology, 72, 2090-6, 2009 **Ref Id** 339615 **Country/ies where the study was carried out**	**Sample size** 243 children recruited through the Quebec Cerebral Palsy Registry (REPACQ). The registry became operational in 2004 in 6 of 17 geographically defined administrative health and social service regions of the province of Quebec, representing roughly half of the province's population and annual births. Cases were ascertained only once a child was beyond the age of 2 years and where possible confirmed at 5 years of age.	**Definition of CP** Cerebral palsy was defined as a non progressive motor impairment of early onset, that is presumably cerebral in origin, which may or may not be associated with developmental delays, cognitive disability, language impairment, epilepsy, sensory (auditory or visual) loss, orthopaedic abnormalities, or behavioural difficulties. **Results** **Severe auditory impairment: n, (%)** <u>by GMFCS level:</u>	**Comorbidities** Several different comorbidities were the focus of this article. Information pertaining to these comorbidities was specifically sought for in the medical records reviewed and in the parental interview conducted at the time of obtaining data for Registry inscription. • Cortical blindness required diagnosis by an ophthalmologist. • Substantial auditory impairment, was defined as a 70 dB or greater hearing loss (bilateral) on audiometric testing. The age of the children (between 2 and 5 years) precluded reliable assessment of possible cognitive disability. Lack of access to psychiatric information precluded data collection regarding behavioural disorders.	**Limitations** Critical appraisal using Munn et al 2014: 1. Was the sample representative of the target population? Unclear (sample characteristics not reported) 2. Were study participants recruited in an appropriate way? Yes - using regional registries. Random sampling is not reported. 3. Was the sample size adequate? Yes - national registry (sample size calculation not required) 4. Were the study subjects and the setting described in detail? No

Study Details	Participants	Diagnosis	Outcomes	Comments
Canada **Study dates** Children over a 4-year birth interval = 1999-2002 inclusive. **Source of funding** Not reported.	**Characteristics** The children were a mean age of 44 months (SD 14 months, range 24–79 months) at the time of registry inscription. **Inclusion criteria** **Exclusion criteria** • Genetic and metabolic disorders were excluded. • By definition, neuromuscular disorders and myelodysplasias were excluded from diagnosis.	I = 6 (6) II = 3 (13) III = 4 (13) IV = 7 (16) V = 8 (21) <u>By motor problem distribution:</u> Spastic quadriplegia = 12 (14) Spastic hemiplegia = 4 (5) Spastic diplegia = 3 (6) Dyskinetic = 6 (38) Ataxic-hypotonic = 3 (33) **Severe visual impairment by GMFCS level, n (%)** I = 4 (4) II = - (-) III = 1 (3) IV = 5 (12) V = 13 (33) **Cortical blindness by neurologic subtype, n (%)** Spastic quadriplegia = 18 (21) Spastic hemiplegia = 2 (3) Spastic diplegia = 1 (4) Dyskinetic = 1 (7) Ataxic-hypotonic = 1 (11)		5. Was the data analysis conducted with sufficient coverage of the identified sample? N/A 6. Were objective, standard criteria used for the measurement of the condition? Yes 7. Was the condition measured reliably? Yes (although details on diagnosis process not provided) 8. Was there appropriate statistical analysis? Yes - but confidence intervals not provided. 9. Are all important confounding factors/subgroups/differences identified and accounted for? N/A 10. Were subpopulations identified using objective criteria? Yes **Other information**

Study Details	Participants	Diagnosis	Outcomes	Comments
Full citation Himmelmann, K., McManus, V., Hagberg, G., Uvebrant, P., Krageloh-Mann, I., Cans, C., Scpe collaboration, Dyskinetic cerebral palsy in Europe: trends in prevalence and severity, Archives of Disease in Childhood, 94, 921-6, 2009 **Ref Id** 339419 **Country/ies where the study was carried out** SCPE registry **Study dates** Children were born between 1976 and 1996. **Source of funding**	**Sample size** 578 children with dyskinetic CP, but 474 analysed for cognitive disability. **Characteristics** • 59% were boys • Data on gestational age were available in 544: 4% born before 28 completed weeks of gestation; 12% born at 28-31 weeks; 70% born after 37 completed weeks of gestation. • Data on birth weight were available in 550 cases: 3% had birth weight <1000 g; 10% had birth weight 1000-1499 g; 17% had	**Definition of CP** Definition was agreed by Surveillance of CP in Europe (SCPE). 1. CP is a group of disorders which are permanent but not unchanging 2. the condition involves a disorder of movement and/or posture and of motor function 3. The condition is due to a non-progressive interference, lesion or abnormality of the developing immature brain. All children within the dataset had a diagnosis of CP confirmed at 5 years of age and were registered in the local CP register before data were transmitted to the SCPE common database. **Results**	**Comorbidities** Severe mental retardation/learning disability was defined as having an IQ below 50.	**Limitations** Critical appraisal using Munn et al 2014: 1. Was the sample representative of the target population? Yes 2. Were study participants recruited in an appropriate way? Yes - using regional registries. Random sampling is not reported. 3. Was the sample size adequate? Yes - national registry (sample size calculation not required) 4. Were the study subjects and the setting described in detail? Yes. 5. Was the data analysis conducted with sufficient coverage of the identified sample? N/A 6. Were objective, standard criteria used for the measurement of the condition? Yes 7. Was the condition measured reliably? Yes 8. Was there appropriate statistical analysis? Yes - but confidence intervals not provided. 9. Are all important confounding factors/subgroups/differ

Study Details	Participants	Diagnosis	Outcomes	Comments
The study was supported by European Commission funds.	birth weight 1500-2499 g; 70% had birth weight of ≥2500 g. • Walking ability was reported in 555 cases: 16% walked without aids; 24% with aids; and 59% were confined to wheelchair ambulation. **Inclusion criteria** Children with dyskinetic CP were included if they were born in the area, with the exception of centre 1, where cases born outside but living in the area were also included. **Exclusion criteria** • post-neonatal CP cases • Six cases born in birth years with	Severe mental retardation/learning disability, n (%) 245/474 (52%) in the dyskinetic group.		ences identified and accounted for? N/A 10. Were subpopulations identified using objective criteria? No - GMFCS not used for severity, no data by CP type or age. **Other information**

Study Details	Participants	Diagnosis	Outcomes	Comments
	no info about live birth numbers at the particular centre were excluded from the prevalence calculation.			
Full citation Odding, E., Roebroeck, M. E., Stam, H. J., The epidemiology of cerebral palsy: Incidence, impairments and risk factors, Disability and Rehabilitation, 28, 183-191, 2006 **Ref Id** 336720 **Country/ies where the study was carried out** SCPE registry.	**Sample size** N not reported. **Characteristics** - boys were 58% **Inclusion criteria** N/A **Exclusion criteria** N/A	**Definition of CP** Definition was agreed by Surveillance of CP in Europe (SCPE). 1. CP is a group of disorders which are permanent but not unchanging 2. the condition involves a disorder of movement and/or posture and of motor function 3. The condition is due to a non-progressive interference, lesion or abnormality of the developing immature brain.	**Comorbidities** • constipation • speech impairment • vomiting	**Limitations** Critical appraisal using Munn et al 2014: 1. Was the sample representative of the target population? Yes 2. Were study participants recruited in an appropriate way? Yes - using regional registries. Random sampling is not reported. 3. Was the sample size adequate? Yes - national registry (sample size calculation not required) 4. Were the study subjects and the setting described in detail? No. 5. Was the data analysis conducted with sufficient coverage of the identified sample? N/A

<table>
<tr><th>Study Details</th><th>Participants</th><th>Diagnosis</th><th>Outcomes</th><th>Comments</th></tr>
<tr>
<td>Study dates
1965-2004.

Source of funding
not reported.</td>
<td></td>
<td>Results

• Constipation = 59%
• Speech impairment: overall prevalence = 42 - 81%

<table><tr><td>hemiplegic</td><td>30%</td></tr><tr><td>diplegic</td><td>20%</td></tr><tr><td>tetraplegic</td><td>85%</td></tr><tr><td>dyskinetic</td><td>95%</td></tr></table>
• Vomiting = 22%</td>
<td></td>
<td>6. Were objective, standard criteria used for the measurement of the condition? No.
7. Was the condition measured reliably? Yes.
8. Was there appropriate statistical analysis? Yes - but confidence intervals not provided.
9. Are all important confounding factors/subgroups/differences identified and accounted for? N/A
10. Were subpopulations identified using objective criteria? Yes - results presented by CP type.

Other information</td>
</tr>
<tr>
<td>Full citation

Sellier,E., Uldall,P., Calado,E., Sigurdardottir, S., Torrioli,M.G., Platt,M.J.,</td>
<td>Sample size
9564 children with CP born between 1976 and 1998 and registered in 17 European registries belonging to the SCPE network.</td>
<td>Definition of CP

• CP of postneonatal origin was defined by the presence of a specific event or episode that</td>
<td>Comorbidities
- epilepsy</td>
<td>Limitations
Critical appraisal using Munn et al 2014:

1. Was the sample representative of the target population? Yes
2. Were study participants recruited in an</td>
</tr>
</table>

Study Details	Participants	Diagnosis	Outcomes	Comments
Cans,C., Epilepsy and cerebral palsy: characteristics and trends in children born in 1976-1998, European Journal of Paediatric Neurology, 16, 48-55, 2012 **Ref Id** 317010 **Country/ies where the study was carried out** SCPE database **Study dates** Data of children born between 1976 and 1998. **Source of funding** Not reported.	**Characteristics** • 5268 children had bilateral spastic CP • 2930 children had unilateral spastic CP • 694 children had diskenetic CP • 395 children had ataxic CP • 5.4% had CP of known postnatal origin • the median age of postneonatal insult was 10 months (IQR 3-22) **Inclusion criteria** Children with CP were included if they were born between 1976 and 1998.	happened after 28 days of age. • Epilepsy was defined as a history of two unprovoked seizures after the neonatal period (i.e. after 28th day of birth) but before CP registration. • Epilepsy was considered active if the child was on medication at time of registration. The way information on diagnosis of epilepsy was obtained depended on the ascertainment method of the register. SCPE is a network of registers with different ascertainment methods. In several registers, data are abstracted from medical records, in other registries, it is the paediatrician in charge of the child who confirms the diagnosis of epilepsy and provides information directly to the register, using a data collection proforma.		appropriate way? Yes - using regional registries. Random sampling is not reported. 3. Was the sample size adequate? Yes - national registry (sample size calculation not required) 4. Were the study subjects and the setting described in detail? Yes. 5. Was the data analysis conducted with sufficient coverage of the identified sample? N/A 6. Were objective, standard criteria used for the measurement of the condition? Yes. 7. Was the condition measured reliably? Yes. 8. Was there appropriate statistical analysis? Yes - but confidence intervals not provided. 9. Are all important confounding factors/subgroups/differences identified and accounted for? N/A 10. Were subpopulations identified using objective criteria? Yes - results presented by CP type.

