NATIONAL INSTITUTE FOR HEALTH AND CLINICAL EXCELLENCE

PUBLIC HEALTH DRAFT GUIDANCE

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Preventing unintentional injuries among children and young people aged under 15: road design and modification

NICE public health guidance X

Introduction

The Department of Health (DH) asked the National Institute for Health and Clinical Excellence (NICE) to produce public health guidance on reducing accidental injuries to those aged under 15 on the road. This guidance focuses on road design and modification.

The guidance is for transport planners, road safety professionals, and others who have a direct or indirect role in, and responsibility for, preventing unintentional injuries to young people aged under 15. This includes those working in the NHS, local authorities, education and the wider public, private, voluntary and community sectors.

It may also be of interest to road users, children, young people, parents and carers and other members of the public.

This is one of five pieces of NICE guidance currently in development on how to prevent unintentional injuries among children and young people aged under 15. The others will address: education and protective equipment to prevent unintentional injuries on the road; home risk assessments and safety equipment; outdoor play and leisure; strategies, legislation, regulation, enforcement, surveillance and workforce development. The guidance complements, but does not replace, NICE guidance on promoting physical activity. (For further details, see section 7).

The Public Health Interventions Advisory Committee (PHIAC) has considered both the reviews of the evidence and the economic analysis.

This document sets out the Committee's preliminary recommendations. It does not include all sections that will appear in the final guidance. NICE is now inviting comments from stakeholders (listed on our website at www.nice.org.uk).

Note that this document does not constitute NICE's formal guidance on preventing unintentional injuries among under 15s: road design and modification. The recommendations made in section 1 are provisional and may change after consultation with stakeholders and fieldwork.

The stages NICE will follow after consultation (including fieldwork) are summarised below.

- The Committee will meet again to consider the comments, reports and any additional evidence that has been submitted.
- After that meeting, the Committee will produce a second draft of the guidance.
- The draft guidance will be signed off by the NICE Guidance Executive.

For further details, see 'The NICE public health guidance development process: An overview for stakeholders including public health practitioners, policy makers and the public' (second edition, 2009) (this document is available at www.nice.org.uk/phprocess).

The key dates are:

Closing date for comments: 2 December 2009.
Second Committee meeting: 15 January 2010.

Members of PHIAC are listed in appendix A and supporting documents used to prepare this document are listed in appendix E.

This guidance was developed using the NICE public health intervention process.

Contents

1 Recommendations

When writing the recommendations, the Public Health Interventions Advisory Committee (PHIAC) (see appendix A) considered the evidence of effectiveness and cost effectiveness. Note: this document does not constitute NICE's formal guidance on this intervention. The recommendations are preliminary and may change after consultation.

The evidence statements underpinning the recommendations are listed in appendix C. A brief description of the interventions is given below, immediately before the list of recommendations.

The evidence reviews, supporting evidence statements and economic analysis are available at www.nice.org.uk/guidance/PHG/Wave18/2

Context

This guidance focuses on engineering measures to reduce road injuries among children and young people. These measures should be part of a broader strategy to reduce such injuries (including education and enforcement).

The recommendations cover 20 mph limits, 20 mph zones and traffic-calming measures:

- 20 mph limits are imposed using signs at the start and end of roads covered by the limit and reminder signs at points in between (terminal and repeater signing).
- 20 mph zones are areas where additional engineering measures (for example, speed humps or chicanes) have been used to slow traffic.
- Traffic-calming measures are engineering changes to the road to slow traffic (for example, physical features such as speed humps or changes in priority). These may be used on single roads or on an area-wide basis.

Who is the target population?

For all recommendations the target population is children and young people under 15, although there will also be benefits to the wider population.

Recommendation 1: needs assessment and planning

Who should take action?

- Directors of public health.
- Local highways authorities.
- Local strategic partnerships.
- Public health professionals with responsibility for reducing injuries.

What action should they take?

When introducing engineering measures to reduce speed, ensure that:

- they are part of broader strategies to reduce road injuries (including education and enforcement strategies)
- they are developed after considering data on injuries (including levels of casualties, their age, the groups involved and where they occur) and traffic speed and volume
- their precise design and form is determined by local context and needs of the site (including physical limitations such as geological considerations)
- they are developed using effective processes of community engagement (see 'Community engagement', NICE public health guidance 9) and with involvement of other interested parties such as the emergency services and local businesses
- a plan is developed for implementing them, based on local priorities for modifying the transport infrastructure.

Recommendation 2: measures to reduce speed

Who should take action?

- Local highways authorities.
- Local strategic partnerships.

What action should they take?

- Introduce engineering measures to reduce speed in urban and rural areas, including both residential areas and mixed priority routes. These could include:
    - changes to the speed limit with signing only (20 mph limits)
    - changes involving speed reduction features (for example traffic-calming measures on single streets or across wider areas such as 20 mph zones).

- Consider developing city or town-wide 20 mph limits and zones on appropriate residential roads.

- Take account of the factors identified in recommendation 1 when introducing measures.

Recommendation 3: school travel

Who should take action?

- Directors of public health.

- Head teachers.

- Local highways authorities.

- Local strategic partnerships.

- Public health professionals with an injury reduction remit.

- School governors.

- School travel planners.

What action should they take?

Consider opportunities to develop engineering measures beyond the school premises (not just in close proximity to the school) to provide safer routes to school. This should be done as part of the development of a broad package of

measures to address school travel, for instance when developing school travel plans.

