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Associations between socioeconomic position and young people's physical activity and sedentary behaviour in the UK: a scoping review

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ABSTRACT

Objective To examine the evidence on the associations between socioeconomic position and young people's physical activity and sedentary behaviours in the UK.

Design Scoping review.

Data sources PubMed, SCOPUS and Web of Science databases were searched for articles published up to and including January 2021.

Eligibility criteria for selecting studies Observational studies in children and adolescents (aged 5–18 years) from the UK that had assessed associations between at least one indicator of socioeconomic position and at least one outcome of physical activity and/or sedentary behaviour.

Data extraction and synthesis Data were extracted by one reviewer and 20% were double checked. Indicators of socioeconomic position were tabulated with domains of physical activity and sedentary behaviour.

Results Fifty-seven publications were included in the review; 37 publications from 19 studies (k=23) of children and 21 publications from 15 studies (k=23) of adolescents. Most studies were cross-sectional. 63% of studies of children, and 40% of studies of adolescents assessed Index of Multiple Deprivation. Eighteen studies measured physical activity in children, 13 measured sedentary behaviour. Eleven studies of adolescents included a measure of physical activity, 10 included a measure of sedentary behaviour. Among children and adolescents, the association between socioeconomic position and measures of either physical activity or sedentary behaviour was highly variable depending on the measure of both socioeconomic position used and the behavioural outcome, with the exception of higher family affluence which was consistently associated with higher reported physical activity among adolescents.

Conclusion Physical activity and sedentary behaviours of children and adolescents in the UK are complex and influenced by multiple indicators of socioeconomic position that are, in most cases, different across age stages, outcomes examined and measurement tools. Greater consistency in the use and measures of socioeconomic position as well as outcomes of behaviour are required for robust country-specific meta-analyses.

Strengths and limitations of this study

► This is a comprehensive scoping review following the reporting guidelines of the Preferred Reporting Items for Systematic Reviews and Meta-Analyses Extension for Scoping Reviews.

► This is a first attempt to examine the extent of the literature surrounding socioeconomic position and physical activity and sedentary behaviour in children and adolescents in the UK.

► This review was limited by the lack of consistency in the use and in the measures of socioeconomic position and behavioural outcomes.

► Meta-analytic synthesis would have enabled more precise quantification of the direction and magnitude of reported associations, but this was deemed inappropriate due to heterogeneity in the exposure and outcome measures used and is also outside of the scope of a scoping review of this nature.

BACKGROUND

Low levels of physical activity and high levels of sedentary behaviour are key determinants of poor child development, mental health problems and unfavourable metabolic and cardiovascular disease risk profiles.[1–3] Many young people in the UK are not meeting the recommended minimum of 60 min of moderate to vigorous intensity physical activity (MVPA) on average per day[4–6] and spend large proportions of the day sitting and engaged in high volumes of screen-based activities.[4 7] Establishing regular participation in physical activity and reduced sedentary behaviour early in childhood is fundamental for lifelong health and well-being because there is evidence that physical activity declines through childhood into adolescence while sedentary behaviours increase.[8 9] Furthermore, there is evidence that physical activity and sedentary behaviour during childhood tracks into adolescence and then adulthood.[10–12] Given this evidence, increasing

physical activity and reducing sedentary behaviour in childhood require targeted public health efforts.

The development of public health interventions, capable of facilitating health-enhancing shifts in physical activity and sedentary behaviours, requires high-quality evidence of the contextual factors that are barriers or enablers of behaviour change. Socioeconomic position, the social and economic factors that influence what positions individuals or groups hold within the structure of a society,[13] is recognised as an important determinant of health and well-being, in part because it influences people's attitudes, experiences, behaviours, exposure to health risk factors and access to services and healthy environments.[14 15] Children who grow up in lower socioeconomic position households have a higher risk of cardiovascular disease[16 17] and all-cause mortality[18] than children who live in higher socioeconomic position households.[19] In the UK, a quarter of children and young people are living in a household with an income below that needed for a minimum socially acceptable standard of living.[20] It has been consistently shown that children of lower socioeconomic position are more likely to become adults with lower socioeconomic position.[21]

A wide variety of markers have been used to denote socioeconomic position in epidemiological and population health studies to date. This has included family level indicators, such as parental education and/or characteristics of the home environment (eg, car or home ownership). Other markers reflect socioeconomic position at the macro-level or community-level, such as the Index of Multiple Deprivation (IMD), which is derived based on home postal code and has versions that are country specific (ie, England and Scotland have different IMD). Socioeconomic position may also be captured at the individual-level, via assessments of child's ownership of particular assets (eg, a computer), or the amount of pocket money received.[22] Such markers may be used individually or incorporated within broader, family level metrics. Systematic review findings, which are based on a synthesis of studies from multiple countries, suggest that the evidence of an association between socioeconomic position and physical activity in young people is inconsistent and varies depending on the socioeconomic position indicators measured, the country in which they were assessed and domains of activity assessed.[19 23] A recent meta-analysis found that young people in high-income countries from lower socioeconomic position backgrounds (classified as paternal/maternal education, occupation, income, socioeconomic status) exhibit higher levels of sedentary behaviours (both screen-based and non-screen-based) compared with those from higher socioeconomic position backgrounds, with the opposite being seen in low-income to middle-income countries.[24] Yet another review found no consistent evidence of an association between parent education (one of the most commonly used markers of socioeconomic position with regard to children's health behaviours) and children's sedentary behaviour and physical activity.[25] The mixed evidence may in part be due to varied indicators of socioeconomic position being incomparable across studies and between countries, which is likely particularly the case for composite indicators because they fail to separate out the different domains of SEP, which might have differing influences on the health behaviours.

In the UK, there is a clear socioeconomic pattern in child weight status,[26 27] but whether this socioeconomic patterning is also clear in physical activity and/or sedentary behaviour among young people in the UK has yet to be determined. To the best of our knowledge, there has been no previous review focusing on data from the UK only. Thus, the aim of this scoping review was to examine the extent, range and nature of the evidence on the associations between socioeconomic position and young people's physical activity and sedentary behaviour in the UK for the purpose of scoping this field of study and identifying gaps in the literature to aid the planning of future research.

