Prevalence and correlates of screen-time in youth: An international perspective.

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Abstract

Background Screen-time (including TV viewing/computer use) may be adversely associated with metabolic and mental health in children.

Purpose To describe the prevalence and socio-demographic correlates of screen-time in an international sample of children aged 4-17 years.

Methods Data are from the International Children's Accelerometry Database (collected between 1997-2009; analysed in 2013). Participants were 11,434 children (48.9% male; mean (SD) age at first assessment 11.7 (3.2) years). Exposures were sex, age, weight status, maternal education and ethnicity. The outcome was self- or proxy-reported screen-time </>2 h/day. Analyses were conducted initially at study-level and then combined using random-effects meta-analysis.

Results Within each contributing study, at least two-thirds of participants exceeded 2 h/day of screen-time. Based on meta-analysis, children who were overweight or obese were more likely to exceed 2 h/day of screen time than those who were non-overweight (Odds ratio; 95% confidence interval: 1.58; 1.33,1.88). Girls (vs. boys: 0.65; 0.54,0.78) and participants with more highly educated mothers (vs. <university level: 0.53; 0.42,0.68) were less likely to exceed 2 h/day of screen-time. Associations of age and ethnicity with screen-time were inconsistent at study-level and non-significant in pooled analyses.

Conclusions Screen-time in excess of public health guidelines was highly prevalent, particularly amongst boys, those who were overweight or obese and those with mothers of lower educational attainment. The population attributable risk associated with this exposure is potentially high; further efforts to understand the determinants of within- and between-country variation in these behaviours and inform the development of effective behaviour change intervention programmes is warranted.

Key words: TV viewing, Computer use, Prevalence, Correlates, Children, Adolescents

Introduction

The influence of sedentary behaviour on physical and psychological well-being is an emerging issue in epidemiology.[1] Screen-based behaviours, such as TV viewing and computer use, may be adversely associated with body composition, cardiovascular disease risk factors, mental health, sleep quality and academic performance in young people.[2,3] These behaviours are highly prevalent during children's leisure-time, such that public health agencies recommend that screen-time should be limited in this population.[4,5] Identification of population groups most at risk of accumulating excessive screen-time enables the appropriate targeting of intervention programmes. Pooled international datasets are particularly valuable in this regard, providing high statistical power and greater exposure heterogeneity than is typically possible in single country studies. The aim of this study was to describe the prevalence and socio-demographic correlates of children's TV viewing and computer use in a large international dataset.

Method

Data are from the International Children's Accelerometry Database, a pooled archive of accelerometer data and hypothesised determinants from 20 studies in children.[6] Data were collected between 1997-2009. All contributing studies obtained the relevant ethical approval. Data were extracted from 9 studies that provided information on children's screen-time: Children Living in Active Neighbourhoods (CLAN), Pelotas 1993 Birth Cohort, European Youth Heart Study (EYHS), Personal and Environmental Associations with Children's Health (PEACH), Iowa Bone Development Study (IBDS), National Health and Nutrition Examination Survey (NHANES).

TV viewing and computer use were assessed separately by self-report or parent proxy. Screen-time was calculated as the sum of TV viewing and computer use and dichotomised as <2/>2 h/day.[4] The 2 h/day threshold is supported by review evidence of the association between screen-time and markers of body composition in this population.[2] The following exposure variables were examined: sex, age, weight status, maternal education and ethnicity. Weight status was categorised as non-overweight vs overweight or obese, according to age- and sex-specific reference values for body mass index.[7] Maternal education was dichotomised as non-attendance vs. attendance of university. Ethnicity was categorised as non-Hispanic White vs. non-White. Exposures exhibiting minimal within-study heterogeneity (<5% of responses in one category) were not considered in study-level analyses.

Analyses were performed in 2013 using Stata 12.0 (College Station,TX). Study-level characteristics were summarised and the prevalence of exceeding 2 h/day of screen-time was calculated. Associations between exposures and the log odds of exceeding 2 h/day of screen-time were estimated using logistic regression, with a random effect at the participant level in studies that included multiple waves of assessment. Study-level estimates were combined using random effects meta-analysis. Heterogeneity between studies was quantified using the I^2 statistic.

