Physical Activity and Children

Review 2

CORRELATES OF PHYSICAL ACTIVITY IN CHILDREN: A REVIEW OF QUANTITATIVE SYSTEMATIC REVIEWS

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Contents

Executive summary

- After comprehensive searches, 5 systematic reviews were identified that addressed quantitatively assessed correlates of physical activity in children and adolescents. These were reviewed.
- Correlates of physical activity were addressed under the categories of demographic and biological, psychological, behavioural, social/cultural, and environmental. Correlates of sedentary behaviours were also considered.
- There is a moderate to large positive association between male gender and physical activity in young people (i.e., males are more active than females)
- There is a small-to-moderate negative association between age and physical activity in adolescence (i.e., physical activity declines with age during this period)
- There is a small association between positive motivation and physical activity in adolescent girls
- There is a small-to-moderate association between positive body image and physical activity in adolescent girls
- There is a small-to-moderate negative association between the existence of barriers to physical activity and participation in physical activity in young people.
- There is a moderate association between previous physical activity and current physical activity in young people
- There is a moderate association between sport participation and total physical activity in young people (with a larger association in adolescent girls)
- There is a moderate negative association between smoking and physical activity in young people
- There is a small negative association between sedentary behaviour at weekends and after school and physical activity in young people
- There is a large positive association between parental and social support and physical activity in young people

- There is a small-to-moderate positive association between access to facilities and participation in physical activity in young people
- There is a moderate negative association between distance from home to school and physical activity in young people
- There is a moderate-to-large positive association between time spent outside and physical activity in young people
- There is a small negative association between local crime and physical activity in young people.

1. Introduction

1.1. Background to the NICE programme on children and physical activity

The National Institute for Health and Clinical Excellence ('NICE' or 'the Institute') has been asked by the Department of Health (DH) to develop public health programme guidance aimed at promoting physical activity, play and sport for pre-school and school age children in family, pre-school, school and community settings.

This guidance will provide recommendations for good practice, based on the best available evidence of effectiveness, including cost effectiveness. It is aimed at professionals with public health as part of their remit working within the NHS, local authorities and the wider public, private, voluntary and community sectors. It will also be relevant to parents and professional carers.

The guidance will support implementation of the preventive aspects of national service frameworks (NSFs) and a number of related policy documents[1]. It has been commissioned in response to growing concerns over low levels of physical activity in young people, and the potential impact on current and future health.

1.2. Background to this review

The present review of quantitative reviews is the first of two background reviews for NICE examining the broad correlates of physical activity for young people. A qualitative review will focus on results of qualitative studies from the

[1] See Children and Physical Activity scope for full details: http://guidance.nice.org.uk/page.aspx?o=410813

four core areas of play and sport for pre-school and school age children in family, pre-school, school and community settings.

This current review is best seen in the context of the 'behavioural epidemiology' framework proposed by Sallis and Owen (1999) and illustrated in Figure 1. In this framework, we first need to assess the behaviour in question (physical activity) and then establish that there are links between physical activity and health (see Descriptive Epidemiology review undertaken as part of this NICE review process[2]).

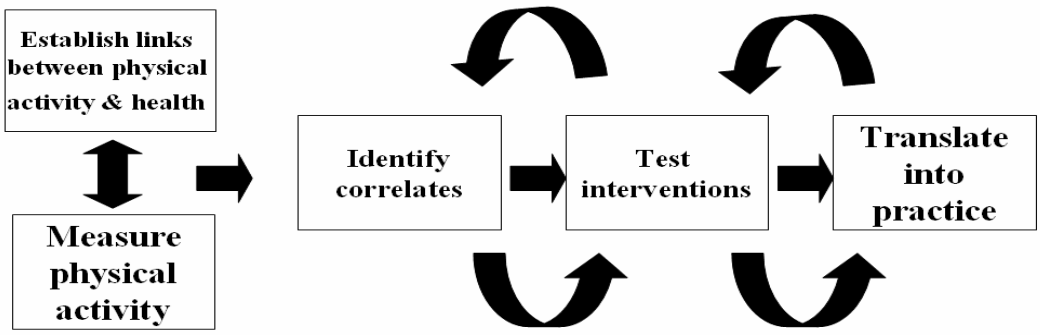

Figure 1. Behavioural epidemiological framework showing the context of correlates in the research process concerning physical activity and health.

Measurement of physical activity, and particularly in children, is difficult. Not only do we want to quantify different levels of activity, but we also require more refined information concerning the nature of the activity, its location and social context, as well as its frequency, duration and intensity. Measurement error plagues our field because without accurate measures of the behaviour we are always struggling to demonstrate strong associations with other

[2] Physical Activity and Children - Review 1: Descriptive epidemiology.

variables, if they exist. Even so-called 'objective' measures do not provide a complete set of information on activity patterns (Welk, 2002; Welk et al., 2000) Overall, these difficulties weaken our ability to draw strong and reliable conclusions from a review of correlates and this note of caution needs to be recognised throughout this paper.

The Behavioural Epidemiological framework proposes that before interventions can be planned, we need to know what might be the key variables that are correlated with the behaviour. This is because a behaviour such as physical activity is not changed by the intervention per se, but by a change in some personal, social or environmental variable – that is, a change in a 'correlate'. This is based on the so-called 'mediating variable framework' whereby it is a variable, or set of variables, that need changing in order for behaviour to change (Baranowski et al., 1998). Such variables are 'mediators' of change (Baron and Kenny, 1986)**.**

Correlates may vary by the degree to which they can be modified and thus whether they act primarily as a moderator or mediator. Mediating variables/correlates are those that we seek to affect in order to bring about behaviour change. For example, if increasing parental support for child physical activity brings about changes in behaviour (i.e., greater physical activity), parental support is acting as a mediator of behaviour change (Baranowski et al., 1998; Baranowski and Jago, 2005; Baron and Kenny, 1986). Moderators are variables/correlates for which outcomes may differ, such as age or gender. For example, reducing time spent playing computer games may increase physical activity for boys but not girls. If so, gender is acting as a moderating variable.

We have used the word 'correlates' to reflect factors that are related to participation in physical activity. Sometimes the word 'determinants' is also used. Correlates has now become a more standard term in the literature because many correlates may not be true determinants. In other words, data may show associations but we may not be able to conclude on causality.

Buckworth and Dishman (2002) refer to correlates as “reproducible associations that are potentially causal” (p. 191).

Referring back to Figure 1, having established likely correlates of physical activity, these might be used as moderators or mediators in physical activity behaviour change interventions. Typically, these are controlled interventions prior to being rolled out into ‘real-world’ practices. Although it seems logical to expect correlates to inform interventions and interventions to precede translation into practice, equally these subsequent phases can inform those that precede it, hence the feedback arrows in Figure 1. For example, information on correlates could emerge from an intervention, with subsequent modification to knowledge about correlates of physical activity.

1.3. Purpose of the review

The purpose of the current review is to identify factors associated with children’s and adolescent’s physical activity and quantify the strength of that association. The following research questions are addressed specifically in relation to children and adolescents:

1. What are the barriers to and facilitators of participation in physical activity?
2. How do the barriers and facilitators differ in the sub populations and age groups with the lowest levels of activity?

The review will contribute to the guidance concerning young people and physical activity, including economic modelling, by attempting to identify and quantify the association between the physical activity of children and adolescents and:

(a) that of their parents
(b) demographic data
(c) children’s physical and psychological characteristics
(d) sedentary behaviours
(e) health status

(f) motor skills or sporting ability
(g) health behaviours, knowledge and intentions
(h) resources and facilities
(i) other correlates as appropriate.