Study Details	Participants	Diagnosis	Outcomes	Comments
	Exclusion criteria • Children from the Tubingen survey (Germany) were excluded as the survey only recorded bilateral spastic CP cases. • Children from the Mersey register (UK) were excluded as information on epilepsy was missing for 91% of children. • All other children with missing information on epilepsy were also excluded. • Children born to mothers who were not living in the	**Results** Children with epilepsy by CP subtype, n (%): • bilateral spastic = 1854 (36.6) • unilateral spastic = 691 (25.6) • dyskinetic = 342 (51.6) • ataxic = 100 (27.2)		**Other information**

Study Details	Participants	Diagnosis	Outcomes	Comments
	region of the survey at the time of birth were also excluded. • Cases from two registers without any denominator available could not be included in the analysis of prevalence rates.			
Full citation Michelsen, S. I., Flachs, E. M., Damsgaard, M. T., Parkes, J., Parkinson, K., Rapp, M., Arnaud, C., Nystrand, M., Colver, A., Fauconnier, J., Dickinson, H. O., Marcelli, M., Uldall, P., European study of frequency of participation of adolescents with and	**Sample size** n = 667 **Characteristics** In all regions: Age group 11 - 13y: 28% 14 - 15y: 40% 16 - 18y: 32% Gender, male: 57% Motor function, GMFCS: I: 34% II: 18% III: 13% IV: 14% V: 21%	**Definition of CP** This study did not provide a definition of CP. **Results** Overall in all regions: IQ< 50 = 28%, IQ 50 - 70 = 26% IQ >= 70 = 46% By severity Only slight impairment: GMFCS I or II and IQ >= 70: 33%. Mainly motor impairment: GMFCS III, IV or V and IQ >=70: 13%. Mainly intellectual impairment:	**Comorbidities** Intellectual impairment: IQ < 50, 50 - 70, IQ >= 70 Assessed using algorithm based on the questions: "Do you think your child learns as well as other children of a similar age?", "Are most of your child's friends a similar age to your child?", "Does your child have severe difficulty learning in all aspects of development?", "Do you think that your child needs much more help than other children to learn things like reading and understanding ideas?"	**Limitations** Critical appraisal using Munn et al 2014: 1. Was the sample representative of the target population? Yes 2. Were study participants recruited in an appropriate way? Yes - using regional registries. Random sampling is not reported. 3. Was the sample size adequate? Yes - European registry (sample size calculation not required) 4. Were the study subjects and the setting

Study Details	Participants	Diagnosis	Outcomes	Comments
without cerebral palsy, European Journal of Paediatric Neurology, 18, 282-94, 2014 **Ref Id** 357226 **Country/ies where the study was carried out** Europe **Study dates** SPARCLE1: From birth (between 1991 - 1997) until age 8 to 12. Of these, n = 594 were followed up in SPARCLE2 (2009/1010) aged 13 - 17. Additional spampling from SPARCLE1: n = 73. A total of n = 667 adolescents analysed. **Source of funding**	**Inclusion criteria** 8 European regions with population-based registers (8/14 registries in the Surveillance of Cerebral Palsy in Europe (SCPE): north England, Northern Ireland, southwest Ireland, southwest France, southeast France, central Italy, west Sweden and east Denmark. A further region from northwest Germany recruited children from multiple sources: their age, gender, levels of impairment were similar to children in population based registers, although German adolescents recruited at slightly younger age. **Exclusion criteria** None reported.	GMFCS I or II and IQ < 70: 19%. Motor and intellectual impairment: GMFCS III, IV or V and IQ < 70: 35%		described in detail? Study subjects - Yes 5. Was the data analysis conducted with sufficient coverage of the identified sample? N/A 6. Were objective, standard criteria used for the measurement of the condition? Unclear - definition and diagnostic criteria for CP unclear 7. Was the condition measured reliably? Unclear 8. Was there appropriate statistical analysis? No-confidence intervals not provided. 9. Are all important confounding factors/subgroups/differences identified and accounted for? N/A 10. Were subpopulations identified using objective criteria? Yes, GMFCS used for motor function. **Other information**

Study Details	Participants	Diagnosis	Outcomes	Comments
SPARCLE1 funded by European Union Research Framework 5 program grant QLG5-CT-2002-00636, German ministry of health GBR-58640-2/14 and German Foundation for Disabled Child. SPARCLE2: Wellcome Trust WT 08315 A1A, medical faculty of university of Lubeck E40-2010, CNSA, INSERM, MiRe, DREES, IRESP, Ludvid and Sara Elsass Foundation, Spastics society and Vanforefonden, social coperative "gli ani in Tasca" and Fondazione Carivit, Goteborg University				

Study Details	Participants	Diagnosis	Outcomes	Comments
Full citation Parkes,J., White-Koning,M., Dickinson,H.O., Thyen,U., Arnaud,C., Beckung,E., Fauconnier,J., Marcelli,M., McManus,V., Michelsen,S.I., Parkinson,K., Colver,A., Psychological problems in children with cerebral palsy: a cross-sectional European study, Journal of Child Psychology and Psychiatry and Allied Disciplines, 49, 405-413, 2008 **Ref Id** 321782 **Country/ies where the study was carried out**	**Sample size** n = 818 **Characteristics** <u>Gender</u>: Boys/girls: 71/328 <u>Age</u> (yrs), n: 7/8: 178 9: 157 10: 161 11: 153 12/13: 150 <u>GMFCS</u>: I: 256 II: 205 III: 131 IV: 84 V: 99 CP subtype: spastic unilateral: 276 spastic bilateral: 407 dyskinetic: 83 ataxic: 29 **Inclusion criteria** 8 population based CP registers in Europe and additional database in NW Germany. Children with a diagnosis of CP born	**Definition of CP** Using the Surveillance of Cerebral Palsy Collaborative Group definition of CP (SCPE). **Results** Total difficulty score: 26% (95% CI 24 - 28) <u>Score by domains</u>: Peer problems: 32% (95% CI 30 – 35%) Hyperactivity: 31%, (95% CI: 29 – 33%) Emotion: 29% (95% CI 26 – 31% Conduct: 17% (95% CI 15 – 19%)	**Comorbidities** <u>Bevavioural difficulties</u> Emotional and behavioural symptoms were measured by the parent-form Strengths and Difficulties Questionnaire (SDS). This has 4 domains: emotion, conduct, hyperactivity, peer problems (all combined - total difficulty score (TDS)). A TDS > 16 was considered to be abnormal. The validity of the SDS was reported to generally satisfactory (Cronbach's alpha, mean = 0.69).	**Limitations** Critical appraisal using Munn et al 2014: 1. Was the sample representative of the target population? Yes 2. Were study participants recruited in an appropriate way? Yes - using regional registries. Random sampling is not reported. 3. Was the sample size adequate? Yes - collective of regional European registries (sample size calculation not required) 4. Were the study subjects and the setting described in detail? Yes 5. Was the data analysis conducted with sufficient coverage of the identified sample? N/A 6. Were objective, standard criteria used for the measurement of the condition? Yes 7. Was the condition measured reliably? Yes (reliability of SDS unclear, validity reported)

Study Details	Participants	Diagnosis	Outcomes	Comments
Europe **Study dates** Follow up from birth (between 1991 - 1997) until age 13 to 17 (SPARCLE2) **Source of funding** SPARCLE1 funded by European Union Research Framework 5 program grant QLG5-CT-2002-00636, German ministry of health GBR-58640-2/14 and Foundation for the disabled clinic.	July 1991 - 1 April 1997 and resident in one of the geographical areas. **Exclusion criteria** None reported.			8. Was there appropriate statistical analysis? Yes - confidence intervals provided. 9. Are all important confounding factors/subgroups/differences identified and accounted for? N/A 10. Were subpopulations identified using objective criteria? Yes **Other information**
Full citation Nystrand, M., Beckung, E., Dickinson, H., Colver, A., Stability of	**Sample size** n = 594 **Characteristics** GMFCS, n = 594	**Definition of CP** Definition of CP not provided. **Results**	**Comorbidities** Communication (assessment method not reported)	**Limitations** Critical appraisal using Munn et al 2014: 1. Was the sample representative of the target population? Yes

Study Details	Participants	Diagnosis	Outcomes	Comments
motor function and associated impairments between childhood and adolescence in young people with cerebral palsy in Europe, Developmental Medicine & Child Neurology, 56, 833-8, 2014 **Ref Id** 357649 **Country/ies where the study was carried out** **Study dates** Follow up from birth (between 1991 - 1997) until age 8 – 12 (SPARCLE1) and 13 to 17 (SPARCLE2) **Source of funding** SPARCLE1 funded by European Union Research	8 - 12 yrs (SPARCLE1) I: 176 (30%) II: 132 (22%) III: 102 (17%) IV: 85 (14%) V: 99 (17%) 13 - 17 yrs (SPARCLE2) I: 204 (34%) II: 105 (18%) III: 76 (13%) IV: 78 (13%) V: 131 (22%) **Inclusion criteria** The Study of Participation of Cerebral Palsy in Europe (SPARCLE) project, collects information from 9 regions in 7 countries. CP registers in 8 regions across Europe (8/14 registries from SCPE) and an additional database from NW Germany. **Exclusion criteria** None reported.	Communication 8 – 12 years Normal: 341/594 (57%) Communication difficulties but uses speech 102/594 (17%) Uses non-speech for formal communication: 73/594 (12%) No formal communication 78/594 (13%) 13 – 17 years: Normal: 349/594 (59%) Communication difficulties but uses speech 91/594 (15%) Uses non-speech for formal communication: 77/594, (13%) No formal communication 73/594 (12%) Missing 4/594 (1%) % who remained stable between childhood and adolescence: 82% kappa statistic 0.90 (95% CI: 0.82 – 0.98) showing agreement between impairment in childhood and adolescence (no change) % who changed for better: 10% % who changed for worse: 7% % who changed 1 level (for example, normal to communication difficulties but uses speech): 14%		2. Were study participants recruited in an appropriate way? Yes - using regional registries. Random sampling carried out. 3. Was the sample size adequate? Yes - study used regional European registries and databases (sample size calculation not required) 4. Were the study subjects and the setting described in detail? Yes 5. Was the data analysis conducted with sufficient coverage of the identified sample? N/A 6. Were objective, standard criteria used for the measurement of the condition? Unclear - criteria for diagnosis of CP not reported. 7. Was the condition measured reliably? Unclear 8. Was there appropriate statistical analysis? No - no confidence intervals for prevalence provided, however confidence interval for stability of impairment provided. 9. Are all important confounding factors/subgroups/differences identified and accounted for? N/A

Study Details	Participants	Diagnosis	Outcomes	Comments
Framework 5 program grant QLG5-CT-2002-00636, German ministry of health GBR-58640-2/14 and German Foundation for Disabled Child. SPARCLE2: Wellcome Trust WT 08315 A1A, medical faculty of university of Lubeck E40-2010, CNSA, INSERM, MiRe, DREES, IRESP, Ludvid and Sara Elsass Foundation, Spastics society and Vanforefonden, social coperative "gli ani in Tasca" and Fondazione Carivit, Goteborg University		% who changed 2 levels or more: 1%		10. Were subpopulations identified using objective criteria? No **Other information** Other comorbidities were reported including: seizures, cognitive level, vision and hearing. Evidence for this was not extracted as other evidence with a larger sample, more recent or UK based was found. Evidence from SPARCLE for cognition was reported from Michelsen 2014 and behavioural difficulties from Parkes 2008.
Full citation	**Sample size**	**Definition of CP**	**Comorbidities**	**Limitations**