2 Public health need and practice

The rate of deaths and serious injuries from road collisions has been declining over recent decades (by about 4% per year in all ages and 9% in children). However, unintentional injury is still a leading cause of death among children and young people aged 1–14 years (Audit Commission and Healthcare Commission 2007). Nearly half (46%) of UK deaths from unintentional injury in people aged 1–14 are road related (DH 2002). In 2007, 94 people younger than 15 were killed, 18,786 were injured in Great Britain on the roads, 2296 of whom were seriously injured. 1608 (67%) of those killed or seriously injured were pedestrians; cyclists (347) and car passengers (353) each make up just under 15% of those killed or seriously injured (Department for Transport 2009a).

The numbers of killed or seriously injured casualties increases with age. There is a noticeable increase between ages 10 and 11, which coincides with the move to secondary school and probably with increasing unsupervised travel. In 2007, 65% of children or young people killed or seriously injured were boys. This higher rate in boys is seen in all modes of transport except for car passengers, where girls account for 53% of those killed or seriously injured. Most of these casualties occur in urban rather than rural areas (2267 compared with 776 aged 0–15 years), and in urban areas the percentage of casualties who are pedestrians is higher than in rural settings (71% compared with 36%).

In urban settings most casualties (75%) are on minor roads (Department for Transport 2009b). Younger children (aged up to about 8) tend to be injured in streets close to their home. As they get older (around 11 and above) children tend to be injured further from home, and on busier roads, reflecting their increasing licence to travel independently. Boys tend to be given greater independence at an earlier age and so this shift occurs at a younger age in boys than in girls.

There are other people besides casualties whose health is affected in less apparent ways. People can be traumatised by near misses, or avoid activities

or opportunities because of danger (real or perceived) on the roads. These opportunities include walking or cycling, meeting friends and family and other types of recreation, as well as the freedom to develop independence.

Overall population-based casualty rates for England are better than the European Union (EU) average. However, this rating masks poorer figures for pedestrians (Department for Transport 2008).

Among people aged under15, the likelihood of dying as a car occupant is 5.5 times higher if their parents are unemployed than if they have managerial or professional jobs; this ratio exceeds 20 among pedestrians and cyclists. The largest factor in this difference in death rate is exposure to danger rather than behaviour (Edwards et al. 2006). People from lower socioeconomic groups are more likely to live in neighbourhoods with streets with terraced housing, on-street parking, little or no off-street play areas and high-speed traffic. More than one quarter of child pedestrian injuries happen in the most deprived tenth of wards (Greyling et al. 2002).

National data, such as those reported in ‘Road casualties Great Britain’ (Department for Transport 2009a), do not routinely feature information on characteristics of the casualty other than age and sex. Information on ethnicity, for instance, has generally come from a small number of local studies, which frequently focus on one ethnic group. A report by the Department of the Environment Transport and the Regions (2001) states that results suggest there is a higher pedestrian casualty rate among children (age range not stated) from Asian backgrounds than non-Asian peers in the same area. Other groups may be similarly affected but have not been systematically studied.

Factors that affect whether someone is injured or killed in a road collision, and severity of injury, play a part either before a collision (such as speed, training and road surface), around the time of collision (such as anti-lock brakes) or after collision (such as vehicle design, seatbelts, airbags and emergency services). Approaches to preventing collisions (primary prevention) focus on altering the behaviour of road users (for example, educating about road

dangers or restricting vehicle speed) or of a vehicle if emergency action is required (for instance anti-lock brakes or anti-skid road surfaces) (Racioppi et al. 2004). Approaches to reducing severity of injury (secondary prevention) include car design and provision and use of safety devices such as seat belts or restraints and helmets. Perceptions of safety, however, can alter behaviour (such as faster driving in a car with anti-lock brakes) so that actual risk is higher than might have been expected (risk compensation). The logical place to start in considering road injuries is with primary prevention.

Road design has a key influence on speed (Department for Transport 2007). 'Excess and inappropriate' speed contributes to around 30% of fatal crashes in high-income countries (World Health Organization 2004). Higher speeds reduce the time available for reactions and increase the severity of collisions. Vulnerable road users (cyclists and pedestrians) are at particular risk: pedestrians have a 90% chance of surviving car crashes at speeds below 30 kph but a less than 50% chance of surviving collisions at speeds of 45 kph (Racioppi et al. 2004).

3 Considerations

PHIAC took account of a number of factors and issues when developing the recommendations.

3.1 PHIAC agreed that there is a moral imperative to protect children, including on the roads. This includes addressing the behaviour of drivers through a variety of approaches.

3.2 Although engineering measures are important in reducing casualties, PHIAC discussed the importance of other factors, including education, enforcement and changing the percentage of journeys undertaken by car, public transport, on foot or by bicycle (modal shift). Engineering, education and enforcement activities are likely to be synergistic.

3.3 Methodological difficulties make it hard to be clear about what intervention has (or has not) achieved specific outcomes:

- Engineering measures are not commonly assessed using trials. Instead, many are developed through continuous gradual improvements of technology.
- The overall downward trend in injuries makes comparisons over time difficult.
- The numbers of people killed or seriously injured are relatively small, so it is difficult for studies to achieve statistical significance.
- There is a lot of action to try to prevent injuries, both locally and nationally, which may add to the difficulty of identifying effective elements of interventions
- The diffuse nature of some interventions, often involving multiple components, makes comparisons between interventions difficult.

- Interventions may be designed to achieve a range of outcomes.
- Interventions are generally designed to reduce casualty rates for all road users rather than just children.

3.4 Much of the evidence considered was from the UK and so was deemed applicable to making recommendations for England. However, PHIAC was aware that older publications from the UK might be less applicable, because changing political, cultural and economic backgrounds can alter the effectiveness of interventions.