The paper is a review of systematic quantitative reviews of non intervention research relating to participation in physical activity by young people (see Methods). The term 'young people' will generally be used, and will include all pre school and school aged children up to age 18 years. Where necessary, distinctions will be made between pre-adolescent (~<12 yrs; 'children') and adolescent (~>12 yrs) populations.

2. Methods

2.1. Sources of evidence

To conduct the review of reviews, the brief for the literature search specified:

- economically developed countries (i.e., UK, Europe, USA, Canada, Australia and New Zealand)
- systematic reviews from 2000 in English language peer reviewed journals of studies that used quantitative methodologies to establish the correlates of young people's participation in physical activity. The year 2000 was chosen as this was the publication date of the first systematic review in this area (Sallis et al., 2000).

2.2. Review team

This review has been carried out by a team from the Public Health Collaborating Centre (CC) for Physical Activity[3]. The Collaborating Centre is an alliance between the British Heart Foundation Health Promotion Research

[3] Lead author: Professor Stuart Biddle, Loughborough University: s.j.h.biddle@lboro.ac.uk. The assistance of Andy Atkin and Natalie Pearson is gratefully acknowledged.

Group (University of Oxford) and the British Heart Foundation National Centre for Physical Activity and Health (Loughborough University).

The lead author for this report was also the author of one of the 5 papers being reviewed, as well as the two systematic reviews of correlates of sedentary behaviours. Any potential bias was minimized by a) applying strict criteria to study selection and data extraction and b) ensuring that other members of the team scrutinized the draft report.

2.3. Literature search

This report provides a summary of evidence on the correlates of physical activity in children and adolescents, encompassing sport, play and transport, where possible. Rather than drawing upon primary research, we utilised a 'review of reviews' approach in the following stages:

- A search strategy was devised and undertaken
- Assessment of search 'hits' for inclusion
- Data extraction and narrative summary of key characteristics of included reviews, highlighting scope of the review, search methodology, inclusion or exclusion criteria, number of studies reviewed and key findings and conclusions
- Assessment of strengths and limitations of included reviews and the extant review level literature as a whole.
- Consideration of these findings in terms of the context and relevance to the UK
- Recommendations for the direction of future research in order to strengthen the evidence base.

2.3.1 Search strategy

An electronic search was undertaken to identify published research addressing factors associated with all types of physical activity in children and adolescents. In view of the fact that a considerable quantity of evidence has been produced on the topic of correlates of physical activity in young people,

we restricted our search to review level evidence that had been conducted using systematic methodologies. Searches were limited to articles published in the English language from 2000 to April 2007.

Searches were conducted using the following databases: PubMed, SPORTDiscus, PsychINFO, Web of Science, Medline, ERIC, ArticleFirst, Sociological Abstracts, Applied Social Sciences Index and Abstracts, Embase, Cinahl, TRIS on line, Global Health, Geobase, Cochrane Library, CSA Environmental Sciences, Cambridge Scientific Abstracts, ISI Science Citation Index and Social Science Citation Index. Search terms included, but were not limited to: 'physical activity', 'exercise', 'sport', 'play', 'walk', 'bicycle', 'bike', 'travel mode', 'trip' 'active travel', 'children', 'adolescent', 'young people', 'youth' 'pre-school', 'correlates', 'determinants', 'associated with', 'review', 'summary', 'research synthesis' Search terms as they relate to specific aspects of the review are presented in Table 1.

Table 1. Search terms

Category	Search terms used
Target population	children; adolescent; youth; young people; pre-school; pedestrian
Activity	physical activity; exercise; sport; play; walk; bicycle; bike; travel mode; trip; active travel
Review paper selection	review; summary; research synthesis
Association	correlates; determinants; associated with

In addition to electronic searching, and as a check, we also conducted manual searches of key peer reviewed journals: *Journal of Physical Activity & Health*, *Pediatric Exercise Science*, *Sports Medicine*, *Obesity Reviews*, *Preventive Medicine*, and the *International Journal of Behavioural Nutrition and Physical Activity*. In order to locate reviews within 'grey' literature that would not necessarily be identified through database searches, we contacted by email

or visited the websites of four UK and US organisations involved in the commissioning, undertaking or cataloguing of research on physical activity and young people. These were:

- Play England: http://www.playengland.org.uk/Page.asp
- Sustrans: http://www.sustrans.org.uk/
- Active Living Research (US): http://www.activelivingresearch.org/
- Institute of Education, University of London: http://eppi.ioe.ac.uk/cms/

We also examined reference lists of available primary research articles, reviews or book chapters, as well as files of members of the research team, to identify further reviews of interest. This was done as an additional check, but did not yield additional reviews to those identified by other searches.

2.3.2 Selection of studies for inclusion and review quality

Inclusion criteria were used in two stages, first, to locate all relevant reviews and, second, to highlight reviews that would be subjected to in-depth analysis. In order to reduce potential sources of bias that may result from a selective presentation of the literature, and ensure that only the most reliable sources of evidence were included in this report, only systematic reviews are presented for in-depth analysis.

Table 2. Inclusion criteria for review of reviews.

	Study included if:
Stage 1 Criteria	1. Published in English between 2000 – April 2007 2. Classified as a review paper 3. Reviewed associations between quantitatively measured variables and physical activity 4. Related specifically to research carried out on children or adolescents (< 19 years old)
Stage 2 Criteria (In-depth analysis)	1. Systematic search strategy employed

Searching produced 23,968 potentially relevant 'hits', of which 7 met initial criteria and 5 were selected for in-depth analysis. Figure 2 provides a breakdown of the selection process.