METHOD

This review was conducted as a scoping review as this allows for the extent, range and nature of the literature to be identified.[28] This review was reported according to procedures documented in the Preferred Reporting Items for Systematic Reviews and Meta-Analyses extension for Scoping Reviews (PRISMA-ScR) checklist.[29] The review protocol was registered with PROSPERO (CRD42019139550).

Search strategy

Search strategies were built around four groups of keywords: socioeconomic position, physical activity, sedentary behaviourand population. Key terms for socioeconomic position were used in combination with key terms for physical activity, sedentary behaviour and population to locate potentially relevant studies. An example of the search strategy is provided as a online supplemental file. PubMed, SCOPUS and Web of Science databases were searched using the key terms up to and including January 2021. In addition, manual searches of personal files were conducted along with screening of reference lists of previous sedentary behaviour and/or physical activity reviews[24 30] and identified articles which included the key terms.

Inclusion criteria

For inclusion, studies were required to: (i) be a cross-sectional or longitudinal observational study or baseline/control arm of an intervention study; (ii) include school-aged children aged 5–11 years and/or adolescents aged 12–18 years (or a mean age within these ranges) from the UK (or for multicountry studies, provide results that were reported separately by country); (iii) include at least one indicator of socioeconomic position; (iv) include at least one quantitative outcome of either physical activity or sedentary behaviour; (v) report a quantitative estimate

of the association between at least one domain of socio-economic position and one domain of physical activity and/or sedentary behaviour and (vi) be published in a peer-reviewed journal in the English language up to and including January 2021.

Identification of relevant studies

Potentially relevant studies, following de-duplication, were selected by (1) screening the titles, (2) screening the abstracts and (3) if abstracts were not available or provided insufficient data, the full-text article was retrieved and screened to determine eligibility. At each stage of the review, any uncertainties in articles were discussed by NP and LBS, all data were managed using EndNote X4 reference manager.

Data charting process

For each study that met the inclusion criteria, study characteristics and outcomes of interest were extracted using a pre-established data extraction form in Microsoft Excel. Data were extracted by NP and 20% were double checked by LBS, discrepancies over the data extracted (n=1) were resolved through discussion. Extracted data included: author and year of publication, name and location of study, study type, sample characteristics (ie, age, gender, ethnicity, sample size), indicator of socioeconomic position, intensity of physical activity assessed (eg, moderate physical activity), type of sedentary behaviour assessed (eg, screen time), measures used for physical activity and sedentary behaviour (eg, questionnaire or device). While data such as sample size, study type and methods used to assess behaviours were extracted and used for appraisal of the studies included, methodological quality or risk of bias of individual studies was not assessed formally, as is standard practice for scoping reviews.[29]

Synthesising associations between indicators of socioeconomic position and physical activity and sedentary behaviour

Identified indicators of socioeconomic position were categorised as community-level and family level indicators and tabulated to highlight the extent, range and nature of the evidence among children and adolescents, respectively. No studies were located that used individual-level markers of child/adolescent socioeconomic position. Data were described for each outcome and domain of activity (ie, moderate activity at lunchtime, vigorous activity after school counts per minute, etc), and for each independent sample (k) or subsample that the study provided data on (ie, girls and boys, different year groups, etc). Tables of results provide summaries at the sample (k) level so that the same samples are not counted more than once for each association. For example, if one study (eg, Millennium Cohort Study (MCS)) has three articles all examining the association between parent education and device-based physical activity, these three articles are listed as separate references but only counted as k=1 because the data come from the same sample.

Furthermore, if one study provides data for boys and girls separately, this would be counted as k=2.

Indicators of socioeconomic position and behaviour outcomes and domains were extracted as per the reporting in the study and were tabulated according to method of measurement (ie, device measured or reported behaviour). Most indicators of socioeconomic position are self-explanatory (eg, maternal education). However, for clarity, the IMD is a community-level measure of deprivation based on home postcodes. England, Wales and Scotland have their own scales for IMD (eg, Scottish IMD). The IMD is an overall measure of multiple deprivation experienced by people living in an area based on indices of deprivation including income, employment, health, education and crime.[31] IMD is assessed on a continuum of high to low deprivation. A high IMD score indicates high levels of deprivation (ie, lower socioeconomic position). Furthermore, Family Affluence Scale (FAS) is a multidimensional household socioeconomic position measure reflecting material affluence. The FAS is often referred to as the 'assets approach' to measuring the material conditions in the family of a child or adolescent who might not be able to accurately report information about parental income or occupation.[32] The assets approach requires children and/or adolescents to report on family ownership of goods and/or family's access to services that are required for an acceptable standard of living.[33] The FAS score is created by summing across indicators and high FAS is indicative of higher socioeconomic position.

Associations between indicators of socioeconomic position and behaviour were coded as '+' for positive associations (eg, higher deprivation associated with higher physical activity), '−' for inverse associations (eg, higher maternal education associated with lower sedentary time) and '0' for non-statistically significant association. Significant or non-significant associations were extracted from articles as per stated in the articles (eg, $p < 0.05$ or $p < 0.01$).

Patient and public involvement

Patients and the public were not involved in this review.

RESULTS

The literature searches identified 6761 unique records of which 57 publications (ie, individual references) were included (figure 1). These consisted of 37 publications from 19 studies (k=23) of children (aged 5–11 years) and 21 publications from 15 studies (k=23) of adolescents (aged 12–18 years). Two publications from two studies included samples of both children (k=2) and adolescents (k=2).