Study Details	Participants	Diagnosis	Outcomes	Comments
Surman, G., Bonellie, S., Chalmers, J., Colver, A., Dolk, H., Hemming, K., King, A., Kurinczuk, J. J., Parkes, J., Platt, M. J., UKCP: a collaborative network of cerebral palsy registers in the United Kingdom.[Erratum appears in J Public Health (Oxf). 2006 Dec;28(4):400], Journal of Public Health, 28, 148-56, 2006 **Ref Id** 339644 **Country/ies where the study was carried out** United Kingdom **Study dates** Data abstracted in July 2004	There are 6910 records of children born 1960-1997 inclusive. After considering the exclusion criteria, 6855 were included in the analyses. **Characteristics** Characteristics of the registers The collaboration comprises five active CP registers, databases and surveys in the UK. The registers cover the birth population of Northern Ireland and Scotland and the three former English health regions of Mersey, Northern and Oxford, around 15% of England and Wales. As the registers were set up at different times, with some data collecting data retrospectively and some collecting data about newly diagnosed children, there is a variability in the completeness of data over time.	The classification of CP agreed by SCPE is used. Definition of impairments: • vision impairment = any vision impairment • severe vision impairment = visual acuity of 6/60 or worse in the better eye/clinical assessment where testing not possible • hearing impairment = clinical assessment that impairment is present • severe hearing impairment = severe/profound impairment or > 70 dB loss in the better ear/clinical assessment where testing not possible • intellectual impairment = moderate or worse developmental delay/learning difficulty likely to	Epilepsy	Critical appraisal using Munn et al 2014: 1. Was the sample representative of the target population? Yes 2. Were study participants recruited in an appropriate way? Yes - using regional registries. Random sampling is not reported. 3. Was the sample size adequate? Yes - national registry (sample size calculation not required) 4. Were the study subjects and the setting described in detail? Study subjects - No: distribution of motor disorders, severity by GMFCS levels and type not reported. Setting: yes. 5. Was the data analysis conducted with sufficient coverage of the identified sample? N/A 6. Were objective, standard criteria used for the measurement of the condition? Yes 7. Was the condition measured reliably? Yes (the presence of seizures was measured

Study Details	Participants	Diagnosis	Outcomes	Comments
about all children and held on the UKCP database for birth years 1960-1997, are used in this paper to illustrate the range of data available. Information about all live births for the appropriate geographical areas was available only for 1976-1996, and therefore, rates per 1000 live births are presented for only those years. **Source of funding** The UKCP collaboration continues to receive financial support from the University of Liverpool and the National Perinatal	• Merseyside and Cheshire CP register (MCCPR): births during 1966-1977 formed a retrospective cohort, and prospective data collection was from 1978. Having identifies the cases, clinical information is then abstracted from obstetric and paediatric case notes. • North of England Collaborative CP Survey (NECCPS): retrospective searches were carried out in 1980, 1985 and 1995 for the survey of births between 1960 and 1990 for the three districts. From 1991 the survey was extended to the whole of the Northern Health region, and data were collected prospectively from local convenors in each of the 16 former health districts. • Northern Ireland CP Register (NICPR): in 1991 the NICPR retrospectively	need special education/IQ < 70 • severe intellectual impairment = severe/profound impairment, delay or learning difficulty/ IQ < 50 • seizures = presence of seizures, either current or past **Results** All CP cases > 1 year, n = 6855 Vision impairment • total with available data, n = 5748 • number, % range = 2317, 34-40 Severe vision impairment • total with available data, n = 5445		either current or in the past) 8. Was there appropriate statistical analysis? Yes - confidence intervals not provided. 9. Are all important confounding factors/subgroups/differences identified and accounted for? N/A 10. Were subpopulations identified using objective criteria? No - GMFCS not used for severity. **Other information**

Study Details	Participants	Diagnosis	Outcomes	Comments
Epidemiology Unit at the University of Oxford. • Both MCCPR and 4Child are partially funded by the Department of Health under the Research Active Disease Registers Initiative. • The NECCPS receives grants from the Directors of Public health of the Northern and Yorkshire Region and Primary Health Care Trusts. • The NICPR is funded by the Department of Health and Social Services and Public Safety. • The Cerebral Palsy Register for Scotland is currently funded by the	identified cases of CP in children up to 14 years of age and then in all newly diagnosed cases. Follow-up clinical information is sought from the child's clinician; up to 1997 such information was available from 97% of the cases. When the register had required parental consent, this was gained in 60% of the cases, although only 2% of parents actually refused. • Four Counties database of CP (4Child): this register began in 1984 following a pilot study in 1983. 4Child catchment area remains Oxfordshire, Berkshire, Buckinghamshire and Northamptonshire. • CP register for Scotland (CPRS): it was established in 1990 by the Public Health Research Unit in Glasgow, retrospectively ascertaining cases from 1984. Data for birth years 1984-1990	• number, % range = 594, 9-11 Hearing impairment • total with available data, n = 6026 • number, % range = 476, 7-8 Severe hearing impairment • total with available data, n = 6216 • number, % range = 149, 2.2-2.4 Intellectual impairment • total with available data, n = 5229 • number, % range = 2663, 39-51 Severe intellectual impairment • total with available data, n = 5229		

Study Details	Participants	Diagnosis	Outcomes	Comments
charity Cerebra.	are currently held by UKCP. <u>Characteristics of the children</u> • 8% are known to have a postnatal cause for their CP • spastic CP is the most common subtype of CP, with bilateral and unilateral spastic CP marking up 91% of cases on the database • rates per 1000 live births, between 1976-1996, for each of the registers, range from 0.8 to 2.0 for spastic CP and from 0.1 to 0.3 to non-spastic CP • Where information was available, almost one-third of children had severely impaired lower limb function and nearly a quarter had severely impaired upper limb function. • Deaths: from 7 to 14%. Over the whole database, 739	• number, % range = 1612, 24-31 Seizures • total with available data, n = 3620 • number, % range = 1201, 18-33		

Study Details	Participants	Diagnosis	Outcomes	Comments
	children (11%) are known to have died before July 2004. 27% of death occurred between the ages of 1 and 4 years. **Inclusion criteria** see exclusion criteria and 'definition' box. **Exclusion criteria** • children who died before their first birthday • Area of residence unknown (0.5%) • Children born to mothers resident outside the register areas (8%) The latter two groups were included for the purposes of general discussion, but excluded where rates have been calculated.			

<table>
<tr><th>Study Details</th><th>Participants</th><th>Diagnosis</th><th>Outcomes</th><th>Comments</th></tr>
<tr><td></td><td>Data about intellectual impairment for Scotland and vision impairment before 1975 for North of England were not systematically collected, and these centres' data are excluded from the analyses of those items.</td><td></td><td></td><td></td></tr>
<tr><td>Full citation

Delacy, M. J., Reid, S. M., Australian cerebral palsy register, group, Profile of associated impairments at age 5 years in Australia by cerebral palsy subtype and Gross Motor Function Classification System level for birth years</td><td>Sample size
N= 3466

Characteristics
Children and young people were born between 1996 and 2005; 2022 (58%) were male. The distibution of GMFCS levels was (I) 34%, (II) 25%. (III) 12%, (IV) 13%, and (V) 16%. Postneonatally acquired CP accounted for 6.1% of the cohort (n=211)</td><td>Definition of CP
Categories for CP subtypes were based on the predominant subtype and comprised spastic hemiplegia (including monoplegia), spastic diplegia, spastic quadriplegia (including triplegia), ataxia, dyskinesia (including dystonic and choreo-athetotic forms), and hypotonia. The subtypes conform to the definitions proposed by the Surveillance of Cerebral Palsy in Europe</td><td>Comorbidities
Distribution of associated impairments for all children with cerebral palsy<table><tr><th></th><th>Mean, % (95 % CI)</th><th>GMFCS I</th><th>GMFCS II</th><th>GMFCS III</th><th>GMFCS IV</th><th>GMFCS V</th></tr><tr><td>Mild/ probable intellectual status</td><td>26.5 (24.0–28.9)</td><td>19</td><td>30</td><td>27</td><td>34</td><td>30</td></tr><tr><td>Known moderate/</td><td>22.7 (19.</td><td>7</td><td>15</td><td>25</td><td>33</td><td>55</td></tr></table></td><td>Limitations
Critical appraisal using Munn et al 2014:

1. Was the sample representative of the target population? Yes
2. Were study participants recruited in an appropriate way? Yes
3. Was the sample size adequate? Yes
4. Were the study subjects and the setting described in detail? Study subjects - yes
5. Was the data analysis conducted with</td></tr>
</table>

Study Details	Participants	Diagnosis	Outcomes							Comments
1996 to 2005, Developmental Medicine & Child Neurology, 58 Suppl 2, 50-6, 2016 **Ref Id** 443548 **Country/ies where the study was carried out** Australia **Study dates** Not reported **Source of funding** Queensland Department of Communities, Child Safety and Disability Services and support from CPL – Choice, Passion, Life. The Victorian Cerebral Palsy Register receives funding from the Victorian Department of Health and	but all cases of children with CP, postneonatally and non-postneonatally acquired, were analysed together. **Inclusion criteria** This study included data from four of eight Australian jurisdictions, covering approximately 63% of the Australian population. There was no minimum age for inclusion as a case. Brain injuries acquired after 28 days of life and up to the age of 2 years in a previously neurologically intact infant were included and all cases were analysed as a single cohort. **Exclusion criteria** Not reported	(SCPE),9 except the ACPR differentiates between spastic quadriplegia, where the spasticity in the upper limbs is equal to or greater than the spasticity in the lower limbs and spastic diplegia where the lower limbs are more affected. Hypotonic CP was defined as a combination of low muscle tone, out of proportion to that expected by intellectual impairment, and hyper-reflexia. In all subtypes, trunk tone and bulbar signs vary but their presence, c **Results** <u>Intellectual status:</u> Three categories were used: known moderate/severe impairment, corresponding to a tested IQ of 50 to 69 and including persons whose level of impairment wasunable to be estimated; and no known impairment, corresponding to a tested IQ ≥ 70 and including persons whose intellectual function was not formally tested but not clinically questioned	**severe intellectual status**	2–26.2)						sufficient coverage of the identified sample? N/A 6. Were objective, standard criteria used for the measurement of the condition? Yes 7. Was the condition measured reliably? Yes 8. Was there appropriate statistical analysis? Yes 9. Are all important confounding factors/subgroups/differences identified and accounted for? N/A 10. Were subpopulations identified using objective criteria? yes **Other information**
			Epilepsy resolved by age 5y	3.6 (3.0–4.3)	3	3	4	5	4	
			Epilepsy	27.8 (24.8–30.9)	13	22	22	42	65	
			Some speech impairment	36.9 (34.6–39.3)	37	46	46	43	10	
			non-verbal	23.8 (21.5–26.1)	2	8	19	45	87	
			Some hearing impairment	8.9 (7.9–9.9)	5	9	10	11	16	
			Bilateral deafness	3.4 (2.6–4.3)	2	2	3	4	9	
			Some visual impairment	30.3 (26.	21	28	39	42	44	