3.5 Nonetheless, PHIAC noted the evidence consistently suggested that engineering measures designed to reduce traffic speed generally reduce collisions and deaths or injuries in children.

3.6 For inclusion in the reviews, evidence needed to provide data on injuries to children. If data on speed was also provided, this was included. However, the literature relating to speed alone has not been considered in this work. Similarly, studies that did not provide an analysis of injuries to children aged under 15 were not included.

3.7 PHIAC noted that pedestrians are much more likely to be killed in collisions at higher speeds.

3.8 For several types of interventions identified in the scope for this work, the reviews either found no evidence (for instance for woonerven and ‘naked streets’) or found no impact on injuries (for instance for ‘home zones’ – where injury reduction is not the primary purpose). These therefore do not appear in the recommendations.

3.9 Engineering measures may have other outcomes (both positive and negative) than those relating to injuries. These include noise, damage to buildings or vehicles (from vibration and the impact of vertical traffic-calming features) and air pollution (including CO_2 emissions). Changes in behaviours may also be related to health

outcomes, for instance increasing levels of physical activity by supporting cycling and walking or encouraging greater social contact.

3.10 Other transport interventions may have aims that are complementary to or in conflict with injury prevention interventions. Changes to the physical environment can have unintended consequences. In addition to the effects described in paragraph 3.9, some changes that reduce injuries may disadvantage some groups, for example those with visual impairment and physical disabilities. Changes that remove physical features (such as the difference between pavement and road) might increase uncertainty on the part of motorists, and so promote a safer driving style; however, they might also make negotiating a street more difficult for people with a visual impairment.

3.11 PHIAC noted that the attitudes of communities and drivers to measures to reduce speed is important – they are more accepting if they can see the point of them (such as those near schools) although it should be noted that these areas may not in fact be most likely to have significant injury rates.

3.12 Economic analysis in NICE guidance generally consists of an estimation of the cost per QALY gained. This enables a comparison with what is deemed to be value for money in the health service. However, when assessing road transport interventions, other approaches are more appropriate. In particular, the Department for Transport uses cost–benefit analysis taking a 'broad societal perspective' to assess value for money. The cost per QALY of most of the modelled interventions was high (only advisory speed limits were found to have a cost of less than £30,000 per QALY gained). However, the cost falls in the transport sector and so it is more appropriate to compare cost effectiveness with other transport interventions, using a method followed in that sector (see

Department for Transport Transport Analysis Guidance[1]). This is in line with the 'Social value judgements: principles for the development of NICE guidance' (NICE 2008)[2].

3.13 Speed cameras and other enforcement strategies were not covered in the scope for this work. PHIAC noted that the guidance on 'Strategies to prevent injuries in children and young people under 15' was considering enforcement and this would include speed cameras.

4 Implementation

NICE guidance can help:

- NHS organisations, social care and children's services meet the requirements of the DH's 'Operating framework for 2008/09' and 'Operational plans 2008/09–2010/11'.
- NHS organisations, social care and children's services meet the requirements of the Department of Communities and Local Government's 'The new performance framework for local authorities and local authority partnerships'.
- National and local organisations within the public sector meet government indicators and targets to improve health and reduce health inequalities.
- Local authorities fulfil their remit to promote the economic, social and environmental wellbeing of communities.
- Local NHS organisations, local authorities and other local public sector partners benefit from any identified cost savings, disinvestment opportunities or opportunities for redirecting resources.
- Provide a focus for multi-sector partnerships for health, such as local strategic partnerships.

[1] www.dft.gov.uk/webtag/
[2] www.nice.org.uk/media/C18/30/SVJ2PUBLICATION2008.pdf

NICE will develop tools to help organisations put this guidance into practice. Details will be available on our website after the guidance has been issued (www.nice.org.uk/PHxx).

5 Recommendations for research

This section will be completed in the final document.

More detail on the gaps in the evidence identified during development of this guidance is provided in appendix D.

6 Updating the recommendations

This section will be completed in the final document.

7 Related NICE guidance

Published

Promoting physical activity for children and young people. NICE public health guidance 17 (2009). Available from www.nice.org.uk/PH17

Community engagement. NICE public health guidance 9 (2008). Available from www.nice.org.uk/PH9

Physical activity and the environment. NICE public health guidance 8 (2008). Available from www.nice.org.uk/PH8

Behaviour change. NICE public health guidance 6 (2007). Available from www.nice.org.uk/PH6

Under development

Preventing unintentional injuries among under 15s in the home. NICE public health guidance (publication expected April 2010).

Preventing unintentional injuries among under 15s: outdoor play and leisure. NICE public health guidance (publication expected October 2010).

Strategies to prevent unintentional injuries among under 15s. NICE public health guidance (publication expected October 2010).

Preventing unintentional road injuries among under 15s: education and protective equipment. NICE public health guidance (publication date to be confirmed).

Preventing unintentional road injuries among young people aged 15–24. NICE public health guidance (publication date to be confirmed).

Transport policies that prioritise walking and cycling. NICE public health guidance (publication date to be confirmed).

