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Media device ownership and media use: Associations with sedentary time, physical activity and fitness in English youth

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ABSTRACT

The aim of this study was to determine whether ownership and use of electronic media were associated with sedentary time and cardiorespiratory fitness (fitness) in youth. We also aimed to determine if associations were independent of physical activity (PA).

Fitness was measured using the 20 m shuttle-run. PA, sedentary time, ownership of media devices and media use were self-reported.

Participants (n = 678, age 10–15 years) reported daily sedentary time of 620 (±210) min. Forty-one percent of participants had low PA and 50.4% had low fitness.

Higher weekend sedentary time was associated with low fitness in girls ($p = 0.005$) and boys ($p < 0.001$) and remained significant when adjusted for PA in the latter ($p = 0.006$). Using social media was associated with higher sedentary time in both sexes and low fitness in girls. High sedentary time was more likely (OR = 5.3, 95%CI: 2.0–14.4) in boys who owned game consoles. Low fitness was more likely in boys who owned digital/satellite TV receivers (OR = 1.8, 95%CI: 1.8–3.2).

Schoolchildren spent >10 h or ~85% of each waking day sedentary. Use of social media was associated with higher sedentary time in both sexes and with low fitness in girls. Reducing social media use in youth offers one potential target for intervention. Behaviours associated with sedentary time differed from predictors of low fitness. The complex and often sex-specific interactions identified between sedentary time, PA and fitness suggest the need for carefully targeted interventions to reduce sedentary time and improve fitness in English youth.

1. Introduction

The proliferation of new media and increased availability via multiple devices, quickly render obsolete research examining the associations between media and health. Early studies of children's sedentary behaviours concerned TV viewing (Biddle et al., 2009a; Eisenmann et al., 2005) while later studies concerned 'screen-time'(Ekelund et al., 2006; Ogunleye et al., 2012) but neither measures accurate estimates overall sedentary behaviour (Biddle et al., 2009a). These studies were of great value as they identified that children engaged in excessive screen-time were often inactive, unfit and in poor metabolic health (Ekelund et al., 2006). It remains unclear whether screen time is negatively associated with health simply because it displaces physical activity (PA) or whether there is a more complex relationship (Cummings and Vandewater, 2007).

Physical activity (PA) promotes health through preferential adaptation of multiple physiological systems (Warburton et al., 2006). One such adaptation is quantifiable through the assessment of cardiorespiratory fitness (herein 'fitness') (Williams, 2001). Objective measures of fitness are more powerful predictors of health than measures of PA (Williams, 2001) and may even provide better estimate of habitual PA than self-report (Swift et al., 2013).

Sedentariness and PA are discrete constructs and there is some evidence from objective measures of both that they are independently associated with children's fitness (Santos et al., 2014) (Martinez-Gomez et al., 2011). Data from the HELENA study (Martinez-Gomez et al., 2011) found a negative association between sedentariness and fitness of inactive girls. However, no significant associations were seen in girls achieving 60 min daily PA (active) no boys. Objective measures accurately quantify the time children spend being sedentary but lack the contextual information regarding the behaviours comprising sedentary time available through self-report.

One such measure, screen-time, has also been identified as a predictor of children's fitness independent of PA (Arango et al., 2014; Sandercock and Ogunleye, 2013). Assessing screen-time does not

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capture the entirety of sedentary behaviours (Olds et al., 2010; Pate et al., 2011) in the way that time-use diaries can (Biddle et al., 2009a). It is ten years since the completion of the landmark study detailing British children's sedentary (Biddle et al., 2009a) in which time there have been many innovations in media and changes in media consumption habits (Ofcom, 2015).

The aims of this study were threefold. First, we sought to identify the media devices that are most-commonly owned, the prevalent patterns of media-use in youth and how they are related to sedentary time. Second, we aimed to determine whether sedentary time and PA were independently associated with fitness. Finally, we aimed to identify associations between media device ownership, media-use and fitness.

2. Methods

Ethical approval was granted by the University Ethics Committee. Written, informed school, parental and pupil consent were also obtained before testing. Data were collected from May–June 2014 in pupils attending six schools that had previously participated in the East of England Healthy Hearts Study (Voss and Sandercock, 2010). Schools were recruited to produce a regionally representative sample at school level based on geographical (rural, urban), school type, (junior or high school) and area-level deprivation. As the area is relatively affluent we purposefully recruited schools drawing students entirely (junior school), or partly (high schools) from deprived areas.

The final sample comprised four junior schools (one rural, one deprived), one urban high school and one high school with a mixed (rural and urban) catchment. We measured one class from grade 6 in three junior schools and two classes from the school in a more-deprived area. We also sampled two classes from each Grade (7–11) of both high schools providing a potential sample of approximately $n = 750$. Parental consent could not be obtained for $n = 46$ (6%) pupils, the remainder of missing cases were due to absenteeism or non-attendance in PE class. We measured $n = 704$ pupils but data were incomplete in a further $n = 26$ (3%) of participants due to injury, incomplete or illegible questionnaires.

