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Is physical inactivity associated with depressive symptoms among adolescents with high screen time? Evidence from a developing country

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ABSTRACT

Background: Increasing levels of screen use and physical inactivity in developing countries may be deleterious for adolescent mental health. This study aimed to examine how physical inactivity is associated with concurrent depressive symptoms among adolescents with high recreational screen time in Bangladesh.

Methods: A self-administered survey was conducted among 898 secondary school students of Dhaka city, Bangladesh. High screen-time was assessed using the Adolescent Sedentary Activity Questionnaire (ASAQ), with a cut-off of >2 h/day. Scores ≥10 on the 10-item Center for Epidemiological Studies Depression Scale (CESD10) suggested depressive symptoms. The Three-Day Physical Activity Recall (3DPAR) instrument was used to estimate physical activity, with those doing ≤60 min/day of moderate-vigorous physical activity (MVPA) classified as not meeting MVPA recommendations. Of the 599 adolescents who were determined to have high recreational screen time (>2 h/day), 505 completed the CESD10, and form the basis for this analysis.

Results: Of the adolescents with high recreational screen time, 32% did not meet MVPA recommendations and 25% reported depressive symptoms. Generalized estimating equations modelling on CESD scores showed that depressive symptoms were more prevalent among adolescents with high screen time who also did not meet MVPA recommendations (OR 2.37; 95% CI: 1.23–4.59), after adjusting for a set of confounders including sociodemographic, psychosocial and lifestyle factors.

Conclusions: Adolescents in Dhaka city with high recreational screen time and not meeting physical activity recommendations are also likely to have depressive symptoms. More research is needed to understand the causal directions of these relationships.

1. Introduction

Due to socio-economic transition and the advancement of technology, screen time (ST) among children and adolescents has increased considerably during the recent past in many economically developing countries (Cui, Hardy, Dibley, & Bauman, 2011; Khan & Burton, 2016; S.; Lee et al., 2015; Paudel et al., 2014; Ravikiran, Baliga, Jain, & Kotian, 2014). Screen-based activities can be for academic or recreational purposes, and include e.g., watching television, using a computer/tablet, playing video games, and using social media on a small screen such as a smart-phone. There has also been an increase in the number of people in many low-and-middle income countries not meeting moderate-to-vigorous physical activity (MVPA) recommendations (Hallal et al., 2012; WHO., 2015). This double burden is a major public health concern for many developing countries, given the established links for each of high screen time and physical inactivity with various health problems. Screen-based sedentary behaviour and physical inactivity among adolescents are each adversely associated with multiple chronic health conditions, including cardiovascular diseases, obesity, and mental health problems (Gordon-Larsen, Nelson, & Popkin, 2004; Nuutinen, Ray, & Roos, 2013).

There is a general understanding that sedentary behaviour (i.e., screen time) and physical inactivity (i.e., not meeting physical activity recommendations) are separate constructs (Brodersen,

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Steptoe, Williamson, & Wardle, 2005; Taveras et al., 2007), and are independently associated with poor mental health among adolescents (Iannotti, Kogan, Janssen, & Boyce, 2009). One study demonstrated independent associations of self-reported screen time and physical inactivity on measures of psychological distress in adolescents (Ussher, Owen, Cook, & Whincup, 2007). Other evidence suggests that high screen time and low physical activity levels interact to increase psychological problems among adolescents (Hamer, Stamatakis, & Mishra, 2009; Kremer et al., 2014; Rothon et al., 2010). In contrast, one Australian study found no cross-sectional or longitudinal association between objective or subjective measures of physical activity, sedentary behaviour, and depressive symptoms among adolescents (Hume et al., 2011). Given that both screen time and physical inactivity are prevalent during adolescence, and can continue into adulthood (Kjønniksen, Torsheim, & Wold, 2008; Telama, Yang, Laakso, & Viikari, 1997), understanding how the combination of sedentary behaviour and physical inactivity impact on psychological wellbeing is crucial to minimize the burden of poor mental health (Liu, Wu, & Yao, 2016). This is important for developing counties where mental health disorders are fairly common (Steel et al., 2014) and resources for mental health diagnosis, support and treatment are scarce (Demyttenaere, Bruffaerts, Posada-Villa, & Gasquet, 2004).

High screen time, physical inactivity, and depressive symptoms are common in Bangladesh. Four in five adolescents report high ($\geq$2 h/day) recreational screen time with a median of 4.0 h/day of screen time (Khan & Burton, 2016), and one in three adolescents do not meet the World Health Organization (WHO) recommendations of 60 min/day of MVPA (Khan, Burton, & Trost, 2017). One recent study found that one in two adolescents in urban Bangladesh has depressive symptoms; this was defined as a score of $\geq$22 using the 20-item Center for Epidemiologic Studies Depression Scale (CESD20) (Billah & Khan, 2014). Understanding the interrelationships among screen time, physical inactivity, and mental health therefore has significant public health implications in this developing country.