8 References

Audit Commission and Healthcare Commission (2007) Better safe than sorry: preventing unintentional injury to children. London: Audit Commission

Department for Transport (2008) Road casualties Great Britain: 2007 annual report. London: The Stationery Office

Department for Transport (2009a) Road casualties Great Britain: 2008 annual report. London: The Stationery Office

Department for Transport (2009b) Child casualties in road accidents: 2007 Road accident statistics factsheet no. 5. London: Department for Transport

Department of Health (2002) Preventing accidental injuries: priorities for action. Report to the Chief Medical Officer from the Accidental Injury Task Force. Norwich: The Stationery Office

Department of the Environment, Transport and the Regions (2001) Road accident involvement of children from ethnic minorities: a literature review. London. Department of Environment, Transport and the Regions

Edwards P, Roberts I, Green J, et al. (2006) Deaths from injury in children and employment status in family: analysis of trends in class specific death rates. BMJ 333: 119–21

Greyling T, Hallam K, Daniel G, et al. (2002) Streets ahead: safe and liveable streets for children. London. Institute for Public Policy Research

Organisation for Economic Cooperation and Development (2004) Keeping children safe in traffic. Paris: Organisation for Economic Cooperation and Development

Racioppi F, Ericsson L, Tingvall C, et al. (2004) Preventing road traffic injury: a public health perspective for Europe. Copenhagen: World Health Organization.

Sethi D, Racioppi F, Mitis F. (2007) Youth and road safety in Europe. Copenhagen: World Health Organization

World Health Organization (2004) World report on road traffic injury prevention. Geneva: World Health Organization

Appendix A Membership of the Public Health Interventions Advisory Committee (PHIAC), the NICE project team and external contractors

Public Health Interventions Advisory Committee

NICE has set up a standing committee, the Public Health Interventions Advisory Committee (PHIAC), which reviews the evidence and develops recommendations on public health interventions. Membership of PHIAC is multidisciplinary, comprising public health practitioners, clinicians, local authority officers, teachers, social care professionals, representatives of the public, academics and technical experts as follows.

Professor Sue Atkinson CBE Independent Consultant and Visiting Professor, Department of Epidemiology and Public Health, University College London

Mr John F Barker Associate Foundation Stage Regional Adviser for the Parents as Partners in Early Learning Project, DfES National Strategies

Professor Michael Bury Emeritus Professor of Sociology, University of London. Honorary Professor of Sociology, University of Kent

Professor K K Cheng Professor of Epidemiology, University of Birmingham

Ms Joanne Cooke Programme Manager, Collaboration and Leadership in Applied Health Research and Care for South Yorkshire

Dr Richard Cookson Senior Lecturer, Department of Social Policy and Social Work, University of York

Mr Philip Cutler Forums Support Manager, Bradford Alliance on Community Care

Ms Lesley Michele de Meza Personal, Social, Health and Economic (PSHE) Education Consultant, Trainer and Writer

Professor Ruth Hall Regional Director, Health Protection Agency, South West

Ms Amanda Hoey Director, Consumer Health Consulting Limited

Mr Alasdair J Hogarth Educational Consultant and recently retired Head Teacher

Mr Andrew Hopkin Assistant Director, Local Environment, Derby City Council

Dr Ann Hoskins Director, Children, Young People and Maternity, NHS North West

Ms Muriel James Secretary, Northampton Healthy Communities Collaborative and the King Edward Road Surgery Patient Participation Group

Dr Matt Kearney General Practitioner, Castlefields, Runcorn. GP Public Health Practitioner, Knowsley PCT

Ms Valerie King Designated Nurse for Looked After Children, Northampton PCT, Daventry and South Northants PCT and Northampton General Hospital. Public Health Skills Development Nurse, Northampton PCT

CHAIR Professor Catherine Law Professor of Public Health and Epidemiology, UCL Institute of Child Health

Mr David McDaid Research Fellow, Department of Health and Social Care, London School of Economics and Political Science

Mr Bren McInerney Community Member

Professor Susan Michie Professor of Health Psychology, BPS Centre for Outcomes Research and Effectiveness, University College London

Dr Stephen Morris Professor of Health Economics, Department of Epidemiology and Public Health, University College London

Dr Adam Oliver RCUK Senior Academic Fellow**,** Health Economics and Policy, London School of Economics

Dr Mike Owen General Practitioner, William Budd Health Centre, Bristol

Dr Toby Prevost Reader in Medical Statistics, Department of Public Health Sciences, King's College London

Ms Jane Putsey Lay Member, Registered Tutor, Breastfeeding Network

Dr Mike Rayner Director, British Heart Foundation Health Promotion Research Group, Department of Public Health, University of Oxford

Mr Dale Robinson Chief Environmental Health Officer, South Cambridgeshire District Council

Ms Joyce Rothschild Children's Services Improvement Adviser, Solihull Metropolitan Borough Council

Dr Tracey Sach Senior Lecturer in Health Economics, University of East Anglia

Professor Mark Sculpher Professor of Health Economics, Centre for Health Economics, University of York

Dr David Sloan Retired Director of Public Health

Dr Stephanie Taylor Reader, Applied Research, Centre for Health Sciences, Barts and The London School of Medicine and Dentistry

Dr Stephen Walters Reader, Medical Statistics, University of Sheffield

Dr Dagmar Zeuner Joint Director of Public Health, Hammersmith and Fulham PCT

Expert co-optees to PHIAC:

Amy Aeron-Thomas Community Member, 'Strategies to prevent unintentional injuries among under 15s', Programme Development Group; Executive Director, RoadPeace

Peter Andrews Group Manager, Safety Engineering Group, Lancashire County Council

Chris Lines Head, London Road Safety Unit, Transport for London

Amanda Roberts Member 'Strategies to prevent unintentional injuries among under 15s', Programme Development Group; Road Safety Team Leader, Telford and Wrekin Council, Shropshire

Heather Ward Chair, 'Strategies to prevent unintentional injuries among under 15s', Programme Development Group; Honorary Research Fellow, Centre for Transport Studies, University College London

NICE project team

Mike Kelly
CPHE Director

Simon Ellis
Associate Director

Hugo Crombie
Lead Analyst

Kay Nolan
Analyst

Lesley Owen
Technical Adviser (Health Economics).