2.1. Demographic information

Date of birth was used to calculate decimal age. Home postcodes provided measures of area-level deprivation via the English Indices of Deprivations (EID) (Department for Communities and Local Government, 2007).

2.2. Media device ownership and media use

Full details of the development of this reporting tool are given in the supplementary materials along with the questionnaire. Participants indicated media devices they owned '*media ownership*' and media use behaviours '*media use*' from a menu of options. The numbers of daily email, text and instant messages sent were recorded on a categorical scale with responses from 'zero' through >50. Participants also reported the sum of these and any other messages sent each day (*Total Messaging*).

2.3. Physical activity

Participants completed the PAQ-A (Janz et al., 2008; Kowalski et al., 1997) a 7-day PA recall tool with acceptable validity for this age-group (Janz et al., 2008; Kowalski et al., 1997), normative values and criterion-referenced cut-offs for low PA (Voss et al., 2013).

2.4. Cardiorespiratory fitness

Cardiorespiratory fitness '*fitness*' was assessed using the 20 m shuttle-run test. Performance was recorded as running speed at the final completed level. Running speed was converted to an estimate of VO_{2peak} (ml kg^{-1} min^{-1}) using a standard equation (Leger et al., 1988) and participants grouped using age- and sex-specific cut-offs (Bell et al., 1986). Participants below the cut-off values were categorised as having low cardiorespiratory fitness; '*Low Fitness*'.

2.5. Sedentary time

To limit participant burden, we used a menu-based approach in which items were restricted to behaviours that contribute significantly to sedentary time (Biddle et al., 2009b) (Olds et al., 2010). We were careful to ensure there was no direct overlap between the items contributing to sedentary time and media-use behaviours listed. Total weekday and weekend sitting time was calculated by summing time spent on each activity. Average 7-day sitting time was calculated as: (Weekday Sedentary Time × 0.71) + (Weekend Sedentary Time × 0.29). As there are no quantitative recommendations relating to sedentary time in England, cut-offs for high and low levels of sedentary time were therefore created based on sex-specific median splits.

2.6. Data analysis

We compared total reported sedentary time, PA and fitness (Table 1) between boys and girls using (independent *t*-tests). Continuous variables that were dichotomized (low fitness, low PA) and those already categorical in nature (media ownership) were analysed using χ^2. As the media use questions that had quantitative, but categorical response options data were treated as ordinal and were described using the median and inter-quartile range (IQR). Between-sex differences were analysed using Mann–Whitney *U*-tests.

Table 1
Sedentary time, physical activity and cardiorespiratory fitness in English schoolchildren (age 10–16 years).

	Boys ($n = 370$)	Girls ($n = 308$)	Mean difference (95%CI)	*t*-Test or χ^2, *p*-value
	Mean (SD)	Mean (SD)		
Age (years)	13.5 (0.8)	13.4 (0.8)	0.1 (−0.6–0.4)	$t = 0.78$, $p = 0.695$
Area-level deprivation (EID score)	12.9 (4.8)	13.0 (4.5)	0.8 (−1.4–2.0)	$t = 0.61$, $p = 0.879$
Ethnicity (% white British)	95.2% ($n = 356$)	92.9% ($n = 286$)	–	$\chi^2 = 1.81$, $p = 0.118$
Weekday sedentary time (min)	767 (290)	739 (261)	28 (−14–69)	$t = 1.30$, $p = 0.191$
Weekend sedentary time (min)	258 (212)	243 (170)	14 (−14–15)	$t = 0.94$, $p = 0.291$
Daily sedentary time (min)	627 (231)	612 (191)	15 (−18–48)	$t = 0.89$, $p = 0.373$
7-Day physical activity (PAQ-A)	2.92 (0.72)	2.55 (0.58)	0.36 (0.26–0.46)	$t = 1.72$, $p = 0.017$
Low physical activity[a]	47% ($n = 170$)	54% ($n = 163$)	–	$\chi^2 = 1.85$, $p = 0.112$
Cardiorespiratory fitness (ml kg^{-1} min^{-1})	43.4 (5.1)	38.2 (5.4)	5.2 (4.4–6.0)	$t = 12.3$, $p < 0.001$
Low cardiorespiratory fitness[b]	40.9% ($n = 126$)	42.9% ($n = 129$)	–	$\chi^2 = 1.85$, $p = 0.112$

Legend: EID — English Indices of Deprivation; PAQ-A (Physical Activity Questionniare for Older Children: 1–5 score), (Kowalski et al., 1997).
[a] Based on cut-offs of Voss et al. (2013).
[b] Based on cut-offs of Bell et al. (1986). All data collected in summer term (May–June) 2014 at $n = 6$ schools, Essex, UK.