Studies of children (aged 5–11 years)

Table 1 describes the characteristics of the included 19 studies of children. Twelve were cohort studies (63%). One study, the MCS, was representative of the UK, two studies were representative of England, Ireland and Scotland,
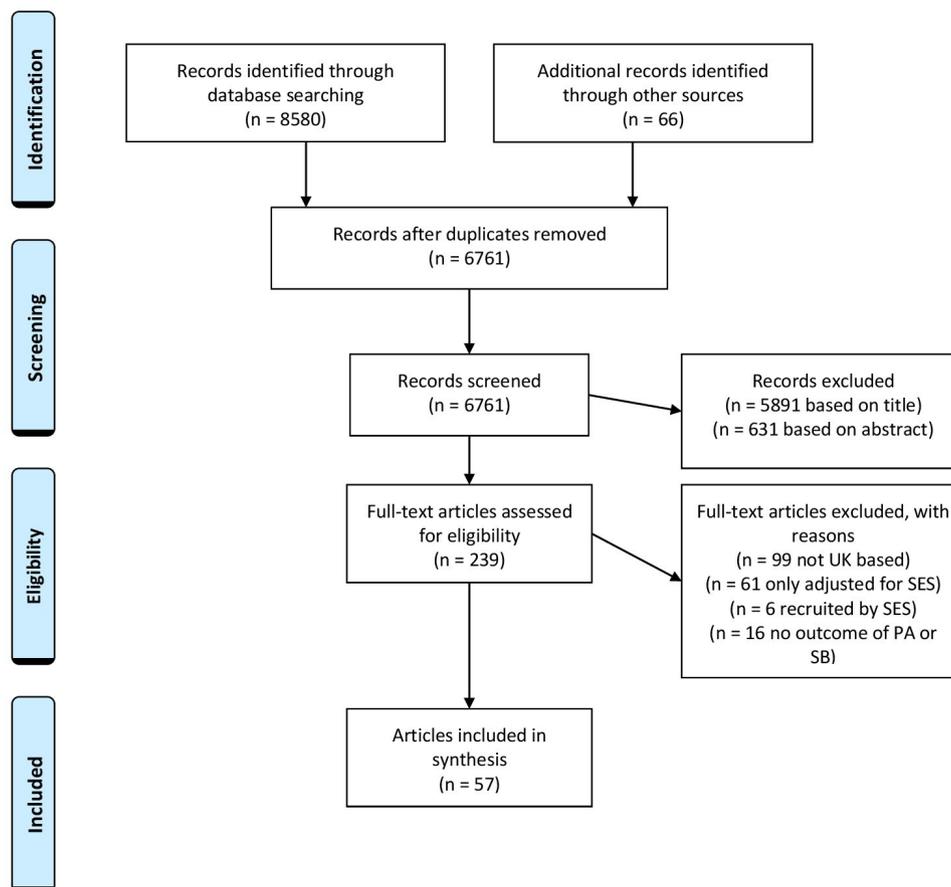
Figure 1 Flow diagram of search strategy.[54] PA, physical activity; SB, sedentary behaviour; SES, socioeconomic status.

respectively. There were no studies of children from Wales. Overall, almost half of publications (n=15, 43%) were from two studies: the MCS (n=8 articles) and the Sport, Physical Activity and Eating behaviour: Environmental Determinants study (SPEEDY; n=7 articles), which is representative of the East Anglia region of the UK. The South-West region of England was over-represented with over a quarter of all studies (n=5), and 22% (n=8) of publications, of children included in the review conducted in this region. Sixteen studies were cross-sectional (84%), one was longitudinal and two studies used both designs. Sample sizes ranged from 194 to 11 965 participants. Fourteen indicators of socioeconomic position were employed, with articles within studies using different and/or multiple indicators. Twelve studies (63%) assessed the English IMD, and two used the Scottish IMD. Maternal education (26%, 5 studies), family structure (21%, 4 studies) and parent/partner education (21%, 4 studies) were commonly assessed indicators of socioeconomic position. Eighteen studies included a measure of physical activity, of which 12 used device-based measures (67%) and 13 assessed sedentary behaviour, of which 8 were device-based (62%).

Socioeconomic position and physical activity

Table 2 describes the findings for associations with physical activity in children. Thirteen indicators of socioeconomic position were examined in association with physical activity, and associations were variable, irrespective of the measure of physical activity (self-report vs device), with many samples within studies showing different results depending on the outcome of behaviour assessed.

At the community level, IMD and Scottish IMD were the only measures of socioeconomic position found. IMD was examined in association with device-based physical activity in eight samples from seven studies, with reported physical activity in nine samples from seven studies. Most samples from studies of device-based physical activity reported no association, whereas the samples with reported physical activity showed mixed results. Maternal education and parent/partner education was positively associated with domains of reported activity in two sample, but both of these family level indicators of socioeconomic position showed inconclusive results with device-based activity (table 2). Family structure was mostly not associated with device-assessed physical activity but showed differing results with reported activity based on the domain assessed.

Studies that examined the association of family/household income (n=1) and maternal employment (n=1) with device measured physical activity reported mixed results that varied by physical activity outcome. Furthermore, one study found an association between higher socioeconomic status (composite score) and lower MVPA and total physical activity. One study found that those children entitled to free school meals had higher levels of school-time physical activity.