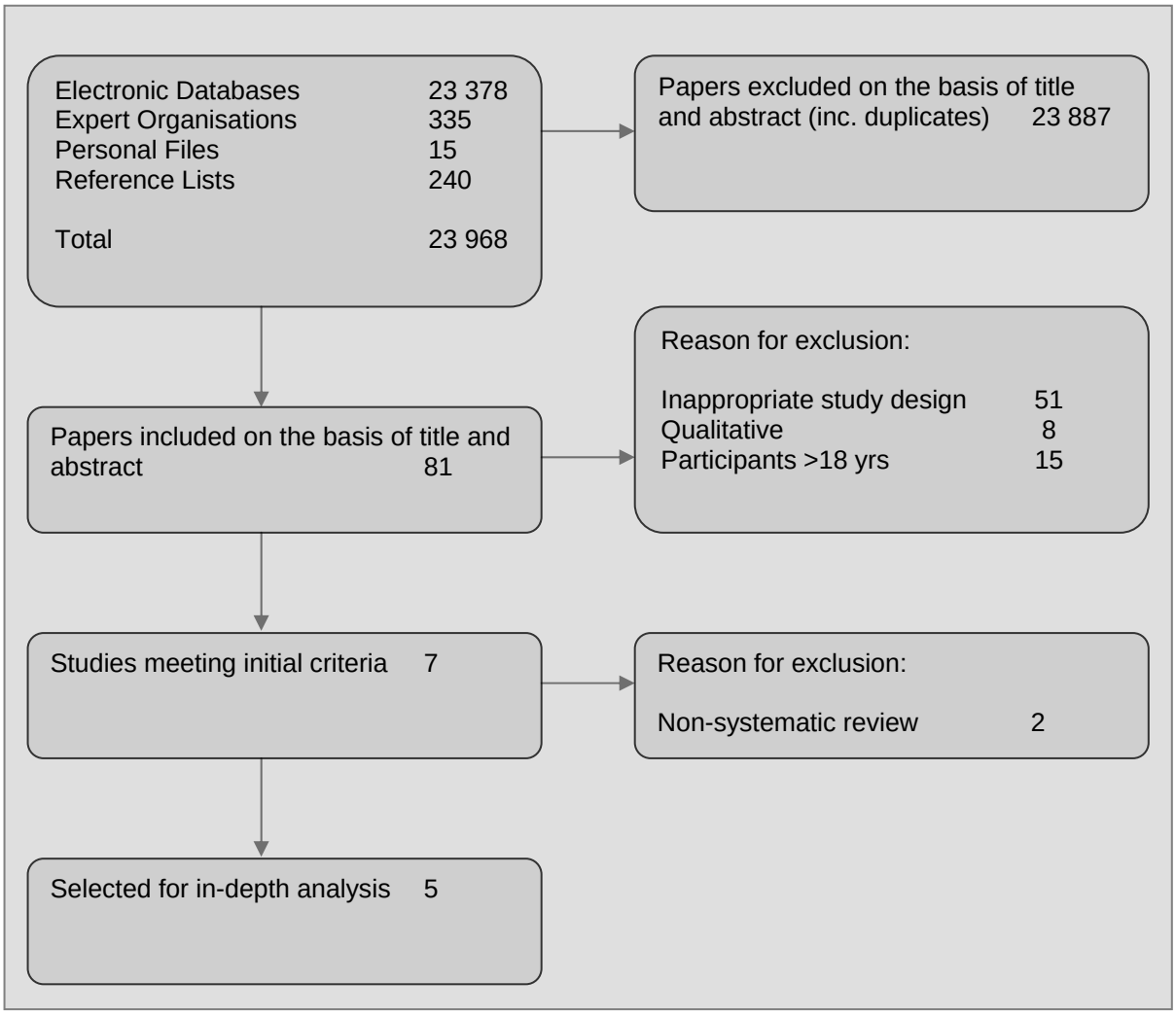

Figure 2. Flow diagram of article selection process

3. Results

Five reviews concerning correlates of physical activity met the inclusion criteria (Biddle et al., 2005; Davison and Lawson, 2006; Ferreira et al., 2006;

Gustafson and Rhodes, 2006; Sallis et al., 2000). It is typical of this field to categorise correlates under the headings of demographic and biological, psychological, behavioural, social/cultural, and environmental factors (Sallis et al., 2000), although not all reviews covered all categories (see Table 3). The focus of the review by Davison and Lawson was the physical environment (recreational infrastructure, transport infrastructure, and local conditions), while Ferreira et al. adopted a wider view of 'the environment' by using the ANGELO grid (ANalysis Grid for Environments Linked to Obesity) (Swinburn et al., 1999). This enabled correlates to be classified into environmental types (physical, socio-cultural, economic, policy), and settings (micro and macro). These authors also distinguished between children and adolescents. Gustafson and Rhodes reviewed parental correlates only while Biddle et al. focussed on adolescent girls. Sallis et al. (2000) reviewed all categories of correlates for children and adolescents separately. There is some overlap between reviews, although the review by Biddle et al. included studies after the publication of the review by Sallis et al.

Table 4 identifies the key characteristics of each review. Results will be presented and discussed under each of the categories of correlates listed above. Not all reviews attempted to assess the strength of association between a correlate and physical activity. Sallis et al. (2000) only included correlates that had been reported at least three times, and then assessed direction of association or concluded that the association was nil or 'indeterminate/inconsistent'. 'No association' was concluded when 0-33% of the studies supported an association, 'indeterminate/inconsistent' for 34-59%, and a positive or negative association when 60-100% of studies reported an association. A similar method was adopted by Davison and Lawson (2006), Ferreira et al. (2006), and Gustafson and Rhodes (2006).

Biddle et al. (2005) used a similar method to Sallis et al (2000) by only including correlates that were studied at least three times, but did not assess the number of studies showing associations as a way of assessing strength of relationships. Instead, they estimated the strength of association based on

statistical conventions proposed by Cohen (1988)[4]. In the present report, strength of association judged by statistical criteria is preferred, though rarely reported in the reviews themselves. The number of studies showing associations is a measure of consistency, not strength.

Table 3. Categories of correlates addressed in each review.

	Correlates				
	Demographic & biological	**Psychological**	**Behavioural**	**Social/cultural**	**Environmental**
Sallis et al. (2000)	✓	✓	✓	✓	✓
Biddle et al. (2005)	✓	✓	✓	✓	✓
Davison & Lawson (2005)	×	×	×	×	✓
Ferreira et al. (2006)	✓	×	×	✓	✓
Gustafson & Rhodes (2006)	✓	×	×	✓	×

Five criteria were used to assess the quality of the reviews (Shea et al., 2001):

1. Were search methods reported?
2. Was the search reasonably comprehensive?
3. Were inclusion criteria specified?
4. Were the primary studies assessed for validity?
5. Were the conclusions drawn supported by the data?

Based on these criteria, all 5 reviews satisfied criteria 2, 3 and 5. All reviews only partially assessed the validity of studies. Reviews by Biddle et al., Davison and Lawson, and Ferreira et al. satisfied criterion 1, with the reviews by Sallis et al. and Gustafson and Rhodes only partially satisfying this

[4] For example, Cohen's *d* values of 0.2, 0.5, and 0.8 represent small, medium and large effects.

criterion. The majority of studies included in the reviews if from outside the UK, often North America.

Table 4. Key characteristics of reviews selected for in-depth analysis

Study	Years covered	Search terms used	Databases used	Sample characteristics	Correlates studied	No. of studies reviewed
Sallis et al (2000)	1970 – 1998	Not described	MEDLINE, PsychInfo	Boys and Girls 3 – 18 years	Demographic / biological Psychological / cognitive / emotional Behavioural Social / cultural Physical environment	108
Biddle et al (2005)	1999 – 2005	Physical activity, sport, youth, adolescent/adolescence, teenage, girl, female, gender, correlates, determinants, motivation, adherence, barriers, enjoyment, importance, support	MEDLINE, Web of Science, PsychInfo, SPORTDiscus	Girls only 10 – 18 years	Demographic / biological Psychological / cognitive / emotional Behavioural Social / cultural Physical environment	51
Davison & Lawson (2006)	1990 – 2006	Physical activity, exercise, recreation, sport, walk/walking, cycle/cycling, transport, active commuting, environment, environmental determinants, physical environmental, built environment, perceived environment, design, urban design, context, facilities, neighbourhood, park, playground, situational factors, safety, crime, weather	PubMed, PsychInfo, EBSCO, CINAHL, TRANSPORT	Boys and Girls 3 – 18 years	Environmental (recreational infrastructure, transport infrastructure, local conditions)	33
Ferreira et al (2006)	1980 – 2004	Physical activity, physical active lifestyle, vigorous activity, leisure activities, recreation, exercise, sport(s), motor activity, physical education, walking, running, (bi)cycling, commuting, determinants, correlates,	MEDLINE, PsychInfo, Web of Science, EMBASE,	Boys and Girls 3 – 18 years	Environmental (home, school, neighbourhood, region / country) Some demographic and	150

		influences, associations, environment, physical environment, built environment, psychosocial determinants, social environment, social norms, socio-economic status, socio-cultural environment, parents, peers, neighbourhood, school, facilities, recreation, equipment, safety	SPORTDiscus		familial variables included	
Gustafson & Rhodes (2006)	Not described (reviewed studies spanned 1985 – 2003)	Parental influence, influences on child physical activity, parent child, physical activity, exercise	MEDLINE, PsychInfo, PubMed, Academic Search Elite, SPORTDiscus	Boys and Girls 3 – 18 years	Parental Some demographic variables included	34