Results

Characteristics of contributing studies are presented in Table 1. Outcome data were available for 11,434 participants (48.9% male; mean(SD) age at first assessment 11.7(3.2) years), who contributed 14,124 observations on screen-time. The percentage of participants providing 1, 2, 3, and 4 observations was 64.6%, 19.7%, 7.1%, and 8.6% respectively. At least two thirds

of particpants exceeded 2 h/day of screen-time across all included studies, and in most cases prevalence was greater than 50%. Results of the regression and meta-analytic modelling are presented in Table 2. Relative to their respective reference groups, girls and children with more highly educated mothers were less likely to exceed 2 h/day of screen-time. Compared to non-overweight children, those who were overweight or obese were more likely to exceed 2 h/day of screen-time. In pooled analyses, no significant associations with screen-time were identified for age or ethnicity. Heterogeniety ranged from 46-94%.

Discussion

Screen-time in excess of current guidelines was highly prevalent, demonstrating widespread usage of screen-based media in young people. Viewed alongside burgeoining evidence linking TV viewing with adverse cardiometabolic health, the population attributable risk associated with screen viewing in childhood is potentially substantial. Rapid advancements and increased ownership of information and communications technology in recent years has seen the variety of screen-based media available to young people expand significantly. Nonetheless, TV viewing in the traditional sense (watching live or time shifted content on a television set delivered by broadcast signal or paid TV subscription) remains the predominant source of children's electronic media use in the USA.[5] Different screen based behaviours may have differential impacts upon health and well-being [8], thus in light of the established evidence base, TV viewing remains a key target for public health intervention in young people.

Children who were overweight or obese had greater odds of exceeding 2/day of screen-time than those of normal weight. This is consistent with much of the existing observational evidence on this topic, but the temporal sequence of this association, and whether it is in fact

bidirectional, remains unclear.[9] The mechanisms that may underlie a causal sequence wherein screen-time promotes excess adiposity also require further investigation. Despite these uncertainties, the evidence is sufficient to endorse continued efforts to limit screen-time for the benefit of metabolic health in this population.

Girls and participants with more highly educated mothers had lower odds of exceeding 2 h/day of screen-time compared to their respective reference groups. Findings are largely consistent with previous research and serve to highlight population groups that may be suitable for targeted intervention programmes.[10] The direction of associations was largely consistent across analysed studies; variation in the magnitude of the associations, together with a small number of divergent findings, likely account for the larger I^2 values observed in some models. Associations of age and ethnicity with screen-time were notable in their variability. For example, the association of age with screen-time was negative in the Pelotas and Iowa Bone Development Studies but positive in EYHS Denmark / Portugal and the PEACH study. Age related trends in screen-time may be country specific or have been obscured by secular trends in media use that have accompanied recent technological developments. Examination of differences in screen time across ethnic groups may have been hindered by the relatively crude categories applied; this compromise, however, was necessary in order to facilitate data harmonisation. In addition, the patterning of screen-time across ethnic groups may vary between countries, as may related interactions with socioeconomic position. This may account, in part, for the contrasting associations observed in the NHANES and Pelotas studies, for example. Further work exploring age- and ethnicity-related variability in screen-time will help to inform the timing and targeting of intervention programmes.

The key strength of this study is the collation and harmonisation of outcome and exposure assessments from a large, heterogeneous sample of children aged 4-17 years. Validity and reliability of items used to assess screen-time likely varied between studies; this may have contributed to observed differences in prevalence. Bias in the reporting of screen-based behaviours may also have changed in concert with secular changes in electronic media availability. Loss of information due to derivation of a binary screen-time outcome is acknowledged as a limitation; however this was necessary to facilitate data harmonisation across contributing studies. Sensitivity analyses were conducted to examine correlates of TV viewing and computer use separately and results were largely unchanged (data not shown). Due to the cross-sectional nature of the analysis, it is not possible to establish causality of the observed associations.

In this large international analysis, TV viewing and computer use were highly prevalent and patterned across socio-demographic factors. Continued work to inform the development of interventions to limit screen-time is a public health priority.