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<td>Human Services and infrastructure support from the Victorian Government's Operational Infrastructure Support Program. The second author received salary support through an Early Career Fellowship (2014–2017) from the National Health and Medical Research Council of Australia. This supplement was funded by the Research Foundation, Cerebral Palsy Alliance.</td>
<td></td>
<td>Epilepsy: defined as a history of at least 2 afebrile seizures before the age of 5 years, excluding neonatal seizures, irrespective of seizure control. Epilepsy status included a category for resolved epilepsy for persons who had been seizure free for 2 or more years without medication
Vision status: was based on clinical or formal assessment before any correction. Functional blindness was defined as a tested visual acuity of 6/60 or worse in the better eye and included those who clinically had light or colour perception but were unable to use their vision in a functional way. Some visual impairment described children who, at age 5, required corrective lenses to achieve normal visual acuity. No impairment indicated normal uncorrected visual acuity on formal testing or visual status that was not clinically questioned.
Speech status was classified by clinical assessment. Nonverbal referred to no or severely limited verbal expressive</td>
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<tr><td></td><td>4–34.3)</td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>Functionally blind</td><td>5.5 (4.8–6.3)</td><td>0</td><td>2</td><td>2</td><td>7</td><td>24</td></tr>
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<tr><th></th><th>mono/ hemiplegia</th><th>diplegia</th><th>tri/ quadriplegia</th><th>dyskinesia</th><th>ataxia</th><th>hypotonia</th></tr>
<tr><td>Mild/ probable intellectual status</td><td>22</td><td>24</td><td>32</td><td>28</td><td>33</td><td>35</td></tr>
<tr><td>Known moderate/ severe intellectual status</td><td>11</td><td>15</td><td>42</td><td>27</td><td>17</td><td>54</td></tr>
<tr><td>Epilepsy resolved by age 5y</td><td>4</td><td>2</td><td>5</td><td>4</td><td>4</td><td>5</td></tr>
<tr><td>Epilepsy</td><td>22</td><td>14</td><td>53</td><td>35</td><td>21</td><td>43</td></tr>
<tr><td>Some speech impairment</td><td>36</td><td>39</td><td>28</td><td>40</td><td>64</td><td>37</td></tr>
<tr><td>non-verbal</td><td>4</td><td>9</td><td>61</td><td>54</td><td>19</td><td>58</td></tr>
<tr><td>Some hearing impairment</td><td>6</td><td>8</td><td>13</td><td>11</td><td>8</td><td>12</td></tr>
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<tr><th>Study Details</th><th>Participants</th><th>Diagnosis</th><th>Outcomes</th><th>Comments</th></tr>
<tr><td></td><td></td><td>communication at 5 years (only a very limited number of words, e.g. mum/dad/yes/no). Some impairment referred to any speech impairment or delay regardless of cause or the presence of intellectual impairment. Hearing status was based on behavioural and/or physiological audiological testing or clinical assessment. Bilateral deafness was defined as unaided loss of >70 decibels (dB) in the better ear, or inability to hear a shouted human voice. Some impairment was defined as unaided loss of 25 to 70dB in the better ear or inability to hear whispers but with retained ability to hear a shouted voice. No impairment was defined as <25dB loss, the ability to hear whispers, or hearing status that was not clinically questioned.</td><td>
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<tr><td>Bilateral deafness</td><td>2</td><td>2</td><td>5</td><td>10</td><td>8</td><td>6</td></tr>
<tr><td>Some visual impairment</td><td>25</td><td>28</td><td>39</td><td>30</td><td>34</td><td>47</td></tr>
<tr><td>Functionally blind</td><td>1</td><td>2</td><td>16</td><td>6</td><td>1</td><td>10</td></tr>
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I.25 Social care needs

Study details	Participants	Methods	Findings/results	Comments
Full citation Mir, Ghazala, Tovey, Philip, Asian Carers' Experiences of Medical and Social Care: The Case of Cerebral Palsy, British Journal of Social Work, 33, 465-479, 2003 **Ref Id** 415809 **Study type** Qualitative study **Aims** To explore South Asian carers' perceptions of causation of CP or their views on the quality of social service support. **Study dates** Specific study dates were not reported. **Source of funding** The study was a joint initiative between SCOPE, who part-funded the research, the Centre for Research in Primary Care and the Asian Disability Network.	**Sample size** N=20 carers of children with CP. South Asian community in Nothern England. 13 Pakistani and 7 Indian were interviewed. Of the 14 women and 6 men, 16 were Muslim, 3 Siskh, and 1 Hindu. **Inclusion criteria** Families or carers from South Asian background **Exclusion criteria** Specific exclusion criteria was not reported.	**Setting** Community setting. **Data collection** • Sampling strategies made use of the Social Services Register of Disabled People in the city. In the second site this was not possible and specialist schools were approached to help with recruitment. • The main method of the study was the semi-structured interview	**Themes/categories** **Theme: <u>familial and emotional support</u>** Sub-theme: <u>need for emotional support</u>- emotional impact of cerebral palsy reported on both mother and child. The mother devoted 'enormous energy to the goal of making her daughter "normal" resulting in emotional damage to the child with cerebral palsy. *"She sometimes talks about being different to me. [Cries]…One day she said to me 'I wish I was dead. Then you would have a daughter who could walk nicely and could do everything'…I said to her 'We don't want another daughter, we want you, you will get better, we'll do exercises every day and you will get better.' Then she started to cry." (Harpreet, carer for her 11 year old child).* Sub-theme: <u>faith and spirituality</u>- faith played an important role in accepting and adjusting to their role as carers. *"Since Nadeem was born we have become more religious, our prayer has become more focused"* (Qamar, parent of a child with CP) **Theme: <u>services providing support</u>** Sub-theme: <u>respite care</u>- the study reported benefits of having respite care in providing a "break" for parents but also in allowing their child with cerebral palsy to socially engage. The study reported	**Limitations** Methodological limitations assessed using an adapted Critical Appraisal Skills Programme (CASP 2006). • **Aims:** aim of the study clearly reported, research method was appropiate for answering the research question. • **Sample selection:** how he sample was selected was clearly reported. The relationship between the researcher and the respondents was not clearly reported. The participants are appropriate to address the topic. • **Data collection:** data collection not clearly described. Roles of the researcher have been clearly described. Data saturation was achieved. • **Data analysis:** analysis clearly described. Data presented is enough to support the findings. Unclear how saturation in terms of analysis was achieved, unclear whether the researcher managed his own pre-understanding in relation to the analysis. Unclear how the analysis was independently validated. • **Findings/results:** results clearly described and applicable to the aims. Hypothesis, theory or model not generated.

Study details	Participants	Methods	Findings/results	Comments
			satisfaction with respite and respite care staff.	Overall quality based on limitations: **moderate** **Other information** • Data collection not clearly described • Role and potential influences of researchers unclear
Full citation McManus,V., Michelsen,S.I., Parkinson,K., Colver,A., Beckung,E., Pez,O., Caravale,B., Discussion groups with parents of children with cerebral palsy in Europe designed to assist development of a relevant measure of environment.[Erratum appears in Child Care Health Dev. 2006 May;32(3):393], Child: Care, Health and Development, 32, 185-192, 2006 **Ref Id** 322388 **Study type** Qualitative	**Sample size** Parents of 28 children with CP from five countries; Denmark, France, Italy, Ireland and Sweden **Inclusion criteria** Specific inclusion criteria not reported **Exclusion criteria** Specific exclusion criteria not reported	**Setting** Each of the groups met at a neutral venue and were led by a facilitator aided by a supporting person **Data collection** • Discussion groups. • All the interviews were audio-taped and transcribed.	**Themes/categories** **Theme: <u>Physical environmental needs</u>** **Sub-theme:** <u>access to adequate means of transport</u> Transport was reported to liberate people enabling them to explore, travel, visit people and participate in work, school and social activities. In Denmark, nearly all families had a 'disability car'. There is no registration tax and they receive financial aid for special fitting of the car. [OA1] Therefore, they do not use various taxi-arrangements with the exception of getting to and from school. However, Danish parents stress that transportation is a barrier since the parents have to accompany the child on every trip as there is poor public transport alternatives. In France public transport is accessible as there are ramps for the tramway and drop-down ramps on the bus. Italy: school buses are often not suitable	**Limitations** Methodological limitations assessed using an adapted Critical Appraisal Skills Programme (CASP 2006). • **Aims:** aim of the study was not clearly reported, research method was appropiate for answering the research question. • **Sample selection:** how he sample was selected was clearly reported. The relationship between the researcher and the respondents was clearly reported. The participants are appropriate to address the topic. • **Data collection:** data collection not clearly described. Roles of the researcher have been clearly described. Data saturation was achieved. • **Data analysis:** data analysis was not clearly described. Data presented is enough to support

Study details	Participants	Methods	Findings/results	Comments
Aims To inform the content of a questionnaire relevant to the environment of children with cerebral palsy living in Europe. **Study dates** Autumn 2003 **Source of funding** Study funded by the European Comission Research Framework 5 Programme- Grant number QLG5-CT-20			for transport of the disabled child. The lack of suitably equipped transport methods means parents often do not ask whether suitable transport is available. Sweden: transport was a problem for nearly all children. “Wheelchairs are not allowed on trams” and arrangements for booking disability friendly transport “never work”. Ireland: “A wheelchair-adapted taxi does not mean a wheelchair friendly taxi”. **Sub-theme:** mobility Swedish parents reported satisfaction with accessing places and adaption of living space. “The apartment was OK when our child was a baby but after some years a new house was bought to fit his needs. The house was totally adapted to our child, no stairs, and no doorsteps. Everything became natural” (mother of child with CP). In Denmark, parents pointed out that accessibility to shops, particularly getting into shops, is a problem. “If we do get in, he can’t move around inside the shop” (one mother describing son’s experience). In Ireland, a parent said wheelchair access is very awkward in some cinemas and “also gaining access to the beach is like moving an army; the wheelchair access is very limited”. Equipment for daily living: One French parent said “the child is the motor of the change” meaning that by responding to the child’s requests for equipment and adaptions at home you give the	the findings. Unclear how saturation in terms of analysis was achieved, unclear whether the researcher managed his own pre-understanding in relation to the analysis. Unclear how the analysis was independently validated. • **Findings/results:** results clearly described and applicable to the aims. The achieved results are applicable to the aims and are comprehensive. Hypothesis, theory or model not generated. Overall quality based on limitations: **low** **Other information** • Aim not directly related to aim of this evidence review • Data collection not clearly described

Study details	Participants	Methods	Findings/results	Comments
			child a better understanding of space and thereby autonomy and independence. Since discovering the motorised tricycle, one father said his son “can do long strolls during the weekend and holidays. It has changed our lives”. Listening too the child's needs: importance of listening to the child's requests for equipment's and adaptions. One parent said "the child is the motor of the change" (France) meaning that understanding the child's needs allows the child to gain a better understanding of their space and thereby 'autonomy and independence'. **Theme:Familial and emotional support needs** **Sub-theme:** supporting parents in daily living: the family as a whole is involved in support, particularly emotional support for the child with cerebral palsy but also for the parents: "Every family member is involved in the life of a child with cerebral palsy" (one parent) **Sub-theme:**need for emotional support: the family as a whole is involved in emotional support for the child with cerebral palsy but also for the parents: "every member is involved in the life of a child with cerebral palsy" (one parent) **Theme: services providing support** **Sub-theme:** need for adequate services, equipment and support	