External contractors

Reviewers: evidence reviews

Review 1: 'Systematic reviews of effectiveness and cost effectiveness of road and street design-based interventions aimed at reducing unintentional injuries in children' was carried out by Peninsula Technology Assessment Group (PenTAG). The principal authors were: Kate Ashton, Tiffany Moxham, Julie Frier, Gabriel Rogers, Ruth Garside and Rob Anderson.

Review 2: ‘Barriers to, and facilitators of, the prevention of unintentional injury in children on the road’ was carried out by PenTAG. The principal authors were: Ruth Garside, Kate Ashton, Tiffany Moxham and Rob Anderson.

Reviewers: cost effectiveness modelling

The economic modelling is reported in: ‘Cost-effectiveness modelling of road and street design-based interventions aimed at reducing unintentional injuries in children’, which was carried out by PenTAG. The principal authors were: Jaime Peters, Rob Anderson and Tiffany Moxham.

Appendix B Summary of the methods used to develop this guidance

Introduction

The reviews and economic analysis include full details of the methods used to select the evidence (including search strategies), assess its quality and summarise it.

The minutes of the PHIAC meetings provide further detail about the Committee's interpretation of the evidence and development of the recommendations.

All supporting documents are listed in appendix E and are available at www.nice.org.uk/guidance/PHG/Wave18/2

Guidance development

The stages involved in developing public health intervention guidance are outlined in the box below.

1. Draft scope released for consultation

2. Stakeholder meeting about the draft scope

3. Stakeholder comments used to revise the scope

4. Final scope and responses to comments published on website

5. Evidence review(s) and economic analysis undertaken

6. Evidence and economic analysis released for consultation

7. Comments and additional material submitted by stakeholders

8. Review of additional material submitted by stakeholders (screened against inclusion criteria used in review/s)

9. Evidence and economic analysis submitted to PHIAC

10. PHIAC produces draft recommendations

11. Draft guidance released for consultation and for field testing

12. PHIAC amends recommendations

13. Final guidance published on website

14. Responses to comments published on website

Key questions

The key questions were established as part of the scope. They formed the starting point for the reviews of evidence and were used by PHIAC to help develop the recommendations. The overarching questions were:

What types of road design or modification to the road and street environment

are effective and cost effective in reducing road injuries among children and young people aged under 15?

What are the barriers and facilitators to implementing environmental modifications and road/street designs relating to the reduction of road injuries?

The subsidiary questions were:

What are the barriers and facilitators to implementing environmental modifications and designs relating to the reduction of vehicle speeds and road injuries?

These questions were made more specific for the reviews (see reviews for further details).

Reviewing the evidence

One review of effectiveness and cost effectiveness was conducted, and one review of barriers and facilitators.

Identifying the evidence

The following databases were searched for evaluations (prospective or retrospective) of relevant interventions that used comparative designs (randomised controlled trials [RCTs], non-randomised controlled trials, before-and-after studies, or natural experiments); full economic evaluations and high quality costing studies conducted in the UK or countries of a similar level of economic development, patterns of transport use and urban environment; primary qualitative research involving the analysis of written or spoken evidence regarding attitudes towards, or experiences of, the relevant interventions, qualitative surveys of attitudes towards, or experiences of the relevant interventions:

- Applied Social Science Index and Abstracts (ASSIA)
- Bibliomap
- Centre for Review and Dissemination
- Database of Abstracts of Reviews of Effects (DARE)

- Database of Promoting Health Effectiveness Reviews (DoPHER)
- EPPI CENTRE databases
- ERIC
- Health Management Information Consortium (HMIC)
- MEDLINE
- MEDLINE In Process
- National Health Service Economic Evaulations Database (NHSEED)
- NHS Economic Evaluation Database (Health Technology Assessment)
- PsycINFO
- SafetyLit
- Social Science Citation Index
- Transport Research Information Service (TRIS)
- Trials Register of Promoting Health Interventions TRoPHI

A follow up targeted search was done in TRIS and MEDLINE of specific named programmes and additional traffic-calming methods determined from the results of the original database searches.

Quality appraisal

Included papers were assessed for methodological rigour and quality using the NICE methodology checklist, as set out in the NICE technical manual 'Methods for the development of NICE public health guidance' (see appendix E). Each study was graded (++, +, –) to reflect the risk of potential bias arising from its design and execution.

Study quality

++ All or most of the methodology checklist criteria have been fulfilled. Where they have not been fulfilled, the conclusions are thought very unlikely to alter.

+ Some of the methodology checklist criteria have been fulfilled. Those criteria that have not been fulfilled or not adequately described are thought unlikely to alter the conclusions.

– Few or no methodology checklist criteria have been fulfilled. The conclusions of the study are thought likely or very likely to alter.

Summarising the evidence and making evidence statements

The review data was summarised in evidence tables (see full reviews).

The findings from the reviews were synthesised and used as the basis for a number of evidence statements relating to each key question. The evidence statements were prepared by the external contractors/ public health collaborating centres (see appendix A). The statements reflect their judgement of the strength (quantity, type and quality) of evidence and its applicability to the populations and settings in the scope.

Economic analysis

The economic analysis consisted of a review of economic evaluations (the cost effectiveness part of review 1) and a cost-effectiveness modelling (report 3).