Table 5. Factors associated with physical activity in children and adolescents

	Correlate Type				
Study	**Demographic / Biological**	**Psychological / Cognitive / Emotional**	**Behavioural**	**Social / Cultural**	**Environmental**
Sallis et al (2000)	• Sex (male) (+) • Parent overweight (+) • Ethnicity (Euro-Am) (+) • Age (-)	• PA intention (+) • PA preference (+) • Achievement orientation (+) • Perceived competence (+) • General barriers (-) • Depression (-)	• Previous PA (+) • Sensation seeking (+) • Community sports (+) • Healthy diet (+) • Sedentary after school (-) • Sedentary at weekend (-)	• Sibling PA (+) • Direct parental help (+) • Parental support (+) • Support from significant others (+)	• Access to facilities (+) • Time outdoors (+) • Opportunities to exercise (+)
Biddle et al (2005)	• Sex (female) (-) • Increased BMI (-) • Ethnicity (white) (+) • Age (-) • Family income (+)	• Enjoyment (+) • Perceived competence (+) • Self-efficacy (+) • Perceived attractiveness (+) • Physical self-worth (+) • Appearance importance (+) • Perceived barriers (-) • Lack of time barrier (-)	• Smoking (-) • Participation in organised sport (+)	• Family and parental support (+) • Fathers PA (+)	None
Ferreira et al (2006)	• Mother's education level (+)	N/A	N/A	• Fathers PA (+) • Support from significant others (+)	• Time outdoors (+) • School PA policy (+) • Non-vocational school (+)

	• Family income (+)				• Neighbourhood crime incidence (-)
Davison and Lawson (2006)	N/A	N/A	N/A	N/A	• Availability of recreation facilities (+) • Distance to school (-) • Equipment / play structures in school (+) • Area deprivation and crime (-) • Presence and condition of footpaths (+)
Gustafson and Rhodes (2006)	Socio-economic status (+)	N/A	N/A	• Parental support (+) • No. of active parents (+) • Mother PA (+) (daughters only) • Father PA (+) (sons only)	N/A

'PA' = physical activity; 'Euro-Am' = European-American; '-' = negative association; '+' = positive association.

3.1 Demographic and Biological Correlates

Four of the 5 reviews provided findings on demographic/biological correlates, with Davison and Lawson's (2006) review not included. Correlates typically studied include markers of socio-economic status, as well as ethnicity, age, and gender. Biological correlates usually include body mass index or weight status, and sometimes physical fitness. Such variables are usually studied as potential moderators of behaviour.

Age and gender

Results. Age and gender were studied as correlates of physical activity in the reviews by Sallis et al. (2000) and Biddle et al. (2005). A decline in activity with age during adolescence is evident, with Biddle et al. reporting this as 'small-to-moderate' for adolescent girls across 11 studies. Such a trend is less evident for pre-adolescent children with Sallis et al. reporting an indeterminate association from 19 studies. Data confirm that boys are more active than girls. This trend was confirmed by Sallis et al., for example, in 81% of 31 studies with children and 96% of 28 studies with adolescents.

Discussion. The age-related decline in activity is consistent with our own appraisal of the data on participation patterns reported in Review 1 (Descriptive Epidemiology) whereby the decline in activity appears most marked in late childhood and early adolescence, particularly for girls. The gender difference appears to be highly reproducible. However, physical activity is nearly always assessed in general terms, such as 'total activity' rather than specific types of activity (e.g., active travel, sports etc). More specific measures of activity might reveal additional information on activity preferences by age and gender.

Ethnic origin

Results. Ethnicity was addressed in the reviews by Sallis et al. (2000), Biddle et al. (2005), and Gustafson and Rhodes (2006), although the latter was in relation to parent-child physical activity behaviours. Reviews suggest that 'white Caucasians' (also described as 'Euro American' by Sallis et al., and with most studies from the USA) are more likely to be active, at least for adolescents, than other ethnic groups. This relationship was reported as 'small' by Biddle et al. (2005) across 7 samples. Sallis et al. (2000) showed that ethnicity had an inconsistent relationship with physical activity in children across 11 studies.

Discussion. Findings on ethnicity may reflect deficits in the literature. Sample sizes are often too small to make meaningful comparisons across more than a few different ethnic populations. In addition, there may be subtle differences between what might appear to be similar minority ethnic groups, such as grouping Bangladeshi, Indian and Pakistani in the UK as 'South Asian' and without differentiation. Confounding effects of socio-economic status (SES) also need consideration.

Socio-economic status

Results. SES was analysed in the reviews by Sallis et al. (2000), Biddle et al. (2005), Ferriera et al. (2006), and Gustafson and Rhodes (2006), although the latter was in relation only to parent-child physical activity behaviours. Sallis et al. reported no association with SES for children (13 studies) or adolescents (9 studies), while Ferriera et al. reported no association for SES in adolescents, parental education in children and adolescents, and father's occupation in children. However, they did report a positive association between physical activity and family income in 6 of 10 studies, and mother's educational level for adolescents (3 of 5 studies). Moreover, Biddle et al. reported a moderately strong positive association between activity for adolescent girls and family income (3 studies), but a mixed picture concerning parental education across 4 studies. Whether children are in single parent

families or not appears unrelated to their levels of physical activity. For example, Ferriera et al. showed no association in 19 of 24 studies.

Discussion. SES is often thought to be an important correlate of physical activity. However, the data are surprisingly unclear with respect to children and adolescents. Moreover, if SES is related to activity, it may affect different physical activities in different ways. Little is known in this regard at present. Measurement variability may also be an issue because 'SES' is reflected in many different ways, such as by educational level, income, or number of parents, or through assessment of both parents or only the father. Overall, the findings are variable and do not provide a clear message regarding SES and physical activity in young people.

Biological correlates

Results. Biological correlates were reviewed by Sallis et al. (2000) and Biddle et al. (2005). The most consistently studied biological correlate is body mass index (BMI). This was reported as inconsistently associated with activity for both children and adolescents by Sallis et al., but Biddle et al's review of more recent studies of adolescent girls showed a small negative relationship with activity across 6 of 8 studies. Sallis et al. reported the unexpected finding of overweight parents being more likely to have active children in 3 out of 5 studies.

Discussion. Higher BMI might be expected to correlate with lower activity levels, but this seems to be the case only for recent data on adolescent girls. Given the biological changes associated with the transition into adolescence for girls, it is not surprising that greater adiposity is related to less activity. However, the studies are largely cross-sectional therefore we are unable to establish the direction of any influence that might exist.

3.2 Psychological Correlates

The psychology of physical activity has an extensive literature (Biddle and Mutrie, 2001) and much of this has been devoted to the study of correlates with young people, although usually in structured youth sport settings (Weiss and Williams, 2004). Less research is available on other environments, such as active transport (McMillan, 2005), play (Stratton and Leonard, 2002), or incidental physical activity. In addition, theoretical perspectives from general, social and health psychology have been adopted to predict physical activity behaviours (Biddle et al., 2007). Typically, the literature on psychological correlates of physical activity in young people has centred on variables of attitudes, barriers, motivation, and self-perceptions, such as self-esteem or body image.

Results. Only the reviews by Sallis et al. (2000) and Biddle et al. (2005) addressed psychological correlates. For children, Sallis et al. reported that physical activity is positively associated with intentions and 'preferences', although the latter was not defined. For adolescents, both reviews found that higher levels of perceived competence were associated with greater physical activity, this being in 2 of 3 studies in the Sallis et al. review. Biddle et al. reported the strength of the association to be small in girls (4 of 5 studies). For children, Sallis et al. reported perceived competence had an indeterminate relationship with physical activity from 7 studies. 'Achievement orientation' was identified by Sallis et al. as being positively associated with physical activity in adolescents, although no further information is provided in the review as to the exact nature of this variable.