Table 1 Characteristics of studies including children aged 5–11 years

Names of studies including children, by country/region	(Reference) and independent samples	Sample size range	Study design	Indicators of SES	Physical activity measure	Physical activity outcomes assessed	Sedentary behaviour measure	Sedentary behaviour outcome assessed
				Characteristics of studies				
UK representative								
Millennium Cohort Study	(55) I, II; 56; (57); (58); (59); (60)	N=3717–11 965	Cross-sectional	IMD; family/household income; family structure; maternal education; maternal occupational status; access to garden; housing tenure; cars in use	Device-measured; proxy-report	CPM; MVPA; VPA; total activity; % meeting guidelines; sport/exercise participation; active transport	Device-measured; proxy-report	Sedentary time; TV viewing; computer use
England representative								
Health Survey for England	(61); (62) B, G	N=1110–3822	Cross-sectional	IMD; family/household income; head of household occupation/occupational class	Self(proxy)-report	Out of school PA	Device-measured; self(proxy)-report	Sedentary time; TV viewing; non-TV sitting; total sedentary behaviour
UK Time Use Survey	(63) I	N=1269	Cross-sectional	Maternal employment			Self(proxy)-report	TV viewing
East Anglia								
The Sport, Physical activity and Eating behaviour, Environmental Determinants in Young People study	(64); (65); (9); (66)	n=316–2064	Longitudinal	Composite SEP score; IMD; car ownership; family structure; parent education; home ownership	Device-measured	Light PA; MVPA	Device-measured	Sedentary time
	(67); (68); (69)	N=316–2064	Cross-sectional	Composite SEP score; IMD; car ownership; family structure; parent education; home ownership	Device-measured	MVPA; VPA	Device-measured; self(proxy)-report	Sedentary time; screen-time; total sedentary behaviour; non-screen-based sedentary behaviour
West Yorkshire								
Unnamed study 1	(70)	N=160	Cross-sectional	IMD	Device-measured	Light PA; MVPA	Device-measured	Sedentary time
North-East England								
Gateshead Millennium Study	(71)	N=480	Cross-sectional	Maternal education	Device-measured	MVPA	Device-measured	Sedentary time
North-West England								
SportsLinx	(72)	N=6337	Cross-sectional	IMD	Self(proxy)-report	Sport/Exercise participation	Self(proxy)-report	TV viewing; video game use
Unnamed study 2–4	(73); (74); (75)	N=194–223	Cross-sectional	IMD	Device-measured; self(proxy)-report	MPA; VPA; total activity; active travel		
South-West England								

Continued

Table 1 Continued

				Characteristics of studies				
Names of studies including children, by country/region	(Reference) and independent samples	Sample size range	Study design	Indicators of SES	Physical activity measure	Physical activity outcomes assessed	Sedentary behaviour measure	Sedentary behaviour outcome assessed
B-PROACTIV	[76] I BG, II BG	N=685–1026	Cross-sectional and longitudinal	IMD; parent education; family structure	Device-measured	MVPA	Self(proxy)-report	Screen-viewing
	[39]							
	[77]	1296	Cross-sectional	IMD; parent education	Device-measured	MVPA active travel		
Avon Longitudinal Study of Parents and Children	[78] a	N=4813	Cross-sectional	Maternal education	Device-measured	CPM; light PA; MVPA	Device-measured	Sedentary time
EarlyBird study	[79]	N=300	Longitudinal	IMD	Device-measured	CPM		
Personal and Environmental Associations with Children's Health study	[52] B, G	N=552–1307	Cross-sectional	IMD; car ownership; family/household income; maternal education; parent education; free-school meal entitlement	Device-measured	CPM; light PA; MVPA	Device-measured	Sedentary time
	[78] b							
	[80]							
International Study of Childhood Obesity, Lifestyle and the Environment	[81]	N=425	Cross-sectional	Parent education	Device-measured	Light PA; MPA; VPA; meeting MVPA guidelines		
Ireland								
Growing-up-in-Ireland	[82]	N=8568	Cross-sectional	Head of household occupation/occupational class; family structure; maternal education	Self(proxy)-report	MPA; VPA	Self(proxy)-report	TV viewing
	[83]							
Children's Sport Participation and Physical Activity study	[84] I	N=446	Cross-sectional	FAS	Self-report	PA		
Scotland								
Growing-up-in-Scotland	[85]	N=774	Cross-sectional	Scottish IMD	Device-measured	CPM; light PA; MVPA	Device-measured	Sedentary time
Unnamed study 5	[86] I, II	N=1700–1906	Repeated cross-sectional	Scottish IMD	Self(proxy)-report	Out of school activity	Self(proxy)-report	Screen-time

For reference 34, I=children aged 5 years, II=children aged 11 years; 43, I=children aged 8–11 years; 56, I=children aged 5–6 years, II=children aged 8–9 years; 66, I=primary school aged children; 68, I=children in 2006 II=children in 2010.
B, boys; CPM, counts per minute; G, girls; I, II, independent samples; IMD, Index of Multiple Deprivation; MPA, moderate physical activity; MVPA, moderate-to-vigorous physical activity; PA, physical activity; TV, television; VPA, vigorous physical activity.

Table 2 Synthesis of the evidence on associations between community-level and family level indicators of socioeconomic position and physical activity in children (aged 5–11 years)

Indicator of socioeconomic position	Device-based PA (n samples ((references) (outcome)))						Reported PA (n samples ((references) (outcome)))					
	N	Positive association (+)	N	Inverse association (–)	N	No association (0)	N	Positive association (+)	N	Inverse association (–)	N	No association (0)
Community level												
Index of Multiple Deprivation (IMD)	1	(56) (MVPA)	1	(70) (light PA)	6	(73) (MPA and VPA during: school time, out of school, before school, after school, class time, recess time, lunch time), (80) (school-time CPM), (79) B, G, (66), (70)(MVPA)	4	(75), (59) (AT), (62) B, G (out of school PA), (AT)	3	(72)(weekend S/E), (77) (AT), (59)(S/E)	2	(72)(weekday S/E), (74) (PA level)
Scottish IMD					1	(85) (CPM, LPA, MVPA)	1	(86) II (out of school PA)			1	(86) I (out of school PA)
Family level												
Maternal education	1	(37) (VPA)	3	(78) a (PA, CPM), (78) b (PA), (58)(MVPA, CPM, meets guidelines)	4	(71), (56), (78) a (MVPA), (78) b (MVPA, CPM)	1	(82) (MPA, VPA)				
Family structure/ Parental status	1	(57) (CPM, MVPA, meets guidelines)			4	(67) (after school MVPA, weekend MVPA), (87)(CPM), (58)(CPM, MVPA, meets guidelines), (76) I, II B, G (weekday and weekend day MVPA)	1	(82) (MPA)			1	(82) (VPA)
Parent/Partner education			1	(67) (after school MVPA), (9)(LPA)	2	(67)(weekend MVPA), (68)(weekday and weekend VPA), (9)(MVPA), (81)(LPA, MPA, VPA)	1	(77) (AT)				
Family/Household income	1	(37) (VPA)	1	(60) (MVPA)	1	(58) (MVPA, CPM, meets guidelines)	2	(55) I, II (S/E)				
Maternal employment (unemployed/ not in full-time employment)	1	(57) (CPM, MVPA, meets guidelines)			1	(87) (CPM)	1	(82) (MPA)			1	(82) (VPA)
Family Affluence Scale					1	(84) I (meets guidelines)						
Composite SES score (high SES)			1	(66) (MVPA and total activity)								
Free school meal entitlement	1	(80) (school-time PA)										