Study details	Participants	Methods	Findings/results	Comments
			Respite care: was a source of support and practical help, but can provide difficulty if there is staff turnover: "it is very good with a helping person at home but it is difficult when there is a change in staff". In Sweden, support and practical help in the home are available which, although not always successful, can be good for the child 'it is very good with a helping person at home but it is difficult when there is a change in staff' Support in the home and school: In Ireland, resources for support are reported as inadequate 'we can't get a teenager to baby-sit our son, due to the requirements for a specialised sitter. This is very expensive, often too expensive to have time off'. A Danish parent saying 'to invite a friend with a disability demands that you are prepared to take care of two disabled children, we do not always have the energy for that'. Financial support: In Italy, there are problems in obtaining grants and aids. France: Financial forms take a long time to complete. "It then takes 1 ½ years to get the Specialised Education Allowance." Lack of information related with financial support: "The information about available financial help is not adequate" Access to school catering for special education needs: Danish and Irish parents felt that schools which cater for special education needs are located far away from	

Study details	Participants	Methods	Findings/results	Comments
			their home. Parents reported that due to this, their child's friends also lived far away. However, parents in Italy reported that they appreciated the lack of schools providing support for special education needs as it allowed their child to integrate and improve social participation. Both Danish and Irish parents state that it was a big problem that the special schools were often located far from their homes, because friends then also lived far away. Delays in services: It was recommended ages ago that we get a hoist for school, and it's only now months later that it's being put in. The department was so unhelpful. There were delays all the way. **Sub-theme:** needs relating to social participation Role of the school: parents feel that the school is the principal factor to improve social participation. Parents in Italy appreciated the lack of schools catering for special education needs as it allowed their child to integrate and improve social participation. However, Danish and Irish parents reported that schools catering for special education needs are located far away from their home and due to this, their child's friends lived far away. Role of siblings within schools: parents feel that siblings play an important role allowing their child with cerebral palsy to become socially integrate and accepted in the school.	

Study details	Participants	Methods	Findings/results	Comments
Full citation Shimmell, L. J., Gorter, J. W., Jackson, D., Wright, M., Galuppi, B., "It's the participation that motivates him": physical activity experiences of youth with cerebral palsy and their parents, Physical & Occupational Therapy in Pediatrics, 33, 405-20, 2013 **Ref Id** 416323 **Study type** Qualitative **Aims** To consult with youth with cerebral palsy and their parents to identify what they perceive as facilitators and barriers to being physically active. **Study dates** Between February 2011 and May 2012. **Source of funding** Funding by The Ontario Federation for Cerebral	**Sample size** N=15 children with CP between 10 and 18 years old and their parents. **Inclusion criteria** • Participants between 10 and 18 years old • Able to understand and respond to questions • Classification at level I to V on the Expanded and Revised Gross Motor Function Classification System (GMFCS E&R) **Exclusion criteria** Specific exclusion criteria was not reported.	**Setting** Specific setting was not reported, but the interviews were made across 6 treatment centers. **Data collection** • Focus groups and individual interviews	**Themes/categories** **Theme: Physical environmental needs** Sub-theme: Access to adequate means of transport Use of private transport: barriers to the use of public transport, including lack of available transit systems. **Theme: services providing support** Sub-theme: Needs relating to social participation Physical activity may be time consuming: parents find it challenging to make time for their children to be physically active or to participate in more time consuming activities. One parent stated: "Any activity for disabled kids, a team sporting activity, if you're doing it, is an all-day activity". Performing physical activity: children with cerebral palsy have preferences for physical activity, especially in relation to peer's perceptions of the condition. One child preferred to perform physical activities alone: "for me I like working alone because that takes away the outside barriers, it's just me and the exercises, there's no people picking me last or anything" (14 year old, GMFCS I). Additionally, one parent reported that their child does not experience a sense of belonging when performing physical activity: "This is	**Limitations** Methodological limitations assessed using an adapted Critical Appraisal Skills Programme (CASP 2006). • **Aims:** Aim of the study clearly reported, research method was appropiate for answering the research question. • **Sample selection:** Unclear how the selected was selected was. The relationship between the researcher and the respondents was clearly reported. The participants are appropriate to address the topic. • **Data collection:** data collection not clearly described. Unclear roles of the researcher. Data saturation was achieved. • **Data analysis:** Unclear description of the analysis. Clear how the themes are derived. Data presented is enough to support the findings. Data saturation in terms of analysis was achieved. Unclear whether the researcher managed his own pre-understanding in relation to the analysis. Unclear how the analysis was independently validated. • **Findings/results:** results clearly described and applicable to the aims. Results are applicable to the aims and are

Study details	Participants	Methods	Findings/results	Comments
Palsy (OFCP) provided important support to this study.			why [name of son] doesn't really fit into anywhere, he doesn't fit into the sports with the kids with the wheelchairs because he says "I don't have a wheelchair, I don't want to be with kids with wheelchairs, I don't need a wheelchair". But he does sports with kids with nothing wrong with them, he's not as good as them or there's problems so he doesn't really fit into either". (Parent of 14 year old, GMFCS, I). Pain as a barrier to physical activity: pain is a barrier to performing activities the child enjoys "... In yoga you are bending every which-way and when I like bend the wrong way, my muscles go into a Charlie horse and that is extremely painful" (17 year old, GMFCS IV).	comprehensive. Hypothesis, theory or model not generated. Overall quality based on limitations: **low** **Other information** • Data collection not clearly described • Role and potential influences of researchers unclear • One family had two parents participating in the focus group • 2 participants were outside the age limit criteria (9 years and 21 years)
Full citation Lawlor, K., Mihaylov, S., Welsh, B., Jarvis, S., Colver, A., A qualitative study of the physical, social and attitudinal environments influencing the participation of children with cerebral palsy in northeast England, Pediatric Rehabilitation, 9, 219-28, 2006 **Ref Id** 340219	**Sample size** N=13 families of children with CP, identified from North of England Collaborative CP Survey. Northeast England. **Inclusion criteria** • Families of children with cerebral palsy aged 14-17	**Setting** The interviews were undertaken in the respondents' homes. **Data collection** • In-depth interviews were undertaken to explore the views and experiences of families of children with cerebral palsy. • The interview structure was set out in a topic guide, developed from a literature	**Themes/categories** **Theme: Physical environmental needs** Sub-theme: access to adequate means of transport Use of private transport along with good parking facilities were the main facilitators to participation. Eleven families had private transport. "Before we had the car we used taxis or we didn't go anywhere. We've had a car for about 4 years and we go everywhere in it, it's much easier". Use of public transport: good for attending leisure activities,	**Limitations** Methodological limitations assessed using an adapted Critical Appraisal Skills Programme (CASP 2006). • **Aims:** aim of the study clearly reported, research method was appropiate for answering the research question. • **Sample selection:** how the sample was selected was clearly reported. The relationship between the researcher and the respondents was clearly reported. The

Study details	Participants	Methods	Findings/results	Comments
Study type Qualitative study **Aims** To ascertain from families of children with cerebral palsy the features of such environments which facilitate or restrict participation. **Study dates** Not specific study dates were reported. **Source of funding** Study funded by the Tyne and Wear Health Action Zone Child Health Group, as part of its Child Health Information Project.	• Already included in the North of England Collaborative Cerebral Palsy Survey **Exclusion criteria** Specific exclusion criteria was not reported.	review and previous research undertaken in northeast England which had identified major domains of participation for children with cerebral palsy. • The interviewer used open-ended questions such as 'What in your opinion are the good and positive things about the environment around you and your child that help you to take the part in everyday activities? • The interviews were tape recorded and transcribed' • The interviewer reviewed the transcripts, adding comments about whether the transcribed data corresponded to her impressions of the interview,	attending school and attending hospital appointments. Public transport in some countries outside the UK was mentioned positively, with one family praising the Netherlands particularly. "(...) this year we got a trip which involved getting on the train, a boat trip on the river and a steam train to bring you back to where you started (...)" Sub-theme: Mobility Structural adaptions: Main facilitators of mobility were structural adaptions allowing access to places in the home and to indoor and outdoor community environment. Some families had extensive adaptions to their homes in order to improve access and mobility for children. “She has a downstairs bedroom, bathroom, shower and toilet. It’s purpose built for her and we were involved in the plan. We have an intercom” (Child 6 father). Main barriers to mobility were also structural ones, operating both at home and in community and included: steps, lack of lifts or ramps and poor path surfacing, making the use of wheelchairs difficult or impossible. Lack of space and the extra time required to use equipment was also mentioned. Health service environments was also featured in concerns. “The GP has a slope up into the surgery, the doors aren’t good because the first door opens inwards and the second door opens outwards into the foyer so that’s very difficult to deal with” (Child 1 mother).	participants are appropriate to address the topic. • **Data collection:** data collection clearly described. Roles of the researcher have been clearly described. Data saturation was achieved. • **Data analysis:** analysis clearly described. Data presented is enough to support the findings. Unclear how saturation in terms of analysis was achieved. The researcher managed his own pre-understanding in relation to the analysis. Unclear how the analysis was independently validated. • **Findings/results:** results clearly described and applicable to the aims. Hypothesis, theory or model not generated. Overall quality based on limitations: **moderate** **Other information** • Out of 28 respondents, 12 families participated • Data collection and analysis clearly reported • Role of and potential influences of researchers

Study details	Participants	Methods	Findings/results	Comments
			Equipment for daily living: Main equipment that were facilitators included wheelchairs, walking frames and hoists. Having outdoor electric as opposed to manual or indoor electric wheelchair was seen as an invaluable piece of equipment facilitating parent and child's independence and participation in activities whilst at the same time reducing the required level of support and supervision. "…his electric chair is a real help" (Child 3 mother). **Theme: familial and emotional support needs** Sub-theme: need for familial support: In some cases extra support from grandparents meant that the parents could continue working. Child 9 father: 'We're very fortunate in that we have two sets of grandparents very close by. If we didn't have the grandparents I don't know what we'll do, one of us wouldn't be able to work'. **Theme: services providing support** Sub-theme: need for adequate services, equipment and support Respite care: Respite care provided a break for the parents, but it was the increased opportunities for their child's social participation which parents emphasised in the study.Child 4 mother: 'Unit X is a residential unit at the school and [child 4] actually goes there one night a week to give him a bit of development and independence'.	