Cost effectiveness review (part of review 1)

A wide range of electronic databases was searched, including some that are specific to the areas of transport policy/research and safety policy/research. Papers or reports were sought that reported quantitative comparative evaluations of local or regional interventions to reduce injuries in children aged under 15 by road/street design or by modifying the road/street environment and highway design (for example, measures to reduce speed and 20 mph zones).

Studies were included if they were full economic evaluations of relevant types of intervention or scheme, and high quality costing studies conducted in the UK or countries of a similar level of economic development, patterns of transport use and urban environment.

Studies were excluded if they were cost-of-illness studies, or other studies which did not involve assessing the cost and related benefits/effectiveness of

particular interventions (or class of intervention). Of 19 identified as potentially relevant 13 were included, all of which were cost–benefit analyses.

Cost-effectiveness modelling

A number of assumptions were made which could underestimate or overestimate the cost effectiveness of the interventions (see modelling report for further details).

Economic modelling using cost–benefit and cost–utility analyses was undertaken to explore the cost effectiveness of mixed priority route schemes, mandatory 20 mph zones and advisory 20 mph zones. The results are reported in ‘Cost-effectiveness modelling of road and street design-based interventions aimed at reducing unintentional injuries in children'. It is available at www.nice.org.uk/guidance/PHG/Wave18/2

Fieldwork

This section will be completed in the final document.

How PHIAC formulated the recommendations

At its meeting in July 2009 PHIAC considered the evidence to determine:

- whether there was sufficient evidence (in terms of strength and applicability) to form a judgement
- where relevant, whether (on balance) the evidence demonstrates that an intervention or programme can be is effective or ineffective or whether the evidence is inconclusive
- where relevant, the typical size of effect (where there is one).
- whether the evidence is applicable to the target groups and contexts being covered by the guidance.

PHIAC developed draft recommendations through informal consensus, based on the following criteria.

- Strength (type, quality, quantity and consistency) of the evidence

- The applicability of the evidence to the populations/settings referred to in the scope.
- Effect size and potential impact on the target population's health.
- Impact on inequalities in health between different groups of the population.
- Equality and diversity legislation
- Ethical issues and social value judgements
- Cost effectiveness (for the NHS and other public sector organisations).
- Balance of harms and benefits.
- Ease of implementation and any anticipated changes in practice.

PHIAC noted that effectiveness can vary according to context. For instance, the effectiveness of interventions on mixed priority routes varied with the initial casualty rate

Where possible, recommendations were linked to an evidence statement(s) (see appendix C for details). Where a recommendation was inferred from the evidence, this was indicated by the reference ‘IDE’ (inference derived from the evidence).

Appendix C The evidence

This appendix lists evidence statements from two reviews, provided by external contractors (see appendix A) and links them to the relevant recommendations. (See appendix B for the key to quality assessments.) The evidence statements are presented here without references – these can be found in the full review (see appendix E for details). It also sets out a brief summary of findings from the economic analysis.

Evidence statement number B1a indicates that the linked statement is numbered 1a in the review 'Barriers to, and facilitators of, the prevention of unintentional injury in children on the road'.

Evidence statement number E1a indicates that the linked statement is numbered 1a in the review 'Systematic reviews of effectiveness and cost-effectiveness of road and street design-based interventions aimed at reducing unintentional injuries in children'. The reviews are available at www.nice.org.uk/guidance/index.jsp?action=folder&o=44733

Where a recommendation is not directly taken from the evidence statements, but is inferred from the evidence, this is indicated by IDE (inference derived from the evidence) below.

Recommendation 1: B2a–d, E10, E11; IDE

Recommendation 2: E1, E1a–c, E2, E2a–c, E3, E3a–e, E5, E5a, E5b, E6a, E6b, E10, E11

Recommendation 3: E7, E7a, E7b, E9

Evidence statements

Please note that the wording of some evidence statements has been altered slightly from those in the review team’s report to make them more consistent with each other and NICE's standard house style.

Evidence statement E1

Five UK based studies evaluated area-wide traffic-calming schemes. There was one controlled (+) and three uncontrolled (one [-] and two [+]) before and after studies, and one ecological study (+). Within these studies, casualties, injury collisions and speed outcomes were reported.

Evidence statement E1a

There is moderate evidence from two uncontrolled before-and-after studies (both UK), that area-wide traffic-calming may reduce rates of killed or seriously injured children (both [+]). Both studies showed reductions in either killed and seriously injured child casualties or collisions in which a child pedestrian or cyclist is killed or seriously injured, but none of these was statistically significant.

Evidence statement E1b

There is moderate evidence from one uncontrolled before-and-after study and one ecological study (both UK), that area-wide traffic calming may reduce child road casualty rates of any severity (both [+]). There is moderate evidence from one controlled and two uncontrolled before-and-after studies (all UK), that area-wide traffic calming may reduce child injury collision rates of any severity (one [-] and two [+]).

Of the two studies that reported child casualty rates, one ecological study showed a statistically significant reduction (rate ratio [RaR] = 0.777 for pedestrians in one of two cities studied, $p = 0.002$ [+]), while the results in the other city, and the uncontrolled before-and-after study are consistent with a reduction, but do not reach significance (+).

The three studies that reported child injury collision rates (one controlled and two uncontrolled before-and-after studies, all UK) also show reductions, but only one approaches statistical significance when compared with a control group (RaR = 0.524; 95% confidence interval [CI] = 0.258, 1.062 for child cyclists; one [-] and two [+]).

Evidence statement E1c

There is weak evidence from two uncontrolled before-and-after studies that area-wide traffic calming may reduce traffic speeds (one [-] and one [+]).

With the possible exception of the much older study (1990), this evidence is judged as directly applicable to similar roads and/or communities in the UK.