Table 2 Continued

Indicator of socioeconomic position	Device-based PA n samples ((references) (outcome))						Reported PA n samples ((references) (outcome))					
	Positive association (+)	N	Inverse association (−)	N	No association (0)	N	Positive association (+)	N	Inverse association (−)	N	No association (0)	N
Home ownership					[67] (after school and weekend day MVPA), [58] (CPM, MVPA, meets guidelines)	2						
Access to a garden					[58] (CPM, MVPA, meets guidelines)	1						
Number of cars in use			[58] (CPM, MVPA, meets guidelines)	1								

Studies in bold represent longitudinal data.
AT, active travel; B, boys; CPM, counts per minute; G, girls; LPA, light physical activity; MPA, moderate physical activity; MVPA, moderate-to-vigorous physical activity; PA, physical activity; S/E, sport/exercise; VPA, vigorous physical activity.

Socioeconomic position and sedentary behaviour

Table 3 presents results for associations with sedentary behaviour in children. Eleven indicators of socioeconomic position were examined, and associations were variable, irrespective of the measure of sedentary behaviour (self-report vs device), with many samples within studies showing different results depending on the behaviour assessed.

IMD was not associated with device-based sedentary behaviour in five samples of children, including longitudinal data. The results with reported sedentary behaviour were mixed and differed within samples depending on the outcome of sedentary behaviour assessed. Maternal education was negatively associated with device measured sedentary time in two out of three samples, whereas parent/partner education showed mixed associations. Family/Household income was not associated with device measured sedentary time in three samples but was associated with lower reported sedentary behaviours in three samples. Other indicators of socioeconomic position such as composite scores of socioeconomic status, occupational social class and access to a garden showed mixed results with sedentary behaviour. Car ownership and family structure were consistently unrelated to sedentary behaviour.

Studies of adolescents (aged 12–18 years)

Table 4 describes the characteristics of the 15 included studies of adolescents. Eight were cohort studies (54%). Five studies were representative of the UK or England, three studies were representative of Ireland, one of Scotland and two of Wales. Five publications (28%) were from the Health Behaviour in School aged Children Study (HBSC) study, two from the Avon Longitudinal Study of Parents and Children (ALSPAC) (11%), two from the Health Behaviour in Teens study (11%), with the remaining articles from single studies. All studies conducted cross-sectional or repeated cross-sectional analyses, with one also using a longitudinal design. Sample sizes ranged from 286 to 16 421. Nine indicators of socioeconomic position were employed in studies of adolescents. Most frequently assessed was IMD (33%, 5 studies). Twelve studies measured physical activity, of which three (25%) used devices. Ten studies measured sedentary behaviour; nine used self-report and one used a device-based measurement.

Socioeconomic position and physical activity

Nine indicators of socioeconomic position were examined in association with physical activity. At the community level, IMD, Welsh IMD and area deprivation measured by the Townsend Index were assessed and there were no consistent results with either self-report or device assessed activity (table 5). Head of household occupation was unrelated to reported physical activity in four out of five samples. Higher affluence (assessed with FAS) was positively associated with reported physical activity in eight samples (from two studies), but unrelated in one study. The association between other indicators of

Table 3 Synthesis of the evidence on associations between community-level and family level indicators of socioeconomic position and sedentary behaviour in children (aged 5–11 years)

Indicator of socioeconomic position	Device-based sedentary time n samples ((references) (outcome))						Reported sedentary behaviour (summary n samples (references) (outcome))					
	Positive association (+)	N	Inverse association (−)	N	No association (0)	N	Positive association (+)	N	Inverse association (−)	N	No association (0)	N
Community level												
Index of Multiple Deprivation (IMD)	[52] B, G (after school ST, weekend ST), [70](ST)	3	[79], [61], [66] (ST), [64] (after school ST, weekend ST), [52] B, G (before school ST, school day ST)	5			[72] (weekday VG, weekday TV, weekend VG), **[39](weekday ScrT)**	2			[61] (TV, non-TV sitting), [72](weekend TV), [39](weekday and weekend day ScrT), **[39](weekend ScrT)**, [59](TV, C)	4
Scottish IMD			[85]	1			[86] I, II (ScrT)	2				
Family level												
Composite SES score	[64] (after school ST, weekend ST), [61](ST)	2			[66] (ST)	1	[69] (non-screen SB)	1	[69] (total SB)	1	[69] (screen-based SB)	1
Family/Household income			[52] B, G (after school ST, weekend ST, before school ST, school day ST), [61](ST)	3					[61] (TV), [55] I, II (weekday TV viewing, weekday C)	3	[61] (non-TV sitting)	1
Occupational social class	[57] (ST)	1			[61] (ST)	1			[61], [83](TV)	2	[61] (non-TV sitting)	1
Parent/Partner education	[52] B (after school ST, school day ST), [52] G (school day ST)	2			[68] (ST), [52] B (weekend ST, before school ST, school day ST), [52] G (after school ST, weekend ST, before school ST, school day ST), [?] (ST)	3			**[39](weekday and weekend day ScrT)**	1	[39](weekday and weekend day ScrT)	1
Maternal employment							[63] I (TV)	1				
Maternal education	[78] a, b (ST)	2			[71] (ST)	1						
Family structure/Parental status					[64] (after school ST, weekend ST), [57] (ST)	2						
Car ownership					[65] (after school ST and weekend ST and), [52] B, G (after school ST, weekend ST, before school ST, school day ST)	3						
Access to a garden	[52] B, G (after school ST, weekend ST)	2			[52] B, G (before school ST, school day ST)	2						

Studies in bold represent longitudinal data.