Study details	Participants	Methods	Findings/results	Comments
			Services providing equipment: Child 10 father: 'One of the services that is a problem is wheelchair services. Everything takes forever. It's taken about 3 or 4 ears to get the electric wheelchair organised. It's the waiting for assessment, waiting for money, waiting for approval, the paperwork to go through' Physical support for daily living and activity: For activities such as bathing, dressing and feeding, lifting. Child 8 mother: 'I lift him myself. We have two hoists, the bedroom one, and overhead one, breaks down all the time. In the mornings I can't hoist [child 8] because he's so stiff until he's had his medication, so I lift him, give him his breakfast, give him his medication and time to relax'. Financial factors: Significant financial implications in having a disabled child which included the extra costs of equipment, adaptations to house and car, travel, clothes, laundry and consumables.Child 2 mother: 'In the past we've made the downstairs toilet for [child 2] and we got the stair lift. We paid for all that ourselves. When it came to asking for any kind of funding we weren't entitled'Increased requirement as child grows: "As he's getting older it's getting harder because of his weight" (Child 7 mother). Child 3 mother: 'We paid £3000 for the electric chair, we raised that. I wouldn't say he's cost me more, he doesn't ask for a thing'	

Study details	Participants	Methods	Findings/results	Comments
			Lack of information on where to look for financial support: "I didn't even know you could apply for a benefit. It was the Health Visitor who told me about the Disability Living Allowance and made me fill the forms out, I wouldn't have bothered but she was adamant'" - Child 12 mother.	
Full citation Capjon,H., Bjork,I.T., Rehabilitation after multilevel surgery in ambulant spastic children with cerebral palsy: children and parent experiences, Developmental neurorehabilitation, 13, 182-191, 2010 **Ref Id** 133298 **Study type** Qualitative **Aims** To explore post-operative family situation, rehabilitation and interdisciplinary cooperation for ambulant children with cerebral palsy after multilevel surgery. **Study dates**	**Sample size** N=8 spastic CP children and their parents. **Inclusion criteria** Specific inclusion criteria was not reported **Exclusion criteria** Families who had children who did not have the cognitive ability to participate in interviews were excluded.	**Setting** University hospital where multilevel surgery and follow-up consultations with the participants were performed **Data collection** • Semi-structured interviews were carried out separately with children and parents at 6 and 12 moths after multilevel surgery, when children and parents returned to the hospital for follow-up consultations. • A low-structured interview guide was developed covering the following themes: experiences with hospitals and health-care throughout the post-operative phase, experiences of pain and coping with training and physiotherapy after hospitalization, experiences of cooperation and	**Themes/categories** **Theme: Condition related needs** Sub-theme: Needs after surgery Satisfaction and participation after a year of rehabilitation Children experienced a low degree of post-operative pain and few other functional impediments achieved their goals of improved muscle strength, balance and ambulation. Additionally one boy was satisfied with increased social participation and activity with other children: "Now I hang around more with the other boys in the class; I couldn't do that before. I scored three goals already; I can stand longer and run more, and I couldn't do that before. I can walk longer distances and feel I am faster; this is the best operation I've ever had". Physiotherapy and training Parents and children reported that the physiotherapist plays an important role in the long term rehabilitation of the child and achieving their rehabilitation goals. "We have been fortunate to have the same physiotherapist for our	**Limitations** Methodological limitations assessed using an adapted Critical Appraisal Skills Programme (CASP 2006). • **Aims:** aim of the study clearly reported, research method was appropiate for answering the research question. • **Sample selection:** how the sample was selected was clearly reported. The relationship between the researcher and the respondents not clearly reported. The participants are appropriate to address the topic. • **Data collection:** data collection procedure was clearly described according to a theoretical framework. Roles of the researcher have not been clearly described. Data saturation was achieved. • **Data analysis:** analysis clearly described. Data presented is enough to support the findings. Clear how saturation was achieved in terms of analysis,

Study details	Participants	Methods	Findings/results	Comments
Specific study dates of the study were not reported **Source of funding** Funded by South Norway Regional Health Authority, Norwegian Physiotherapy Association and Rikshopiaet, University Hospital, Centre for Shared Decision Making and Nursing Research, Oslo, Norway.		acceptance from teachers and schoolmates and evaluation of outcome compared with their efforts during rehabilitation. • The interviews lasted 0.5-1.5 hours, were tape recorded ans transcribed verbatim • Interviews with the children were usually shorter than the ones with the parents, but same topics were covered. • A total of 32 interviews were covered.	son ever since he was young. He has facilitated things that were difficult at school, so he has been a very supportive person for us in many ways throughout the past years" (mother of 15 year old boy). However, both children and parents reported that training after multilevel surgery was 'more physically and psychologically demanding than other surgeries' but was helped by the support of the physiotherapist. Additionally, one child reported that training is more physically draining as he experiences severe pain; 'I wasn't prepared for it to be this difficult. If I had known what this entitled, I would have dropped out of school for his year. I get just as psychologically fatigued as I get physically tired, because I have to concentrate on walking in the proper way and following a new technique. You get so worn out that you just want to be alone' (17 year old boy). In the first 6 months post-surgery, children reported being highly motivated to train regularly. However, the following months proved more challenging. Many children felt that training was repetitive, painful and not achieving their goals: "I have really done my best, but this has involved very much training and a lot of repetition. It turned out that there was no pool training, and I thought I would eventually be able to walk farther, but in fact I walk only shorter distances (15 year old boy)".	unclear whether the researcher managed his own pre-understanding in relation to the analysis. Unclear how the analysis was independently validated. • **Findings/results:** results clearly described and applicable to the aims. Hypothesis, theory or model not generated. Overall quality based on limitations: **low** **Other information** • Data collection and analysis clearly reported • Role and potential influences of researchers unclear.

Study details	Participants	Methods	Findings/results	Comments
			Additionally, many children who used orthosis found them uncomfortable (for example, causing blisters and abrasions) and many children prefer to not to use them. Coping with pain The study reported that 2 children developed sympathetic dystrophy including over-sensitivity to all sensory stimuli and persistent pain for a period of up to 1 year. This resulted in desperation and insomnia throughout the entire initial post-operative half year and both families experienced these 6 moths as a nightmare. They experienced a lack of or inadequate levels of support: "We have gone through a half year of sleeplesness and a nightmare of pain. We have used sleeping pills and at times pur daughter has wanted to die". This has been a tremendous challenge for the entire family (...) There are two of us who can share this responsibility, but what about single mothers?" (Father of a 13-year-old-girl) Due to the levels of pain and decreased quality of life experienced by the families, the parents questions whether the operation was necessary. None of the family felt they would be capable of going through the ordeal a second time. Lack of information regarding support during rehabilitation Parents reported that they felt they have not received adequate levels of support from staff personnel,	

Study details	Participants	Methods	Findings/results	Comments
			mostly due to not knowing who to contact for support or where to receive information. "If we had been given good enough information in advance, it would have been easier to cope. I feel a little upset because I don't know who I can contact. Who is supposed to be helping me?" (Mother of teenage girl with CP).	

I.26 Transition to adult services

Study details	Participants	Methods	Findings/results	Comments
Full citation Carroll, E. M., Health Care Transition Experiences of Young Adults With Cerebral Palsy, Journal of Pediatric Nursing, 30, e157-64, 2015 **Ref Id** 416217 **Aim of the study** To uncover the meaning of transition to adult-centered care as experienced by young adults with cerebral palsy participants and to engage then in an	**Sample size** N=9 young adults. **Characteristics** N=6 were female. Age range was 19 to 25. Physical mobility related to cerebral palsy impairment varied across the sample and included: independent walkers (n=2); walkers using adapting devices (n=3); and wheel chair reliant (n=4). **Inclusion criteria** (1)To be 18-25 years; 2) carry the diagnosis of cerebral palsy; 3) be able to articulate	**Data collection** The unstructured interview was opened by the question, "You have been told that you will be moving from pediatric to adult provider"; or "you have already transferred to an adult healthcare provider- could you tell me what that experiences has been like for you?" Interviews were conducted in participants' homes, college dormitory and library meeting rooms; the interviews ran between 60 or 90 minutes. Interviews were audio taped and replayed by the researcher while practicing reflective journaling. The recordings were simultaneously reviewed	**Themes/categories** **Theme: Medical team** Sub-theme: Expert novices Participants addressed more fragmented adult health care model, and the systems involved in that model are completely new for the participants. They also addressed the lack of knowledge that specialists had about cerebral palsy?: "(...) how frustrating is to be, to having an acute need and to have a doctor say I don't know what the effects would be because I don't know enough about CP and you ask him well where should I go and they don't have any answer for you".. There is also an expectation that they should be partners in the health visit; there should be dialog: "i want them to present me, as the person with the issue, the opportunity to choose one option given all	**Limitations** Methodological limitations assessed using an adapted Critical Appraisal Skills Programme (CASP 2006). • **Aims:** Aim of the study clearly reported, research method was appropriate for answering the research question. • **Sample selection:** How he sample was selected was clearly reported. The relationship between the researcher and the respondents not clearly reported. The participants were appropriate to address the topic. • **Data collection:** Data collection clearly described. Roles of the researcher have been clearly described. Data saturation was achieved.

Study details	Participants	Methods	Findings/results	Comments
exploration of the meaning of this transition, through the research question: what are the lived experiences of young adults with cerebral palsy transitioning from pediatric to adult healthcare? **Study dates** Not reported **Source of funding** Not reported	language; 4) report that an extended interview of approximately 1 hour will not pose a burden to them due to its reliance on language; 5) must have made a transition to adult provider or have been notified of their transfer from pediatric/adolescent services into adult-centered care within 6 months. **Exclusion criteria** Not reported	with transcripts to identify any recollected non-verbal gestures or tones.	the information. I want to choose it and then I want them to tell me how to execute it". Sub-theme: Accepting less A difference between expectations and experiences was observed: "I think that was probably the moment where I realised I had hopped over a fence, and there was no going back in the other direction to its many benefits". Participants also shared their moment of realizing that transition to adulthood with CP should not be a new topic for the service delivery: "I don't know much about this history of CP but I have got to assume that there are people with CP who are into adulthood now and have been in adulthood for twenty plus years so like the fact that they are just realizing now that there's a need [for adult services] is fascinating to me, like, where have you been?" **Theme: Transition timing** Sub-theme: Evidence/ experience-based expectations Participants have been mentored in taking the absolute best care care of themselves by their trusted pediatric and specialist providers. High expectations have been instilled through that experience: "I would say at this point, it is about keeping things maintained. I hope I do not have to have too much more surgeries. So for right now, I would probably want to look into some nonsurgical maintenance". Sub-theme: Interdependence	• **Data analysis:** Analysis clearly described. Data presented is enough to support the findings. Unclear how saturation in terms of analysis was achieved, unclear whether the researcher managed his own pre-understanding in relation to the analysis. Unclear how the analysis was independently validated. • **Findings/results:** results clearly described and applicable to the aims. Hypothesis, theory or model generated not generated. Overall quality based on limitations: **moderate**