Surprisingly, variables such as self-efficacy (confidence) and enjoyment have not been consistently associated with higher levels of activity across the reviews identified. While Biddle et al. report a positive association for physical activity for adolescent girls with self-efficacy (all 10 studies) and enjoyment (7 of 8 studies), Sallis et al. report that self-efficacy is inconsistently associated with activity in both children (9 studies) and adolescents (13 studies), while

enjoyment of PE for adolescents was found to be unrelated to activity across 5 studies.

Issues of body image and appearance seem to be important for adolescent girls and are negatively associated with physical activity. Specifically, the correlates of perceived body attractiveness, importance of appearance, and physical self-worth were all small-to-moderate in their strength of association with physical activity in adolescent girls (Biddle et al., 2005). Global feelings of self-esteem were unrelated to physical activity in Sallis et al.'s review across all 6 studies.

Barriers to physical activity can be real or perceived. Both reviews showed that barriers are consistently associated with less physical activity. These appear to be small or small-to-moderate in strength. Barriers include perceived lack of time, other activities (e.g., homework), lack of interest or motivation, and the effort required.

Discussion. There is clear evidence throughout the psychological literature that motivation to indulge in behaviours of free choice, such as leisure-time physical activity, are associated with perceptions of intentions, confidence and competence (Ajzen, 2001; Bandura, 1997; Deci and Ryan, 2002), particularly for adolescents. Intention is a key mediating variable in the Theory of Planned Behaviour (Ajzen, 1988; Biddle and Mutrie, 2001), a framework that has been studied extensively in the physical activity literature. Intentions act as the immediate antecedent of behaviour, with intentions themselves predicted by attitudes, subjective (social) norms and perceptions of perceived behavioural control. Research in physical activity shows that the association between intentions and activity is strong (Hagger et al., 2002). Planning how best to implement intentions may strengthen this relationship further (Gollwitzer, 1999) and help close the 'intention-behaviour gap'.

Competence perceptions seems to be an important correlate of physical activity for adolescents. One issue concerning perceptions of competence is how one judges competence. Research has been conducted on whether

young people define success as winning, and hence being 'other people' focussed (ego orientation), or through being self-improvement focussed (task orientation; this is likely to be the 'achievement motivation' correlate alluded to by Sallis et al.). Such a differentiation of competence perceptions develops in late childhood (Nicholls, 1989). A systematic review of the literature on this topic in physical activity showed that adopting a task orientation is likely to be beneficial for motivation and well-being in young people (Biddle et al., 2003). One reason for this is that a task orientation is associated with self-focussed strategies of personal effort and striving - a more intrinsic motivational style. This is associated, in turn, with higher levels of enjoyment and satisfaction (Deci and Ryan, 1985; Deci and Ryan, 2002; Hagger and Chatzisarantis, 2007). Pressuring children to be active, or making them feel guilty if they are inactive, are likely to be counterproductive (Chatzisarantis et al., 2007).

Enjoyment of activity seems more important for girls than boys, particularly at a time when activity levels are showing a decline. This is consistent with self-efficacy theory (Bandura, 1997) whereby perceptions of efficacy or confidence are likely to be most predictive in situations of difficulty or adversity. For example, confidence in being able to walk to school for those who live close by is less likely to predict activity than, say, confidence to undertake a strenuous exercise programme requiring travel, money and social support.

Regarding self-esteem and physical self-perceptions, the findings reported can be explained by reference to a multidimensional hierarchical model of self-esteem (Fox, 1997; Shavelson et al., 1976). This model proposes that self-esteem is influenced by multiple domains of the self, such as perceptions of our academic, physical, or social selves. For example, the physical self comprises sub-domains of physical fitness, sports competence, physical appearance/attractiveness, etc. These will influence feelings of self-esteem over time (see Figure 3). One might expect that global perceptions of self-esteem will be less influential on activity levels than perceptions of the physical self, and this is supported in the results.

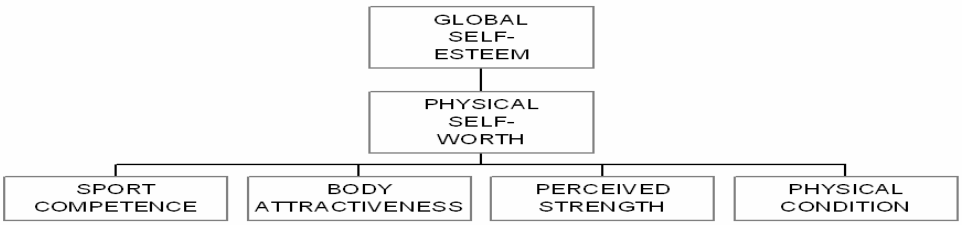

Figure 3. Sub-domains of physical self-worth, as proposed by Fox & Corbin (1989).

3.3 Behavioural Correlates

Some behaviours may co-exist with physical activity. For example, it has been argued that certain health behaviours may cluster, such as non-smoking, healthy diet and physical activity. For this reason, studies have investigated behavioural correlates of physical activity in young people. Only the reviews by Sallis et al. (2000) and Biddle et al. (2005) included this category of correlates.

Results. For children, Sallis et al. found that a healthy diet (all 3 studies), but not calorific intake per se, and previous physical activity, were consistently and positively related to physical activity. However, 'healthy diet' was not defined. Previous physical activity was also shown to be a correlate of current activity for children (5 of 6 studies), supporting the view that there is at least a moderate level of tracking of activity during this age period, as outlined in NICE Review 1 (Descriptive Epidemiology). Sedentary time was inconsistently associated with activity across 15 studies.

For adolescents, Sallis et al. (2000) found that previous physical activity was a correlate (11 of 12 studies), alongside community sports participation (all 7 studies). Biddle et al. (2005) also found that competitive sports participation was a correlate of physical activity in adolescent girls (all 4 studies), with a moderate-to-large strength of association.

For adolescents, smoking was negatively associated with activity in girls across 3 of 4 studies (Biddle et al., 2005), although Sallis et al. (2000) reported this to have an inconsistent association when results for boys and girls were combined across 15 studies. Data from 3 samples in one paper showed that sedentary time after school and weekends was negatively associated with physical activity (Sallis et al., 2000).

Discussion. There is some evidence for other health behaviours to be associated with physical activity in young people. These include diet, smoking, previous physical activity, and sedentary behaviours. For children, the relation with healthy diet may be a function of parental influence for both diet and physical activity behaviours, although this may vary by age.

Overall sedentary time was inconsistently associated with activity, and this supports a comprehensive meta-analysis showing an association close to zero between the most prevalent sedentary behaviour of TV/video viewing and physical activity in young people (Marshall et al., 2004). This suggests that some sedentary behaviours can coexist with physical activity. However, while overall sedentary time may be unrelated to physical activity, certain key time periods may be important. After school and at weekends may be such times when sedentary behaviours compete with physical activity, and this may have been missed by not analysing data within specific time periods. Later in the evening, for example, when TV viewing is at its peak, is a time when sedentary behaviour is less likely to compete with physical activity. This is consistent with the finding that general sedentary time (Sallis et al., 2000) and TV viewing (Biddle et al., 2005; Marshall et al., 2004) has either an inconsistent or no relationship with physical activity. More studies on specific

links between sedentary time and activity are required (see Section 3.6 on *Correlates of Sedentary Behaviour*).

Findings suggest that playing sport may be a good predictor of physical activity in adolescents. While this is an intuitively logical finding, it might be a mistake to think that playing organised sport is the key to increasing activity levels in adolescents. As Biddle et al. said, “There are many forms of physical activity and these all need to be exploited to maximise participation. For those who wish to play organised sport, they must be provided with opportunities and suitably encouraged. For others, we must provide either a sporting environment that is more appealing than at present or seek other opportunities for physical activity, such as active transport” (p. 429). These comments were made in the light of many adolescents, particularly girls, rejecting competitive sport. Nevertheless, it appears that if we can attract this age group into sport, and keep them there, activity levels will be enhanced.