B, boys; C, computer use; G, girls; SB, sedentary behaviour; ScrT, screen time; ST, sedentary time; TV, television; VG, video games use.

Table 4 Characteristics of studies including adolescents aged 12–18 years

Names of studies including adolescents, by region	(Reference) reference numbers of articles and independent samples	Sample size range	Study design	Indicators of SES	Physical activity measure	Physical activity outcomes assessed	Sedentary behaviour measure	Sedentary behaviour outcome assessed
UK/England representative								
Project Sedentary Teenagers and Inactive Lifestyles	(88) B, G	N=1171	Cross-sectional	IMD; family structure; parent occupation	Self-report	Sport/Exercise participation	Self-report	TV viewing; computer use; total sedentary behaviour
Health Behaviour in School aged Children study (HBSC)	(89) B, G / (90)	N=5148–16 421	Cross-sectional; repeated cross-sectional	FAS	Self-report	MVPA; VPA		
UK Time Use Survey	(63) ‖	N=835	Cross-sectional	Maternal employment			Self-report	TV viewing
Programme for International Student assessment	(91) B, G	N not specified	Cross-sectional	Family wealth	Self-report	MPA; VPA		
Unnamed study 6	(92)	N=3348	Cross-sectional	IMD			Self-report	TV viewing; streaming
East of England/Anglia								
ROOTS study	(33)	N=825	Cross-sectional	IMD	Device-measured	Light PA; MPA; PAEE	Device-measured	Sedentary time
East of England Healthy Hearts Study	(94)	N=6240	Cross-sectional	IMD	Self-report	PA	Self-report	Screen-time
Midlands								
Unnamed study 7–8	(95) / (96)	N=611 / N=381 B, G	Cross-sectional / Cross-sectional	IMD / Family structure	Self-report	Active travel		
Greater London								
Health Behaviour in Teens study	(97) B, G	N=5863	Longitudinal	Area deprivation (Townsend Index)	Self-report	VPA	Self-report	Screen-time
	(98) B, G	N=4320	Cross-sectional	Area deprivation (Townsend Index); family structure	Self-report	VPA	Self-report	Screen-time
South-West England								
Avon Longitudinal Study of Parents and Children	(99) / (100)	N=5595–6406	Cross-sectional	Head of household occupation; maternal education	Device-measured; self-report	MVPA; total activity; inactivity	Self-report	TV viewing

Continued

Table 4 Continued

Names of studies including adolescents, by region	(Reference) reference numbers of articles and independent samples	Sample size range	Study design	Characteristics of studies Indicators of SES	Physical activity measure	Physical activity outcomes assessed	Sedentary behaviour measure	Sedentary behaviour outcome assessed
Unnamed study 9	([101]) G	N=286	Cross-sectional	Head of household occupation	Self-report	VPA		
Ireland								
Young Hearts study 2000	([102])	N=2016	Cross-sectional	Maternal occupation	Self-report	PA	Self-report	Screen-time
HBSC	([89]) B, G ([90])	N=975–4098	Cross-sectional; repeated cross-sectional	FAS	Self-report	MVPA; VPA		
Children's Sport Participation and Physical Activity study	([84])||	N=1508	Cross-sectional	FAS	Self-report	PA		
Scotland								
HBSC	([103]) B, G	N=19 073	Cross-sectional	FAS	Self-report	VPA		
Wales								
HBSC	([104]) ([105])	N=7376–9194	Cross-sectional	FAS	Self-report	MVPA; PA; VPA	Self-report	Screen-time
Active project	([106]) B, G	N=270	Cross-sectional	Welsh IMD	Device-measured	MVPA		

For reference 43, ll=adolescents aged 14–18 years; 66, ll=postprimary school age.
CPM, counts per minute; IMD, Index of Multiple Deprivation; MPA, moderate physical activity; MVPA, moderate-to-vigorous physical activity; PA, physical activity; PAEE, physical activity energy expenditure; TV, television; VPA, vigorous physical activity.

Table 5 Synthesis of the evidence on associations between community-level and family level indicators of socioeconomic position and physical activity in adolescents (aged 12–18 years)

Indicator of socioeconomic status	Device-based PA n samples ((references) (outcome))						Reported physical activity n samples (references) (outcome)					
	Positive association (+)	N	Inverse association (−)	N	No association (0)	N	Positive association (+)	N	Inverse association (−)	N	No association (0)	N
Community level												
Index of Multiple Deprivation (IMD)			(93) (LPA)	1	(93) (MVPA, PAEE)	1		3	(95) (AT), (88) B (weekday S/E), (88) G (weekday S/E, weekend S/E)		(88) B (weekend S/E), (94) (PA level)	2
Welsh IMD	(106) G (MVPA)	1		1	(106)B (MVPA)							
Area deprivation (Townsend Index)								1	(98) G (VPA), (97) G (VPA)	1	(98) B (VPA), (97) B (VPA)	1
Family level												
Maternal education				1	(99) (MVPA, CPM)	1		1	(100) (inactivity)			
Head of household occupation/ occupational/social class				1	(99) (MVPA, CPM)	1	(102) (PA)	1			(88) B, G (weekday S/E, weekend S/E), (100) (inactivity), (101) (VPA)	4
Family/Household income									(100) (inactivity)	1	(100) (inactivity)	1
Family Affluence Scale/Family wealth							(89) UK, Ir, (90) UK, Ir, (104), (103), (104), B, G (VPA), (105)(PA), (89) UK, Ir (PA guidelines), (91) B, G (out of school MPA and VPA)	8			(84) II (meets guidelines)	1
Family structure/ Parental status (single parents)											(98) B, G (VPA), (88) B, G (weekday and weekend S/E)	4
Parent/Partner education	(99) (CPM)	1			(99) (MVPA)							

AT, active travel; CPM, counts per minute; Ir, Ireland; LPA, light physical activity; MPA, moderate physical activity; MVPA, moderate-to-vigorous physical activity; PA, physical activity; S/E, sport/exercise; VPA, vigorous physical activity.

socioeconomic position showed varied and inconclusive associations with adolescent physical activity.