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Table 1. Descriptive characteristics of included studies

Study	Country	Year	N		Age range, y	Weight status (% overweight / obese)	Ethnicity (% White)	Mother education (% University+)	Screen-time (% >2 h/day)
			Boys	Girls					
CLAN	Australia	2001	518	589	4-15	27.0	-	36.0	59.3
		2004	146	169	13-15	28.1	-	40.8	51.8
Pelotas	Brazil	2006-07	238	219	12-14	23.0	67.0	-	76.4
EYHS	Denmark	1997-98	403	454	8-16	13.1	94.3	26.4	34.3
		2003-04	385	504	8-17	14.3	94.1	42.6	46.9
	Estonia	1998-99	290	362	8-17	9.4	97.6	37.9	62.4
	Norway	1999-00	190	182	8-10	12.2	83.3	52.6	48.7
	Portugal	1999-00	270	280	9-16	20.0	97.9	4.8	63.6
PEACH	England	2006-08	623	639	9-11	22.9	83.7	32.1	47.1
		2007-09	423	469	11-12	24.0	86.2	34.6	58.5
Iowa Bone	USA	1998-00	192	223	4-7	17.6	94.2	49.1	62.2
Development		2000-04	247	250	7-11	29.8	94.6	50.0	58.4
Study		2003-05	212	232	10-12	34.3	95.1	50.8	33.8
		2005-07	199	200	12-14	33.2	94.7	50.4	38.9
NHANES	USA	2003	1239	1194	6-17	38.0	26.1	-	78.7
		2005	1285	1298	6-17	36.2	26.6	-	72.5

- data not collected

Table 2. Study-level odds ratios (95% CI) and pooled meta-analytic estimate for exceeding 2 h/day of screen-time.

Study	Sex (ref: boys)	Age (continuous)	Weight (ref: normal)	Maternal education (ref: <university)	Ethnicity (ref: white)
CLAN	0.67 (0.50, 0.91)**	[a]	1.61 (1.15, 2.25)**	0.41 (0.30, 0.56)**	- -
Pelotas	0.94 (0.60, 1.46)	0.46 (0.22, 0.95)*	1.57 (0.90, 2.75)	- -	0.60 (0.38, 0.95)*
EYHS Denmark	0.46 (0.36, 0.58)**	1.08 (1.04, 1.12)**	1.78 (1.29, 2.45)**	0.74 (0.58, 0.93)**	1.37 (0.84, 2.22)
EYHS Estonia	0.69 (0.49, 0.98)*	1.04 (0.98, 1.10)	1.68 (0.92, 3.10)	0.70 (0.50, 0.99)*	- -
EYHS Norway	0.61 (0.39, 0.96)*	0.83 (0.41, 1.66)	1.87 (0.92, 3.81)	0.44 (0.27, 0.70)**	1.62 (0.86, 3.05)
EYHS Portugal	0.64 (0.45, 0.92)*	1.15 (1.08, 1.22)**	1.06 (0.68, 1.66)	- -	- -
PEACH	0.62 (0.37, 1.02)	1.68 (1.21, 2.33)**	2.33 (1.24, 4.38)**	0.40 (0.23, 0.70)**	1.63 (0.70, 3.99)
IBDS	0.50 (0.36, 0.71)**	0.81 (0.77, 0.85)**	2.08 (1.49, 2.91)**	0.49 (0.35, 0.68)**	0.88 (0.38, 2.02)
NHANES	0.83 (0.73, 0.95)**	[a]	1.27 (1.11, 1.46)**	- -	1.26 (1.09, 1.45)**
Pooled estimate	0.65 (0.54, 0.78)**	1.03 (0.89, 1.19)	1.58 (1.33, 1.88)**	0.53 (0.42, 0.68)**	1.14 (0.84, 1.53)
Heterogeneity (I^2)	68.8%, ***P*=<0.01**	94.9%, ***P*<0.01**	46.1%, *P*=0.06	63.7%, ***P*=0.02**	56.1%, ***P*=0.04**

*** P<0.05; ** P<0.01**. Regression models were mutually adjusted for all exposures available within each study

ref, reference group; - data not collected or insufficient heterogeneity (<5% responses in one category)

[a] Association of age with screen-time was non-linear. Results (OR; (95% CI)) are presented with age categorised using study-specific quartiles (Q). CLAN: Q1 (ref), Q2 1.85 (1.23, 2.78)**, Q3 2.10 (1.38, 3.18)**, Q4 1.25 (0.85, 1.85). NHANES: Q1 (ref), Q2 0.98 (0.82, 1.18), Q3 0.78 (0.65, 0.94)**, Q4 1.05 (0.87, 1.27).