3.4 Social/Cultural Correlates

Results. Four of the five reviews reported findings for social/cultural correlates, leaving only Davison and Lawson’s (2006) review excluded. This category of correlates typically centre on different forms of parental, sibling and peer behaviour and support, and the review by Gustafson and Rhodes (2006) focused on parental correlates of children’s physical activity only. They reviewed 34 studies, with only one from the UK.

Surprisingly, the reviews by Sallis et al. (2000) and Ferriera et al. (2006) reported no consistent social/cultural correlates of physical activity in pre-adolescent children. Parental support was associated with adolescent physical activity by Sallis et al. (2 of 3 studies) and Biddle et al. (7 of 8 studies; small-to-moderate association). The most comprehensive review in this area is by Gustafson and Rhodes (2006). They located 19 studies examining parental support of physical activity for young people from 1992-2003, with 16

being cross-sectional and 3 longitudinal. A strong positive association was reported in all but one of the studies.

A common assumption in this area is that active parents will have active children. However, the evidence supporting this is weak across four reviews. The only exception was reported by Biddle et al. (2005) who found a small-to-moderate positive association between physical activity of adolescent girls and the physical activity level of the father. However, this conclusion was drawn from only 5 studies, with just 3 showing an association. In reviewing 24 studies where measures of both parental and child physical activity existed, Gustafson and Rhodes (2006) concluded that there is "much uncertainty" (p. 88) about the relationship between parental and child activity levels.

Discussion. The key issue concerning social and cultural correlates of physical activity for young people is parents. A distinction needs to be made between parental support and parental behaviour (see Figure 4). Although parental support is associated with greater activity in their offspring, the nature of parental support needs unpacking. Such support comes in many different forms, including social, material or emotional support. Gustafson and Rhodes (2006) suggested that three important forms of parental support are encouragement, involvement and facilitation.

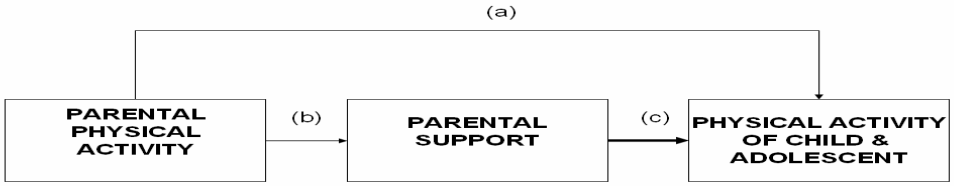

Figure 4. Possible relationships between parental physical activity, parental support, and the physical activity of young people.

The evidence from the reviews shows that parental support is associated with physical activity in young people (route ‘c’ in Figure 4). Evidence is less supportive of route ‘a’. However, parental physical activity may act on young people’s activity through the mediating variable of parental support (via routes ‘b’ and ‘c’). Equally, route ‘b’ may not exist and the only influence is from parental support (route ‘c’). Although we cannot resolve these issues at present, a recent large-scale study sheds light on some of these relationships. Ornelas et al. (2007) analysed data from 13,246 American adolescents (mean age=15.5y) sampled in the National Longitudinal Study of Adolescent Health. Measures at wave 1 included family cohesion, parental monitoring (rules and guidelines on TV viewing, clothes, food choices etc), parent-child communication, and parental engagement (participation of parent with child in various activities). Moderate-to-vigorous physical activity was assessed at wave 2, one year after wave 1.

Results showed that greater family cohesion, parent-child communication and parental engagement were all independent predictors of physical activity over a 1 year period for both boys and girls (odds ratios 1.09 – 1.25). Parental monitoring was not associated with physical activity for either sex. This provides useful data on the likely types of parental behaviour and support that might be helpful in promoting physical activity for young people. Our confidence in the findings is strengthened by the large sample size and longitudinal design.

3.5 Environmental Correlates

Recent literature has showed greater awareness of potential environmental influences on physical activity (Sallis et al., 2002). For example, Trost et al (2002) updated a prior review on correlates of physical activity in adults and over only a 3-year period found a significant increase in studies investigating environmental variables. However, it is important to understand what is meant by ‘the environment’. Ecological models talk of the environment as anything

outside of the individual (Sallis and Owen, 2002), although typically physical activity researchers often just refer to the physical environment, such as open spaces (Kaczynski and Henderson, 2007) or the layout of urban spaces (Transportation Research Board of Institute of Medicine of the National Academies, 2005). Davison and Lawson (2006) reviewed the 'physical environment' and defined it as follows:

> "objective and perceived characteristics of the physical context in which children spend their time (e.g., home, neighborhood, school) including aspects of urban design (e.g., presence and structure of sidewalks), traffic density and speed, distance to and design of venues for physical activity (e.g., playgrounds, parks, and schoolyards), crime, safety, and weather conditions". (e-p. 2).

Ferreira et al's (2006) review of environmental correlates uses a more comprehensive definition and framework, as highlighted earlier. To recap, they distinguish between 'micro' and 'macro' environments and also between physical, socio-cultural, economic, and policy environments, thus adopting the broader ecological approach. Micro environments are defined as "environmental settings where groups of people meet and gather. Such settings are often geographically distinct and allow direct mutual influences between individuals and the environment. Examples are homes, schools, and neighbourhoods" (p. 131). Macro environments are defined as "the broader, more autonomous infrastructure that may support or hinder health behaviours. Examples are town planning, the transport infrastructure, the media, and the health care system" (p. 131).

Results. Four reviews provided evidence on environmental correlates, with only Gustafson and Rhodes' (2006) review being omitted. Sallis et al's (2000) review located six environmental variables studied at least three times with children. These were access to programmes and facilities, parental transport to physical activity, season, urban/rural environment, neighbourhood safety, and time spent outdoors. Positive associations with physical activity were found for time spent outside (all 3 studies) and facility/programme access (3 of 4 studies). The season and urban/rural distinction were inconsistently associated with activity.

For adolescents, Sallis et al. found only three variables studied at least three times: equipment, opportunities to exercise, and sports media influence. Only 'opportunities to exercise' was consistently and positively associated with physical activity (2 of 3 studies). Unfortunately, we have no further information on the nature of these opportunities, although Sallis et al. did find that availability of equipment was unrelated to physical activity in this age group across 9 studies.

Biddle et al. (2005) identified 18 environmental variables studied as correlates of physical activity in adolescent girls. These included local facilities, crime, access, the school PE environment, and seasonal factors. Unfortunately, none were studied more than twice and thus did not meet the inclusion criterion.

Ferreira et al's (2006) review of children's environmental correlates found that time spent outside was a consistent correlate of activity (all 5 studies), supporting the finding from Sallis et al. (2000) (all 3 studies). In addition, Ferreira and colleagues found that school physical activity policy was also associated with greater activity. Such policies addressed time allowed for free play, time spent outdoors at school, and number of field trips.

For adolescents, in contrast to Sallis et al.'s finding that 'opportunities to exercise' are associated with greater physical activity, Ferreira et al. found no association between activity and 'access to community physical activity facilities' in 32 of 45 studies. Davison and Lawson (2006), on the other hand, did find a positive association for 'availability of recreation facilities' when analysing data across children and adolescents. Specifically, 6 of 8 studies showed a positive association when perceptions of the environment were assessed by either adults or children. Both studies assessing the environment objectively also showed a positive association.