Although a number of studies have demonstrated links between prolonged screen-time or physical inactivity and poor mental health of adolescents in developed countries (Biddle & Asare, 2011), less is known about mental health among adolescents who have high screen time and physical inactivity. The aim of this study was to examine how physical activity was associated with concurrent depressive symptoms among adolescents with high recreational screen time in Dhaka city, Bangladesh.

2. Methods

A questionnaire survey on health and psychosocial wellbeing was conducted in class time among 898 students of eight secondary schools purposively selected from Dhaka, the capital city of Bangladesh [more details elsewhere (Khan & Burton, 2016)]. Each school had a total of between 61 and 190 students who participated in the survey. The research project was approved by the Behavioural Social Sciences Ethics Review Committee at The University of Queensland, Australia.

2.1. Outcome measure

Depressive symptoms were measured using the 10-item Centre for Epidemiologic Studies Depression Scale (CESD10), which has been shown to be an acceptable self-report tool to screen for depression in adolescents in the community setting (Bradley, Bagnell, & Brannen, 2010; Haroz, Ybarra, & Eaton, 2014). The internal consistency, measured by Cronbach's alpha coefficient, for this study was 0.81. A total score for each student was obtained by summing the scores across 10 items of CESD10, with an admissible range of 0–30. A higher score indicated more depressive symptoms, with a score of $\geq$10 used as cut off for depressive symptoms (Andresen, Malmgren, Carter, & Patrick, 1994) in the descriptive analysis. Because the cutoff has not been validated in Bangladesh, we used total CESD score as a continuous variable to examine its association with physical inactivity: a similar approach was used in analysis of CESD-20 data in Bangladesh (Black, Baqui, Zaman, ElArifeen, & Black, 2009).

2.2. Other measures

Students' recreational screen-time was assessed using the Adolescent Sedentary Activity Questionnaire (ASAQ), which has demonstrated reliability and satisfactory reproducibility. (Guimarães, da Silva, Legnani, Mazzardo, & de Campos, 2013; Hardy, Booth, & Okely, 2007). Students were asked to report time spent on a usual school day and a usual weekend day for each of the following activities: (i) watching television, (ii) watching DVDs/videos, (iii) using the computer for fun; and (iv) using social media (e.g., Facebook, Twitter). Recreational screen time for a usual school day and a usual weekend day were computed by summing the time spent across the four screen-based activities, and a weighted average was used to derive an average recreational screen-time per day (i.e., {school-day screen time $\times$ 5 + weekend-day screen time $\times$ 2}/7). High recreational screen time was defined as > 2 h/day, which is consistent with a widely used screen-time recommendation (American Academy of Pediatrics, 2001). Of the 898 students who returned the surveys, 758 completed the ASAQ and 79% of those students (n = 599) had high recreational screen time.

In addition, students completed the 3-Day Physical Activity Recall (3DPAR) log, which has demonstrated reliability and validity among Asian adolescents (K. Lee & Trost, 2005). The 3DPAR requires respondents to recall their activities from each of the previous three days, beginning with the most recent day, with each day segmented into 34 30-min blocks from 7:00 a.m. through to 12:00 midnight. For each of the 30-min blocks, students reported the main activity done, from a list of 44 common activities, and rated the intensity of the activity as light, moderate, hard, or very hard. Each 30-min block was assigned a metabolic equivalent (MET) value to derive physical activity level. Students were classified as not meeting MVPA recommendations if they did not average two or more 30 min blocks of physical activity with $\geq$3 METs/day over the 3-day assessment period, which is consistent with WHO guidelines to accumulate $\geq$60 min/day of moderate-vigorous physical activity (MVPA).

The self-administered questionnaire also included items to assess demographics (e.g., age, gender, parental education) and lifestyle factors (e.g., sleep, eating patterns, social activities). Participants responded to items assessing self-perception of weight category (underweight, normal weight, overweight, obese), involved with sports at school (yes, no), feeling safe at school (never, rarely, sometimes, often, always), life satisfaction (10 point scale with 1 = dissatisfied and 10 = satisfied), intake of fast food (none, 1–3, 4–6 times/week, 1, 2, 3, 4 + times/day), and intake of sugary drinks during the past week (none, 1–2, 3–4, 5–6, 7–9, 10 + cans). Students were also asked to take home a questionnaire for a parent to provide information on mother's occupation, father's occupation, family income, and their child's sleep disturbance during the last month (yes, no).

Students' height and weight were measured by the research team. Obesity was defined as a body mass index (BMI) at or above the 95th percentile for children of the same age and sex; overweight was a BMI between the 85th and 95th percentiles, normal weight was a BMI less than the 85th percentile but at or above the