Evidence statement E2

Three UK-based studies evaluated single road traffic-calming schemes. These were all uncontrolled before-and-after studies (three [+]). Within these studies, casualties, injury collisions and speed outcomes were reported.

Evidence statement E2a

There is weak evidence from two UK-based uncontrolled before-and-after studies, to show that single road traffic calming may reduce child road casualty rates. Only one of these studies showed a statistically significant reduction in child casualties from 12 to zero ($p<0.001$ [+]). In the other study, numbers of casualties were too small (decreasing from three to zero) to be meaningful (+).

Evidence statement E2b

There is weak evidence from one UK-based, uncontrolled before-and-after study that single road traffic calming may reduce child pedestrian injury collision rates (RaR 0.0381, $p<0.001$) while child cyclist injury collision rates were also reduced, but non-significantly (RaR = 0.632, $p=0.081$ [+]).

Evidence statement E2c

There is weak evidence from two uncontrolled before-and-after studies that single road traffic calming may reduce traffic speeds (both [+]). This evidence is judged as directly applicable to similar roads and/or communities in the UK, although the Chorlton evidence is dated.

Evidence statement E3

Four UK-based studies evaluated 20 mph zones (mostly in urban areas). There was one controlled and three uncontrolled (all [+]) before-and-after

studies, one of which was adjusted for background trends. There is some overlap between studies. Two of the studies are of 20 mph zones in London; one of which essentially updates the other. There are also small overlaps between these London-based studies and the England-wide study, and potentially between the England-wide study and the study based in Hull. Within these studies, casualties and speed outcomes were reported.

Evidence statement E3a

There is moderate evidence from two uncontrolled before-and-after studies (one adjusted for trends on background roads; both UK-based) that 20 mph zones reduce killed or seriously injured child casualty rates (RaR = 0.242, to 0.859 depending on analysis and study, $p<0.05$ where recorded [++]). One controlled before-and-after study also showed a reduction in killed or seriously injured child casualty rates in the intervention group when compared with a control group; however, this reduction was not significant (+). It must be noted that this study also evaluated schemes in London and is essentially updated by this uncontrolled before-and-after study.

Evidence statement E3b

There is weak evidence from one uncontrolled before-and-after study (London-based), which was adjusted for trends on background roads, that 20 mph zones may reduce child pedestrian killed and seriously injured casualty rates. However this reduction is not significant once the results had been adjusted for changes in background trends on outside roads (+). One study also showed that 20 mph zones may reduce child pedestrian killed and seriously injured casualty rates (before and after data only reported for this outcome; RaR 0.394, $p<0.001$ [+]). As noted above, however, this study is essentially updated by the uncontrolled before-and-after 2008 study. The evidence shouldn't therefore be 'counted' twice.

Evidence statement E3c

There is weak evidence from one before-and-after study (controlled data only reported for this outcome) that 20 mph zones may reduce child cyclist killed or

seriously injured casualty rates. This reduction approaches statistical significance (RaR = 0.399, p=0.06 [+]).

Evidence statement E3d

There is moderate evidence from three UK-based uncontrolled before-and-after studies (one using adjusted analyses [+]), and one controlled before-and-after study of London schemes (+), that 20 mph zones may reduce child road casualty rates overall, and for child pedestrians and child pedal cyclists when analysed separately (road casualty rates overall RaR = 0.331 to 0.716 depending on analysis and intervention, p<0.001 where recorded).

Evidence statement E3e

There is weak evidence from two studies that 20 mph zones may reduce traffic speeds (both [+]). This evidence is judged as directly applicable to similar roads and/or communities in the UK, although some data is rather dated.

Evidence statement E5

Three UK-based studies evaluated mixed priority route schemes (all +). These were all uncontrolled before-and-after studies. Within these studies, casualties and speed outcomes were reported. These studies all reported low numbers of casualties both before and after the intervention (between six and zero).

Evidence statement E5a

There is moderate evidence from three UK-based, uncontrolled before-and-after studies that mixed priority route schemes may reduce child road casualty rates (all [+]) – one study showed a significant reduction in child pedestrian casualties, while changes were consistent with no effect in one and increased in the other.

Evidence statement E5b

There is weak evidence from three studies that mixed priority route schemes may cause small reductions in traffic speeds (all [+]). This evidence is judged as being directly or partially applicable to similar roads and/or communities in the UK.

Evidence statement E6a

There is weak evidence from one case-control study (US-based) that living near a speed hump may reduce a child's risk of injury on the road (unadjusted odds ratio [OR] = 0.50, 95% CI =0.27, 0.89; [+]).

Evidence statement E6b

There is weak evidence from one case-control study that living in an area with 0–5 streets with a speed limit of 30 kph may increase a child's risk of injury compared to a child living in an area with 15 or more streets with the same speed limit (OR = 5.3, 95% CI=1.6, 17.6 [+]).

Evidence statement E7

There is moderate evidence from two controlled before-and-after (injury data time-series) studies (both [+]) in the USA, that Safe Routes to School (SRTS) programmes based predominantly on engineering measures may reduce the rates of crash-involved child pedestrians or cyclists, or the rate of child injury road collisions.

Evidence statement E7a

In 125 SRTS project areas across California, and after assuming modest (10%) increases in rates of walking and cycling to school due to the programmes (such as increased exposure), a mean reduction of 7% in the all-injury collision rate with child pedestrians and cyclists was estimated (14% for children aged 5–12) (+). However, the estimated impact on fatal or severe child injuries was less conclusive (ranging from a 52% increase to a 24% reduction, again depending on assumed changes in levels of walking/cycling to school).