Ferreira et al. found that objectively assessed neighbourhood crime incidence was negatively associated with activity (2 of 3 studies), but adolescent perceptions of safety were not (13 of 14 studies). Similarly, Davison and

Lawson found a negative association between physical activity and objective measures of area deprivation and crime (3 of 3 studies), but not for perceived safety (7 of 9 studies). In addition, they reported that higher levels of physical activity were associated with the availability of facilities, including permanent play structures, in schools, as well as with living closer to school.

Discussion. Research on the relationship between physical activity and environmental factors in young people is still evolving. Environmental variables, while seemingly holding great potential for understanding physical activity in children and adolescents, require greater clarity and further study.

Having said that, it does appear that variables clustered around the concepts of access, opportunities, and availability to be active are associated with higher levels of physical activity. This is consistent with results showing that sports participation is a good predictor of activity levels (see Section 3.3 on Behavioural Correlates). Moreover, time spent outside is an important factor for physical activity, although this is likely to interact with factors such as local amenities, safety, road traffic density etc. Greater precision is needed to unpack many of these concepts. Underlying this lack of clarity may be the way we study environmental variables and physical activity. Specific environmental features are only likely to affect certain types of physical activity, such as access to pavements or pedestrianised areas is likely to influence walking but not necessarily cycling. Having exercise equipment in the home is not likely to influence active commuting whereas distance to school is. If only generalised measures of physical activity are available, as is the case in many studies, then relationships with environmental variables will be hard to find.

3.6 Correlates of Sedentary Behaviour

Little is known about the correlates of highly prevalent sedentary behaviours in young people. This is partly because studies of youth inactivity often centre on ‘activity absence’, such as not meeting a criterion level of physical activity. This prevents a clear view on how inactive youth actually spend their time

(Gorely et al., in press; Marshall et al., 2004; Marshall et al., 2002; Marshall et al., 2006).

Studying sedentary behaviour as a concept distinct from physical activity is now being advocated (Biddle et al., 2004a; Biddle et al., 2004b; Owen et al., 2000). Many young people find sedentary behaviours more reinforcing than physically active alternatives and appear more likely to choose sedentary activities even when physically active alternatives are freely available (Epstein et al., 1991; Vara and Epstein, 1993). Physical inactivity also appears to track slightly better than physical activity for young people (Janz et al., 2005; Kelly et al., 2007) (also see Review 1: Descriptive Epidemiology).

Although the study of sedentary behaviours is still quite new, it is prudent to consider what evidence does exist concerning likely correlates of such behaviours. It is probable that they will differ from correlates of more active behaviours.

Two systematic reviews exist that address correlates of sedentary behaviour in young people (Gorely et al., 2004; Marshall et al., 2004)[5]. Gorely et al. focussed on a wide ranging set of possible correlates for TV viewing only while Marshall et al. conducted a meta-analysis of the relationships between physical activity and a) TV viewing and b) video/computer game use[6]. The latter review, therefore, only addresses the issue of whether physical activity itself is a correlate of two types of sedentary behaviours.

Marshall et al. (2004) located 39 independent samples with measures of TV viewing and physical activity in young people. The mean sample-weighted effect size was -0.096 (95% CI = -0.080 to -0.112; total N = 141,505). When

[5] These reviews are separate from the 5 main reviews of physical activity correlates because they address correlates of specific sedentary rather than active behaviours.

[6] It is worth noting that new technologies and games are emerging that require participants to be more active in operating the games. However, no evidence exists as to the extent of playing time or the health benefits of such developments.

fully corrected for measurement error, the effect size was -0.129. For video/computer game use and physical activity, 10 independent samples were located and the mean sample-weighted effect size was -0.104 (95% CI = -0.080 to -0.128; total N = 119,942). When fully corrected for measurement error, the effect size was -0.141. From this meta-analysis, it was concluded that the relationship between TV viewing and physical activity is negative but small. This is consistent with the evidence from Sallis et al. (2000) who found sedentary time to be inconsistently associated with activity in children, and sedentary time in general to be unrelated to activity in adolescents. However, they did report that physical activity in adolescents is negatively associated with sedentary time at weekends and after school. Of course, 'sedentary time' includes much more than TV viewing. As highlighted in the section on behavioural correlates, if certain sedentary behaviours do reduce physical activity, this is most likely at key time points, such as immediately after school, rather than across the whole day.

Gorely et al. (2004) conducted a systematic review of 68 studies concerned with correlates of TV/video viewing in 2-18 year olds. TV viewing is the most prevalent sedentary behaviour for youth. International trends suggest that young people watch between 1.8-2.8 hrs/day, depending on age and gender (Marshall et al., 2006). Recent detailed diary records with adolescent girls in the UK show that 38% on weekdays and 58% at weekends watch more than 2 hrs/day of TV. However, while only 3% watch more than 4 hrs/day during the week, 21% do so at weekends (Gorely et al., in press).

Gorely et al. (2004) found the following variables to be consistently associated with TV/video viewing (+: positive association; -: negative association):

- ethnicity (non-white +[7])
- parent income (-)
- parent education (-)

[7] Showing that those from non-white ethnic backgrounds watch greater amounts of TV than other ethnic groups.

- body weight (+)
- between meal snacking (+)
- number of parents in the house (-)
- parents TV viewing habits (+)
- weekend (+)
- having a TV in the bedroom (+).

Variables consistently unrelated to TV/video viewing were gender, other indicators of socio-economic status, various measures of body fatness, cholesterol levels, aerobic fitness, strength, other indicators of fitness, self-perceptions, emotional support, physical activity, other dietary variables, and being an only child. These results show that few modifiable correlates of TV viewing have been identified.

3.7 Moderating variables: Age, Gender, & Type of Physical Activity

One objective of this review of reviews was to identify whether the correlates of young people's participation in physical activity differ in the sub populations and age groups with the lowest levels of activity, and to address children under 7 years of age and adolescent girls. It is not possible to do address some of these issues because the reviews available either do not distinguish between levels of physical activity (usually they report an association between activity expressed as a continuous variable and a correlate), or they do not adequately address sub-population differences beyond gender and a basic age split between children and adolescents. As such, only evidence on adolescent girls can be addressed in any detail and the review by Biddle et al. (2005) reviewed only this population. Review level evidence for those under 7 years of age is not available. However, we can conclude that activity levels of pre-adolescent children (under 12 years) are positively associated with:

- male gender
- intentions and preferences
- eating a healthy diet

- previous physical activity
- access to facilities
- time spent outside
- school policies on physical activity.

Of these, male gender and intentions also apply to adolescents. However, for the younger age group we are unable to differentiate between pre-school and school-age children, or those under and over the age of 7 years.

Data show that adolescent girls have lower levels of physical activity than boys. Few of the reviews addressed the issue of gender in any detail. Based on the findings of Biddle et al.'s (2005) review of adolescent girls, and comparing that with the other reviews of adolescents, one could suggest that some correlates may be important for adolescent girls. These include BMI, body image, and participation in organised sport. BMI and body image are likely to be related and given the media influence on so-called 'desirable' body shapes for girls, could have powerful influences. The issue concerning competitive sport has been addressed earlier. Essentially, it appears that if adolescent girls can be recruited into sport and motivated to maintain involvement, their levels of physical activity will be similar to those of boys (Vilhjalmsson and Kristjansdottir, 2003). However, we also know that many girls are not motivated to start participation in the first place.

It would be helpful from the point of view of public health policy to be able to identify the correlates of different types of physical activity, such as active transport, sport, recreation, and play. Regrettably, the reviews make little distinction between types of activities. However, it may be possible to propose some links, albeit tentatively. Given the knowledge we have of the key correlates, it seems logical that some of them will be more relevant to some types of activities than others. The following examples are proposed:

- Active travel: road hazards, distance to school, local crime

- Competitive sport: perceived competence, self-efficacy, achievement orientation, availability of facilities
- Play: time spent outside, access to recreational facilities.