Study details	Participants	Methods	Findings/results	Comments
			Participants appreciate the support received throughout their care in which parents, peers and providers were important factors. ? "I have always been physically dependent on my parents; we are sort of like a little package when I am at home. And my parents are not overprotective in any way, and they have always allowed me to go off on my own if I wanted to and try things. But just out of necessity, we need to be together a lot".	
Full citation Bjorquist, E., Nordmark, E., Hallstrom, I., Living in transition - Experiences of health and well-being and the needs of adolescents with cerebral palsy, Child: care, health and development, 41, 258-265, 2015 **Ref Id** 416348 **Aim of the study** To gain a deeper understanding of how adolescents with cerebral palsy (CP) experience their own health, well-being and needs of support during their transition to adulthood.	**Sample size** N= 12 **Characteristics** Age range was between 17 and 18 years old. All participants had CP and represented a range of gross motor function and cognitive abilities as reported by the participants themselves and/or the interviewers. **Inclusion criteria** Not reported **Exclusion criteria** Not reported	**Data collection** Data were collected through a combination of focus group and individual interviews. 5 adolescents participated in 1 to 3 focus group interviews, 4 adolescents in 1 to 2 individual interviews and 3 adolescents participated in both.An interview guide was used, consisting of topics associated with transition to adulthood. This was illustrated by pictograms and pictures, which is an ideogram that conveys its meaning through its pictoral resemblance and is used for supporting people with learning disabilities. The focus groups interviews were held at a Child and Youth Habilitation centre and lasted approximately 90 min. The individual interviews were conducted in a place chosen by the participant and lasted	**Themes/categories** **Theme: <u>Transition timing</u>** Sub-theme: <u>Surrounded by support, but what is going on?</u> Participants had little awareness about adult services and they only had a vague idea about the type of support that was available there.One participant described his experience from an information meeting about becoming an adult: "...It was one of those big meetings. It was about if you're moving away from home and you need help with the economy and things like that if you have like more severe disabilities. But... there wasn't really much that concerned me, just that I'll transfer to the Adult Habilitation services when I turn 20..." Sub-theme: <u>Hopes for the future, but a desire for stepping-stones</u> Participants looked forward to being independent and being treated with respect as adults, but at the same time they thought	**Limitations** Methodological limitations assessed using an adapted Critical Appraisal Skills Programme (CASP 2006). • **Aims:** Aim of the study clearly reported, research method was appropriate for answering the research question. • **Sample selection:** How the sample was selected was clearly reported. The relationship between the researcher and the respondents was clearly reported. The participants are appropriate to address the topic. • **Data collection:** Data collection clearly described. Roles of the researcher have been clearly described. <u>Data saturation was achieved.</u> • **Data analysis:** Analysis clearly described. Data presented is enough to support the findings. Unclear how saturation in terms of analysis was achieved.Unclear whether the researcher managed his own pre-understanding in relation to

Study details	Participants	Methods	Findings/results	Comments
Study dates July 2011 to June 2012 **Source of funding** Support for the study was provided by Swedish Research Council and the Research platform for Disability studies in Habilitation, Region Skane. The authors of the study report no conflicts of interest.		approximately 60 minutes. One of the interviews was conducted with a parent and used a larger set of pictograms. 2 participants had a proxy present during the interview. All interviews started with an open question 'How do you find life right now when you are young and soon to become an adult?'. During the focus group, open-ended questions connected to the pictograms were asked and researchers asked connected questions such as: 'Can you tell me more?' or 'What do you mean?'	it was too early to think about the future and they lacked readiness and willingness to move away from home. They were concerned about the future and unsure about what kind of support would they need: "...excuse me, but do I really have to think about the future right now?" Likewise, they wished for support in the process of transition and individualised information about what kind of support would they be able to get. Verbal information was preferred to information booklets which were difficult to read.They desired a contact person, such as a care coordinator, for the individual support needed: "I would prefer support from staff. Of course my mother's said that if I want any help I can come home... but maybe it's not such fun to have to go there every time" Moving away from home steep-by-step was considered an option to facilitate the first time in adult life just as settling down near the parents or moving to a college or a group home with staff and friends nearby, like a stepping-stone.	the analysis. The analysis was independently validated. • **Findings/results:** results clearly described and applicable to the aims. Hypothesis, theory or model not generated. Overall quality based on limitations: **moderate**
Full citation DiFazio, R. L., Harris, M., Vessey, J. A., Glader, L., Shanske, S., Opportunities lost and found: experiences of patients with cerebral palsy and their parents transitioning from pediatric to adult	**Sample size** N=14 (5 adults with cerebral palsy and 9 parents of adults with cerebral palsy). **Characteristics** Age range 18-43 years old (25 years average); 40% (n=2) of the adult patients and 25%	**Data collection** Prior to conducting the 2 focus groups, separate but parallel moderator guides were developed for the patients and carers to be used in facilitating group discussion as needed. Initially, information regarding health care transition (HCT)	**Themes/categories** **Theme: <u>Transition timing</u>** Sub-theme: E<u>motional aspects of transition</u> Participants were unprepared and they felt that they were not active participants of the timing of the decision. Parents expressed "feeling abandoned" and having been "kicked out". Finishing a long-standing	**Limitations** Methodological limitations assessed using an adapted Critical Appraisal Skills Programme (CASP 2006). • **Aims:** Aim of the study was clearly reported, research method was appropriate for answering the research question.

Study details	Participants	Methods	Findings/results	Comments
healthcare, Journal of Pediatric Rehabilitation Medicine, 7, 17-31, 2014 **Ref Id** 416444 **Aim of the study** To describe and define the experiences of adults with cerebral palsy (CP) and parents of adults with CP who have been involved in a transfer of physiatry care from pediatric to adult healthcare and to explore their experiences more generally in the transition from pediatric to adult services. **Study dates** Not reported **Source of funding** Study supported by a grant from the Peabody Foundation, Inc., specifically the William V. Tripp III Fund for the Advancement of Pediatric Orthopaedic Nursing Grant. The authors report no conflicts of interest.	(n=2) of the parent of adult patient were male. **Inclusion criteria** Patients and parents were required to speak English, were capable of independently providing informed consent, and were interested and available to participate in the focus groups. Additionally, they had to have the necessary communicative and cognitive abilities to actively participate in the focus groups. Parents of adult children with CP needed to meet the same inclusion criteria: their adult child had transferred their physiatry care to an adult's health care provider and had completed at least one visit. **Exclusion criteria** Not reported	was culled from research findings and informed by health care transition theory, expert clinical opinion and patient experiences shared with the healthcare team. The primary question that guided the study was "How would you define a successful transition process?" Four key content domains for the moderator guides were identified including: 1) Transition Planning, 2) Accessibility of Services, 3) Experience with Adult Providers, 4) Recommendations for Improvements to the Transition Process. Open-ended questions with selected probes were developed for each of these domains. Focus groups were conducted in a private hospital meeting room, lasted 90 minutes and were audio-taped. Each focus groups had a moderator and a recorder and an iterative process was used to ensure the clarity of the questions. Moderators allowed the data to be driven by the participants by encouraging them to what it was important to them.	relationship with their physician was perceived as a deep violation of a trusting relationship. One of the patients expressed: "(...) if you're seeing somebody every six months or every year until you're like seventeen, eighteen, there's some kind of connection there. So then they'd be like okay you are away now. It's kind of like wait, what are you doing with me?" Sub-theme: No bridge to care from one to another Patients often were placed in limbo, often resulting in delaying necessary care: "My knee has been hurting for years...They're kind of okay go see Dr... And I'm like Dr... Is awesome, but he doesn't deal with knees, he in turn refers me to somebody else and that person does not get back to me and I still haven't done this (...)" Sub-theme: Readiness Patients wanted the process to be transparent, specific and clear, with frank discussion around its trajectory: "I think a discussion needs to occur earlier (...) just need to bring this up with the two parents and adolescent at an earlier stage so that everybody, parent and child become comfortable with the fact that they are going to have a transition period (...)" (parent). In this line, parents and patients also identified the need of understanding what would it be different about adult care, thus allowing them to be more proactive, informed decisions about care requirements and preferences. "They don't put him under anesthesia, they just kind of tranquilize him... my son doesn't speak so he has no real way of communicating, but when he feels strongly about something, he sticks his	• **Sample selection:** How the sample was selected was clearly reported. The relationship between the researcher and the respondents was clearly reported. The participants are appropriate to address the topic. • **Data collection:** Data collection was clearly described. Roles of the researcher have been clearly described. Data saturation was achieved. • **Data analysis:** Clear description of the analysis. Clear how the themes are derived. Data presented is enough to support the findings. Data saturation in terms of analysis was achieved. The researcher managed his own pre-understanding in relation to the analysis. Clear how the analysis was independently validated. • **Findings/results:** Results clearly described and applicable to the aims. Results are applicable to the aims and are comprehensive. Hypothesis, theory or model not generated. Overall quality based on limitations: **moderate**

Study details	Participants	Methods	Findings/results	Comments
			tongue out and the whole time we were there, he had his tongue out" (Mother of a young man with significant global impairment reflected on the differing approaches to Botox injections". Sub-theme: Educational needs of transition Patients indicated they needed more formal preparation in self-advocacy and needed to learn how to become self-sufficient in managing their own care (i.e. how to manage appointments, maintain persona healthcare records...). "As kids I mean we just see like pieces of paper being handed off to people and assuming it goes off to some magical land where it gets taken care of when that's not the case at all and then when it gets handed over to us, you kind of don't know that to do with it". However, patients expressed some ambivalence when it comes to handling bureaucratic issues: "I don't know if it was my parents doing it and I just thought t hat the office staff did it. I really son't know, but I'm doing more work that leads me to advocate for myself, but I feel like you have assistants, you have secretaries: can't somebody else send a letter or make a phone call?" **Theme: Medical teams** Sub-theme: Access The lack of appropriately trained/experienced adult providers was the most significant challenge that parents and patients identified."It was like he had no clue of my non-verbal child and I was totally put off by his suggestions. He has lost 12 pounds. This is a three year transition. He has contractures... I know he needs care and it's very frustrating" (Parent). Primary	

Study details	Participants	Methods	Findings/results	Comments
			care and specialty physicians willing to care for adults with CP were either unavailable or unexperienced. Additionally, the lack of specialists made the transition more challenging. For example, adults with CP usually require less orthopedic surgical interventions than children, but they still need ongoing support: "Again in the orthopedic end, I asked my doctor if there was anybody he would recommend to transfer my care over, he did not know. So I was left in limbo and still to this day I'm looking for a surgeon that will take a look at me and my care". The lack of specialty providers comfortable with dealing the underlying developmental issues and the lack of multidisciplinary teams was also acknowledge: "(...) like he (his son) has GI problems also. if I just went to my local hospital for convenience and went to a GI doctor, they'd look at him like oh my God, I don't know what to do. Like they can do the GI part, but they don't know the other part and that's what is nice about coming here (referring to the pediatric setting) (...)". Sub-theme: <u>Challenges of current delivery system</u> Parents and patients found inconvenient the shift from multi-disciplinary care in pediatric services to brief specialty visits focusing in a single complaint in the adult setting: "And they give you 15 minutes. So like the're trying to figure out, trying to figure it it out in 15 minutes. When a normal person goes in for their 15 minutes, forget about all the other stuff and I don't know about you guys but I always leave feeling like I didn't get results". Participants were also dissatisfied with the lack of coordinated care covering the gamut of preventive, corrective, and restorative	