Evidence statement E7b

The evaluation of 53 projects in three unnamed US States (+) compared linear regression coefficients (giving 'T statistics') between the time-series trends of child injury data for the SRTS sites; these showed significantly greater reductions in crash-involved child pedestrians and cyclists at SRTS sites when compared with at least two of the six 'control' time-series in all

three US states (NB. all of the ‘T’ values were negative, indicating that the reductions in crash outcomes in SRTS sites were always lower [if not always statistically significantly lower] than in the comparison time-series.)

This evidence from evaluations of SRTS programmes in the US is judged as partially applicable to similar localities in the UK.

Evidence statement E9

There is weak evidence from one controlled before-and-after study, that combined traffic calming, safe routes to schools and education may reduce child road casualty rates when a before-and-after comparison was made (OR 0.722, p = 0.007 [+]), however compared to the control group, the reduction was not significant. This Swedish evidence is judged as partially applicable to similar roads and/or communities in the UK.

Evidence statement E10

There is moderate evidence from three cost–benefit analyses of a variety of area-wide traffic-calming schemes that show that, even in the short term (after 1 year), benefits are likely to exceed costs in most circumstances. However, there was considerable variation in first year rates of return. This evidence was judged to be partly applicable to the UK road setting.

Evidence statement E11

There is moderate evidence from one cost–benefit analysis of advisory 20 mph speed limits that shows that, in the short term, benefits are likely to exceed costs. Similarly, there is moderate evidence from one cost–benefit analysis of mandatory 20 mph zones that shows that, in the medium to long term, benefits are likely to exceed costs. The evidence on 20 mph zones is judged as being directly applicable to other urban roads in England, whereas the applicability of the evidence on advisory speed limits in Scotland may have less applicability in England and Wales due to different road regulations relating to 20 mph speed limits.

Evidence statement B2a

Five studies, four UK and one USA-based, discuss risk-taking behaviour among children and young people as a potential cause of collisions (two [+] and three [-]).

Evidence statement B2b

Like adults, children and young people often engage in ’common‘ risk behaviours which are seen as part of everyday life, such as not always using crossings, crossing between parked cars or in traffic.

Evidence statement B2c

One UK study reports that teenagers were more likely to take risks on the road than younger children (aged 8+).

Evidence statement B2d

Three UK studies suggest that a minority of children and young people engage in ’extreme‘ risks – playing ‘chicken’ in the road, holding onto the back of buses e.t.c., and that boys are more likely to do this, and to encourage such behaviour in each other. Such behaviours are regarded in a similar way to thrill-seeking sports.

Cost-effectiveness evidence

The results of the economic modelling suggest that advisory 20 mph zones are a highly cost-effective use of resources for the prevention of unintentional injuries in the road (with base case incremental cost effectiveness ratio [ICERs] <£24,000 and net present value [NPV] >£30,000). However, caution is required in interpreting these results because of the different legal definitions of these interventions (between Scotland and England), and the related likelihood that they were sited in areas with different prior collision, pedestrian flow and vehicle speed characteristics.

Mandatory 20 mph zones were found to be much more cost-effective in areas with high levels of casualties (1.6 per year per km), with a base case ICER £89,700 compared to when implemented in low casualty areas (ICER: £457,762). Similarly, mixed priority routes were more cost effective in areas of

high casualty, but were still very expensive and would not be cost effective according to the decision criteria normally applied by NICE to health technologies (ICER: £182,640).

Deterministic sensitivity analyses identified a number of parameters that were important to all interventions: the number casualties in the comparator area, effectiveness of the intervention, the background reduction in casualties and the effective lifetime of the intervention.

Appendix D Gaps in the evidence

PHIAC identified a number of gaps in the evidence relating to the interventions under examination, based on an assessment of the evidence. These gaps are set out below.

1. There is a lack of evidence on the effectiveness and cost effectiveness of woonerven, home zones and quiet lanes on reducing unintentional injuries on the road for children and young people under 15.

2. There is a lack of evidence as to whether there was any differential effect of environmental intereventions on different populations in terms of age, gender, rural/urban/road type and level of deprivation.

3. There is a lack of UK evidence on the effectiveness and cost effectiveness of safe routes to school on reducing injuries on the road in children and young people under 15.

4. There is a lack of UK evidence on the effectiveness and cost effectiveness of cycle routes on reducing injuries on the road in children and young people under 15.

5. There is a lack of evidence on the attitudes of drivers/road users to environmental interventions that reduce unintentional injuries in children on the road.

6. There is a lack of UK evidence as to the barriers and facilitators of implementing environmental interventions to reduce unintentional injuries in children on the road, for example, which factors enhance successful implementation of design-based interventions.

Appendix E Supporting documents

Supporting documents are available at www.nice.org.uk/guidance/PHG/Wave18/2 These include the following.

- Reviews of effectiveness:
  - Review 1: 'Systematic reviews of effectiveness and cost-effectiveness of road and street design-based interventions aimed at reducing unintentional injuries in children'
  - Review 2: 'Barriers to, and facilitators of, the prevention of unintentional injury in children on the road'

- Cost effectiveness modelling: 'Cost-effectiveness modelling of road and street design-based interventions aimed at reducing unintentional injuries in children'

For information on how NICE public health guidance is developed, see:

- 'Methods for development of NICE public health guidance (second edition, 2009)'available from www.nice.org.uk/phmethods

- 'The NICE public health guidance development process: An overview for stakeholders including public health practitioners, policy makers and the public (second edition, 2009)' available from www.nice.org.uk/phprocess