4. Discussion

This review of reviews has addressed demographic/biological, psychological, behavioural, social/cultural, and environmental correlates of physical activity in young people, as well as providing a brief summary of review-level evidence concerning the correlates of selected sedentary behaviours. However, the field of study concerning physical activity correlates suffers from several methodological shortcomings. First, the measurement of physical activity is still in its infancy (Welk, 2002). Despite technological advances that allow for movement sensors to better quantify activity, we still have difficulties in assessing the type and context of physical activity using anything other than self-report, at least for large samples. Without appropriate and accurate measures of the behaviour itself, we will always struggle to identify clear correlates. Moreover, we need to have studies addressing not only total physical activity, but different types of activities, such as walking for transport, playing sport, casual play etc. This will allow for more precise identification of correlates. This has been done, in part, in adult research (Humpel et al., 2002; Owen et al., 2004).

One other difficulty is that primary research studies will use different measures and definitions for similar constructs. A good case in point concerns parental influence. The evidence points to a positive association between parental influence and physical activity of children, but the term ‘parental influence’ is broad and has been studied in many different ways.

Many studies are cross-sectional assessments of both psychological correlates and physical activity, thus there is a likelihood of bias. It would be better to utilise a prospective design whereby we assess psychological

correlates at baseline and then assess physical activity objectively at some time in the future. Few studies have done this. Moreover, the assessment of psychological correlates has been varied. There is a need for greater use of validated measures of constructs, although this can be difficult in large-scale surveys where time to complete the survey is short.

The conclusions drawn are based on a review of reviews. This in itself has limitations. We have relied on only five reviews of correlates of physical activity, not all of which address all categories of correlates. Moreover, there may be a tendency to publication bias and the reporting of more positive results.

Notwithstanding these limitations, we have evidence that is suggestive of a number of different types of correlates of physical activity for children and adolescents. Beyond age and gender, though, most are likely to have only small or small-to-moderate effects in isolation and may work best in interaction with other influences. Regrettably, we are still not close to identifying the nature of these interactions.

5. Conclusions

In judging evidence to produce summary evidence statements, we have used criteria based on strength and category of evidence. For strength of evidence we provide verbal descriptors of ‘small’, ‘moderate’ and ‘large’ by generally adopting the conventions of Cohen’s strength of effect for correlations (0.1=small; 0.3=moderate; 0.5=large) (Cohen, 1988), where we are able to use such criteria. Full details are shown in Table 6. The summary evidence statements also describe the type of study design on which the evidence statement is based.

SUMMARY EVIDENCE STATEMENTS

(Review 2. Quantitative Correlates review)

1. Demographic/biological correlates of physical activity

There is evidence from four systematic reviews of observational studies (Biddle et al., 2005; Ferreira et al., 2006; Gustafson & Rhodes, 2006; Sallis et al., 2000) that:

- There is a moderate to large positive association between male gender and physical activity in young people (i.e., males are more active than females)
- There is a small-to-moderate negative association between age and physical activity in adolescence (i.e., physical activity declines with age during this period)

2. Psychological correlates of physical activity

There is evidence from two systematic reviews of observational studies (Biddle et al., 2005; Sallis et al., 2000) that:

- There is a small association between positive motivation and physical activity in adolescent girls
- There is a small-to-moderate association between positive body image and physical activity in adolescent girls
- There is a small-to-moderate negative association between the existence of barriers to physical activity and participation in physical activity in young people.

3. Behavioural correlates of physical activity

There is evidence from two systematic reviews of observational studies (Biddle et al., 2005; Sallis et al., 2000) that:

- There is a moderate association between previous physical activity and current physical activity in young people
- There is a moderate association between sport participation and total physical activity in young people (with a stronger level of association in adolescent girls)

- There is a moderate negative association between smoking and physical activity in young people
- There is a small negative association between sedentary behaviour at weekends and after school and physical activity in young people

4. Social/cultural correlates of physical activity

There is evidence from four systematic reviews of observational studies (Biddle et al., 2005; Ferreira et al., 2006; Gustafson & Rhodes, 2006; Sallis et al., 2000) that:

- There is a large positive association between parental and social support and physical activity in young people

5. Environmental correlates of physical activity

There is evidence from four systematic reviews of observational studies (Biddle et al., 2005; Davison & Lawson, 2006; Ferreira et al., 2006; Sallis et al., 2000) that:

- There is a small-to-moderate positive association between access to facilities and participation in physical activity in young people
- There is a moderate negative association between distance from home to school and physical activity in young people
- There is a moderate-to-strong positive association between time spent outside and physical activity in young people
- There is a small negative association between local crime and physical activity in young people.

Table 6. Summary of direction and strength of evidence for key correlates of physical activity for young people. All evidence is derived from systematic reviews of observational studies.

Correlate category	Correlate	Direction of association	Estimated strength of association	Comments
Demographic/biological	Male gender	+	Moderate-to-large	Gender differences are highly reproducible, but could vary depending on type of physical activity assessed.
	Age	-	At least small-to-moderate in adolescence	Highly reproducible. Little effect in pre-adolescence.
Psychological	Positive motivation, expressed via constructs such as intentions, enjoyment, perceived competence, self-efficacy	+	Small in adolescent girls	Effects less likely in younger children.
	Positive body image	+	Small-to-moderate in adolescent girls	
	Barriers	-	Small-to-moderate	Perceived barriers may reflect real barriers or be justifications of personal preferences
Behavioural	Previous physical activity	+	Moderate	Consistent with evidence for moderate tracking during childhood and adolescence.
	Sport participation	+	At least moderate	Some evidence for larger effect in adolescent girls.
	Smoking	-	Moderate	
	Sedentary behaviour at weekends and after	-	Small	Important to note that overall sedentary time was unrelated to physical activity.

	school			
Social/cultural	Parental and social support	+	Large	But unclear on the most positive type of parental support.
Environmental	Access to facilities	+	Small-to-moderate	
	Distance from home to school	-	Moderate	But will interact with local conditions.
	Time spent outside	+	Moderate-to-large	
	Local crime	-	Small	

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ANNEX 1.

Glossary[8]

Active Travel. Physically active means of transport, usually walking and cycling.

Adolescents. Young people aged 12-18 years.

Children. Young people aged less than 12 years.

Correlates. Factors associated with levels of physical activity.

Determinants. A term often used interchangeably with correlates, but suggesting a causal relationship with physical activity.

Exercise. One aspect of physical activity, usually involving planned repetitive and structured movement with the objective of maintaining or improving physical fitness (Caspersen et al., 1985).

Mediating Variable. Variables we seek to affect in order to bring about behaviour change.

Moderating Variable. Variables for which study outcomes may differ, such as by age or gender.

Physical Activity. Body movement produced by the skeletal muscles that results in energy expenditure above resting levels (Bouchard and Shephard, 1994; Caspersen et al., 1985).

Physical Fitness. The ability of the individual to perform muscular work. It is a function of both current physical activity levels and heredity. Performance-related aspects of fitness are associated with athletic ability ('motor fitness') while health-related components of physical fitness include cardiovascular fitness, muscular strength and endurance, muscle flexibility, and body composition (fatness).

Sedentary behaviour. Specific behaviours involving little or no physical movement, such as motorised transport or working at a computer.

Sport. Physical activity that is rule governed, structured, competitive, and involves gross motor movement characterised by physical strategy, prowess and chance (Rejeski and Brawley, 1988).

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[8] Words underlined are defined elsewhere in the Glossary.

Young People. Generic term used to denote children and adolescents.