Socioeconomic position and sedentary behaviour

Eight indicators of socioeconomic position were examined in association with adolescent sedentary behaviour. At the community level, area deprivation was associated with reported activity in a cross-sectional and longitudinal sample. IMD showed mixed results with reported sedentary behaviour (table 6). At the family level, head of household occupation showed mixed results with reported sedentary behaviour that varied across samples according to outcome assessed. Family structure (living in single parent households) was associated with higher levels of reported sedentary behaviour in four samples, and not associated with reported sedentary behaviour in two samples.

DISCUSSION

The purpose of this scoping review was to examine the extent, range and nature of the evidence on the association between socioeconomic position and young people's physical activity and sedentary behaviour in the UK. Of the 57 included publications, almost 65% reported data for children. Across childhood and adolescence, the majority of reported analyses were cross-sectional, with only three longitudinal analyses among samples of children and only one among adolescents. Considerable variation in the characterisation and measurement of the exposures/outcomes examined in this review combined to provide a mixed picture with regard to the association of socioeconomic position with physical activity and sedentary behaviour in young people living in the UK.

A substantial proportion of the evidence base is derived from studies that recruited country or regionally representative samples. In studies of children, the coverage of data comes mostly from the MCS, SPEEDY representing East Anglia, and the South-West region of England, respectively. While Scotland and Ireland were represented in studies of children, Wales was not represented. In studies of adolescents, data were found for all four home countries of the UK. Much of the data were from the HBSC study, where consistent associations were found between family affluence and reported physical activity.

The prevalence of children living at different socioeconomic positions varies by country within the UK. Recent evidence suggests that 30% of all children in England and Wales live in poverty, compared with around 24% in Ireland and Scotland.[34] The limited data available across the nations and the variation in exposures and outcome measures used in the studies included in this scoping review precludes any conclusions about whether the associations between socioeconomic position and physical activity and sedentary behaviour are different. Future research is needed in the home countries that aims to improve the understanding of associations within countries so that policies can be targeted where most needed.

Socioeconomic position of young people is typically inferred based on characteristics measured at the parental (eg, maternal education, occupational status), household (eg, housing tenure, household income) or neighbourhood (eg, area deprivation) level. The pathways through which these different indicators may influence children's health in general are complex[35] and the magnitude of the observed inequalities is known to vary by indicator.[36] Across the included literature, 17 indicators of socioeconomic position were used. This heterogeneity may explain the lack of consistent associations found in this review and others.[19 23] Furthermore, the evidence presented here also highlights that the same indicator of socioeconomic position may have different associations with subcomponents/domains of physical activity and sedentary behaviour. For example, higher maternal education and higher household income was shown to be associated with higher levels of vigorous physical activity but with lower levels of moderate physical activity in children.[37] Similar findings have been seen in the adult literature, for example, in a recent study of over 40 000 British adults, lower educational attainment was associated with higher active travel and occupational activity, but lower weekly leisure-time physical activity.[38] Furthermore, while the longitudinal evidence was scant in this review, the evidence that does exist confirms the findings from the cross-sectional data. For example, Salway et al found that children from more deprived background saw higher increases in screen-time from age 6 to 9 years, compared with those from less deprived backgrounds.[39] In this same study, there were no associations between household education and screen-time, but the longitudinal analyses showed that those from households of higher education had less increases in screen-time from age 6 to 9 years compared with those from households with lower education.[39] In addition, we did not observe clear evidence that associations between specific markers of socioeconomic position and physical activity were opposite in sedentary behaviour, consistent with previous evidence that the correlations between these two behaviours are low.[40] This exemplifies the importance of specificity in the definition of the socioeconomic exposure and the domain of the outcome of interest in observational research and in the design and delivery of interventions.

In the present review, the most common indicator of socioeconomic position used was IMD. IMD provides a measure of the level of deprivation experienced by people living in a small area (approximately 1500 residents) based on indices of deprivation including income, employment, health, education and crime.[31] While census data collected on IMD is key for targeting services to help tackle deprivation, it is not a direct or necessarily meaningful measure of deprivation at the individual/household level.[41] This scoping review suggests that further evidence is needed to assess the relationship between individual or household measures of socioeconomic position and physical activity and sedentary behaviours in children. Nonetheless, area-level markers of socioeconomic position may

Table 6 Synthesis of the evidence on associations between community-level and family level indicators of socio-economic position and sedentary behaviour in adolescents (aged 12–18 years)

Indicator of socioeconomic position	Device-based sedentary time (n samples ((references) (outcome))						Reported sedentary behaviour n samples ((references) (outcome))					
	Positive association (+)	N	Inverse association (–)	N	No association (0)	N	Positive association (+)	N	Inverse association (–)	N	No association (0)	N
Community level												
Index of Multiple Deprivation		1	(93) (ST)				(94) (ScrT), (92) (TV, streaming)	2			(88) B, G (TV, total SB, C)	2
Area deprivation (Townsend Index)							(98) B, G, (97) **B, G** (ScrT)	2				
Family level												
Maternal education								1	(100) (TV)			
Family/Household Income								1	(100) (TV)			
Head of household occupation/ occupational/social class							(88) B (weekend TV and C), (88) G (weekday total SB), (102) (weekend ScrT)	2	(88) G (weekend TV), (102) weekday ScrT		(88) B, G (weekday TV C, weekend total SB), (88) B (weekday total SB), (88) G (weekend C), (100), (101) (TV)	4
Family Affluence Scale/Family wealth											(104)(ScrT)	1
Family structure/ Parental status (single parents)							(98) B, G (ScrT), (88) B (total SB, weekend TV, weekday C), (96) B (weekday total SB)				(88) B, G (weekday TV, weekend C), (88) G (total SB, weekend TV, weekday C), (86) G (weekday SB), (96) B, G (weekend SB)	3
Maternal employment							(63) II (TV viewing)					

SB, sedentary behaviour; ScrT, screen time; ST, sedentary time; TV, television.