Study details	Participants	Methods	Findings/results	Comments
			services: "(...) There's so many more comprehensive interdisciplinary pediatric services period for any illness than there are for adults.. So there isn't a continuity for this" (Parent). **Theme: <u>Services</u>** Sub-theme: <u>recommendations for an improved care model</u> Referrals to adult providers that they know are capable and committed to caring for an individual with CP was necessary, but not sufficient for transition.They reported willingness "to do the footwork" if they had a vetted list of names of providers that might be a good match. They addressed the referrals as an important component of the transition process for many patients, especially when needing to move to a new medical group or facility: "(...) when meeting my son's adult primary care doctor for the first time, it was the doctor that admitted he could not care for my son. We went on-line. Right there in his office and he pulled up all of the doctors.. he was looking at the history, their education and he said we were going to choose between the older one and the younger ones and I was like I've got the two older ones and they don't have the patience, let's try the younger ones". Parents stated a preference for a temporal transitional unit where adult and pediatric providers shared a philosophical approach, communicating freely. Recognizing the increasing incidence in the number of children with CP who will be transitioning their care: "Now why can't the (pediatric) hospital hire some adult doctors and work together? I mean there are enough of us I'm sure and I mean the kids are getting older and kids are living longer" (patient). They also identified the need of a social worker,	

Study details	Participants	Methods	Findings/results	Comments
			nurse or care coordinator who could help to advocate on their behalf as needed, as well as support groups for parents designed for information sharing: "Support groups are great, but they take up your time. I'm too busy doing everything. I want to be knowledgeable and empowered. I want something where you can talk about your concerns, share ideas and have a nurse or a physician or something brig the information".	
Full citation Lariviere-Bastien, D., Bell, E., Majnemer, A., Shevell, M., Racine, E., Perspectives of young adults with cerebral palsy on transitioning from pediatric to adult healthcare systems, Seminars in Pediatric Neurology, 20, 154-9, 2013 **Ref Id** 339875 **Aim of the study** To report data about the transition process gathered from young adults with cerebral palsy who have experienced various forms of transition.	**Sample size** N= 14 young adults wit cerebral palsy **Characteristics** 7 males and 7 females; aged 18-25 years(mean age = 20.9 years) **Inclusion criteria** Not reported **Exclusion criteria** Not reported	**Data collection** Participation included a semi-structured, one-to-one qualitative interview. Audio-taped interviews were transcribed verbatim and analyzed using a conventional thematic qualitative content analysis based on a coding guide to support the coding process.Coding was supported by the use of QSR NVivo 8 qualitative analysis software (Doncaster, Australia). The interview questions and discussion focused on topics such as (1) description of the experience of living with a disability and the type and frequency of medical services received, (2) the transitions from the pediatric healthcare system to the adult health care system, (3) the ethical and social issues encountered in healthcare	**Themes/categories** **Theme:Services** Sub-theme: Transition envisaged with fear and apprehension Lose connection with easily available services in the pediatric healthcare system "(...) I told you just now about my respiratory therapist, we ended it this year. But I had it in recent years, but we ended it because we thought that in the adult system it would be much more difficult to find, and we wanted to see how my body would react (...)". Sub-theme:Lack of time and resources in the adult healthcare system Several participants missed the lengthy medical visits they had received in the pediatric system "When I was at [name of the pediatric hospital] for the same surgery I would stay for 12 hours and sleep overnight, whereas in the adult system, after the same surgery they ship you home after an hour (...)"	**Limitations** Methodological limitations assessed using an adapted Critical Appraisal Skills Programme (CASP 2006). • **Aims:** aim of the study not clearly reported. • **Sample selection:** how the sample was selected was not clearly reported. The relationship between the researcher and the respondents not clearly reported. The participants were appropriate to address the topic. • **Data collection:** data collection procedure was not clearly described. Roles of the researcher have not been clearly described. Saturation of data was not discussed by the researcher. • **Data analysis:** analysis clearly described. Data presented is enough to support the findings. Unclear how saturation in terms of analysis was described. Unclear whether the researcher managed his own pre-understanding in relation to

Study details	Participants	Methods	Findings/results	Comments
Study dates Not reported **Source of funding** Support for this work comes from NeuroDevNet (Racine, Shevell, and Majnemer) and the Canadian Institutes of Health Research, New Investigator Award (Recine).		(including but not limited to issues such as autonomy, making medical decisions, and relationships between participants and healthcare professionals).	Sub-theme: Better support and more follow-up in the pediatric system Participants valued the follow-up and support received in pediatric healthcare, especially the fact that they took the time to communicate with them, reminding them to take appointments. "(...) if you don't run after them [occupational therapists, physicians], if you don't remember you need to see a physician, they won't call you". Sub-theme: Services globally more appreciated in the pediatric system whether in terms of quality and timelines of services or the atmosphere in the healthcare facility "(...) the more I grow up, the less satisfied I am". Sub-theme: Abrupt loss of services, feeling a void at the time of transition Participants felt as they have lost the resources available to them in the pediatric system. It is the abruptness of the transition that was most disruptive to participants. They raised the absurdity of feeling like a radical change was expected when they turned 18 years old. "But you know, really, even if you're older than 18, the disability is still there, (...) the 18 years mark is not magic, you know! (Laugh) We still have a lot of needs, you know". Sub-theme: Feeling of abandonment during the transition "...when I moved from the pediatric system to the adult system, i felt really disoriented. Because I saw that we would be less supported and that it would be more difficult".	the analysis. Unclear how the analysis was independently validated. • **Findings/results:** results clearly described but unclear whether those are applicable to the aims. Hypothesis, theory or model not generated. Overall quality based on limitations: **very low** Limitations reported by the authors of the study: • Qualitative study design was not intended to test hypotheses but rather to capture the experience of individuals with CP • Mixed sample prevents strong conclusions • Individuals of the study were receiving care in different institutions.

Study details	Participants	Methods	Findings/results	Comments
			Sub-theme: Sadness to leave the pediatric system and the relationships they have developed "(...) it's like a family, when you grow up with a family, well [name of the hospital] or [name of another pediatric hospital], you grow up with them (...). The fact of leaving all this, it's like leaving part of my family, so it's hard" **Theme: Medical team** Sub-theme: Lack of support, preparation and information during the transition Participants would have liked more information about the characteristics, better support during the transition period and having been introduced earlier to the healthcare professionals. "(...) at least to be told "OK, you are now 18, so you will go there, and it is so-and-so physician who will take care of you" Sub-theme: Improper management and transfer of medical records Sub-theme: More knowledge and experience with CP in the pediatric system Professionals are less familiar with characteristics of CP "(...) physicians do not know what to do (...) when they say "Oh, well you can go do your exercises, and workout, and you'll be OK, you'll be better". This is what I have done all my life. They do not have any other solutions that this for me". Sub-theme: More consideration and concern for the patients in the pediatric healthcare system	

Study details	Participants	Methods	Findings/results	Comments
			Participants felt that they were receiving less consideration, encouragement and trust from healthcare professional in the pediatric system; "(...) when you are young, physicians will take your case more seriously (...) when you are 21 years old, they look at your case as something not important (...)" Sub-theme: Difficulty accessing physicians and healthcare professionals in the adult healthcare system "That, I will admit that, I had forgotten that but I really struggle to find a physiatrist. And I don't feel my request was taken seriously (...)"	
Full citation Young,N.L., Barden,W.S., Mills,W.A., Burke,T.A., Law,M., Boydell,K., Transition to adult-oriented health care: perspectives of youth and adults with complex physical disabilities, Physical and Occupational Therapy	**Sample size** N=30 children and young people and their 30 parents (n=30 pairs) **Characteristics** The youth sample ranged in age from 14.8 to 19.6 (mean 17.8) years and the adult sample from 24.8 to 32.8 (mean 28.0) years. In total, there were 14 individuals with	**Data collection** Youths and parents were interviewed separately with in semi-structured interview format. During the interviews participants were prompted to discuss a broad range of health care services received in childhood and currently, their anticipation or experience of the health care transition, and factors affecting outcomes in this	**Themes/categories** **Theme:Transition timing** Sub-theme: Lack of information provided This challenge was particularly faced by parents of adults, who recalled the process of transition: "someone who knew the system and knew what was needed and, could have guided us. Instead of having to go out and beat the bushes". A parent of a participant who had transitioned 2 years before: "someone, on a one-on-one basis,	**Limitations** Methodological limitations assessed using an adapted Critical Appraisal Skills Programme (CASP 2006). • **Aims:** Aim of the study clearly reported, research method was appropriate for answering the research question. • **Sample selection:** How he sample was selected was clearly reported. The relationship between the researcher and the respondents not

Study details	Participants	Methods	Findings/results	Comments
in Pediatrics, 29, 345-361, 2009 **Ref Id** 322339 **Aim of the study** To examine the issue of clinical transition from the perspectives of individual patients with mild, moderate, and severe cerebral palsy (CP), spina bifida (SB) and acquired brain injury (ABIc) and their parents, to better understand the scope of this issue and to assist with the development of evidence-based health care transition programs. **Study dates** Not reported **Source of funding** Canadian Institutes foe Health Research (CIHR). Dr. Young holds a Canada Research Chair, which is also funded by CIHR. Authors report no declarations of interest.	CP (5 mild CP, 5 with moderate CP and 4 with severe CP), 9 participants with SB and 7 with ABI. The sample included 5 youths who had not yet started the transition,7 youths and 15 adults who had completed the transition. **Inclusion criteria** To present with a diagnosis of CP, ABIc or SB and having received clinical care from one of the 6 Children's Treatment Centres (CTC) in Ontario, Canada. **Exclusion criteria** Not reported	transition. Immediately after each interview the 2 interviewers met to compare findings. Interviews were taped, transcribed and imported into NVivo	who would walk through all the individuals that you are seeing and if not give you names [of new adult services providers], at least give you some specifics so you would go look for them. In other words, the best person to make recommendations might be the current caregiver, but again to have somebody help us to coordinate it so that we are not out there trying to do it ourselves". Sub-theme: <u>Uncertainty regarding the transition process</u> As a consequence of the lack of information: "Now what happens? What happens if she breaks an arm or leg? And they said 'Well that's when you have to go to your family doctor and take it from there'. And that was the end of it". Another parent recommended that the transition process started earlier: "I just would wish it would start early and get parents involved, to the point that we kind of now where we're going. I think the hardest part is we're scares, we're nervous". Sub-theme: <u>More information</u> Many participant thought is was necessary having more information before the process of transition, and not solely directed to parents, but also to patients: "I think they've told my mom the different services. They don't really inform me. They seem to have my mom still more involved than me, I'd like to know". The participants who had already been through the process, expressed how important it would have been having had more information: "(...) they could have told me some of the services that I have available to me in the hospital and what to expect".	clearly reported. The participants are appropriate to address the topic. • **Data collection:** Data collection clearly described. Roles of the researcher not clearly described. Unclear whether Data saturation was achieved. • **Data analysis:** Analysis clearly described. Data presented is enough to support the findings. Unclear how saturation in terms of analysis was achieved, unclear whether the researcher managed his own pre-understanding in relation to the analysis. Unclear how the analysis was independently validated. • **Findings/results:** Results clearly described and applicable to the aims. Hypothesis, theory or model not generated. Overall quality based on limitations: **low/moderate**

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			Sub-theme: More support Before, during and after the transition: "There could be somebody, a transition to adulthood coordinator, would probably be a good idea. Someone who knows the issues and could help quarterback the next stage". They also expressed their disappointment regarding the gap and lack of continuity of care: "I think it's wrong and not very professional if you discontinue your patient at a certain age, where it's their most prime age of needing to understand hoe the adult body works". Many parents reported that they had been their child's advocate, especially during the developmental years: "I wanted to be able to look my child in the eye when they are 25 and say 'we left no stone unturned' and she has the best possible life"	