still be insightful for examining potential neighbourhood socioeconomic position influences on physical activity or sedentary behaviour and for geographical targeting of interventions. Social scientists argue that area-based measures of socioeconomic position may be more relevant for adolescents than household measures because of the growing amount of time that they spend outside of the household and engaging with their community.[42 43] In the present review, the IMD was not associated with device measured physical activity or sedentary behaviour but showed positive, negative and null associations with self-reported or proxy reported outcomes. This could, in part, be because the questionnaires used to collect reported physical activity tend to collect information on purposeful bouts of more organised activity that can be recalled. Thus, questionnaires are likely to pick up sports participation and leisure time activity that arguably could be more closely associated with area-level deprivation. For example, recalled bouts of sports/exercise may be more closely linked to facilities, green space, play parks and perceived safety which have previously been shown to be related to structured activity.[44] The inability of device-based assessment to capture specific activity types means that such associations may have been obscured in studies that used this methodology.

The evidence presented here is characterised by substantial variability in the markers of socioeconomic position used across different studies, but they are generally similar to those seen in the literature for adults. Collection of common indicators used in adult studies (such as income, employment and education) can be problematic in this younger population, as many young people cannot accurately describe their parent's education, income or details of their current employment, and collection of data from parents could result in high levels of missing data. It has thus been suggested that assessing material circumstances, such as number of assets in the home as used in the FAS might be valuable because these circumstances are easier to recall.[45] In addition, multidimensional measures, like the FAS, have their strength in capturing an overall measure of socioeconomic position rather than looking at single domains. This can be important when the study is interested in the overall concept of socioeconomic position as opposed to the constituent parts.[46 47] In the present review, FAS was only used in two studies of adolescents. One of these was the HBSC study which showed, consistently (across five publications), that higher affluence was associated with higher self-reported MVPA, VPA and meeting physical activity guidelines. Data (not included in the review) from the HBSC study reveals this same trend across other European countries and for other health behaviours, such as fruit and vegetable consumption (ie, higher affluence associated with higher consumption), and health outcomes, such as obesity.[48] Advantages of the FAS include that it is relatively straightforward for young people to complete and that it recognises that socioeconomic position is a complex concept that cannot be fully described or have its complete meaning defined in any single measure. It further recognises that as young people age, they start spending more time outside of the home, and thus may become more influenced by their community/neighbourhood environment. However, limited research is available on its validity and comparison with other measures of socioeconomic position.[49]

The majority of the device-based measures of physical activity and sedentary behaviour characterised behaviour at daily or weekly level, which may mask socioeconomic variations in behaviour that occur within these periods. For example, emerging literature shows that physical activity and sedentary behaviours are most varied out of school (eg, structure day hypothesis[50]), and that weekend activity behaviour is more susceptible to seasonal variation than weekday activity.[51] One study in the present review, for example, found that IMD was associated with higher levels of after school sedentary time and sedentary time on weekends, but not associated with before school or school day sedentary time.[52] However, limited research is available on whether this also holds true for physical activity. Future research that explores socioeconomic patterning of physical activity and sedentary behaviour within specific periods of the day or week will allow for more precise targeting of behaviour change interventions.

Finally, there may be a different association between socioeconomic position and intensity of physical activity, although the evidence base is scarce. One large-scale study in those aged 7 years showed that children from less affluent families (and certain ethnic minorities groups) spent less time in vigorous physical activity.[37] Vigorous physical activity, compared with lower intensity physical activity, has a stronger association with adiposity,[53] and this socioeconomic disparity in inactivity intensity may partly help explain inequalities in obesity prevalence.

Future research

Future research which has at the heart of its aim to understand the relationship between socioeconomic position and health behaviour outcomes should consider using multidimensional, simple to report measures of socioeconomic position in studies of children and adolescents including individual, community/neighbourhood measures of socioeconomic position. Consistency in the domains of socioeconomic position reported and physical activity and sedentary behaviour levels would allow harmonisation of data across studies and country-specific meta-analyses. There is a need to have a better theoretical understanding of how measures of socioeconomic position apply to children, and how their influence would operate on physical activity and sedentary behaviours to understand whether there are specific domains of socioeconomic position that would be more appropriate to focus on in these types of studies.

National surveys, such as Health Survey for England, need to make informed decisions regarding the socioeconomic position indicators and ensure that the same measure is included over time to assess secular trends,

while adding new measures as knowledge evolves on how to best measure socioeconomic position. There is also a need to consider routine inclusion of device measured physical activity, alongside questionnaires, within health surveys to capture varied types and intensity of activities. Lastly, the relative importance of different domains of socioeconomic position likely vary with age, with neighbourhood and community measures becoming more important in adolescence when children spend more time outside of the home. This information should be used to inform the refinement of relevant and valid indicators of socioeconomic position.

Strengths and limitations

Strengths of the review include the systematic methodology and reporting in accordance with PRISMA-ScR guidelines. The present review also examined and reported the results of children and adolescents separately allowing the complete extent, range and nature of the evidence to be synthesised. Meta-analytic synthesis would have enabled more precise quantification of the direction and magnitude of reported associations, but this was deemed inappropriate due to heterogeneity in the exposure and outcome measures used and is also outside of the scope of a scoping review of this nature. We recognise the value of qualitative research on this topic and acknowledge that a mixed-studies review may have provided additional insight. However, given the volume of research on this topic, a more focused quantitative research review was undertaken as a starting point.

CONCLUSIONS

A large number of indicators of socioeconomic position have been studied in relation to physical activity and sedentary behaviour among children and adolescents in the UK, and the evidence is mixed. It is clear that physical activity and sedentary behaviours of children and adolescents in the UK are complex and influenced by multiple indicators of socioeconomic position that are, in most cases, different across age stages, outcomes examined and measurement tools. Greater consistency in the use and measures of socioeconomic position as well as outcomes of behaviour are required for robust country-specific meta-analyses. More longitudinal studies that adopt devices (such as accelerometers) to measure physical activity and sedentary time in addition to questionnaire-based measures are required.

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