



Intervention to reduce recreational screen-time in adolescents: Outcomes and mediators from the 'Switch-Off 4 Healthy Minds' (S4HM) cluster randomized controlled trial



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ABSTRACT

Introduction. The primary objective was to evaluate the impact of the 'Switch-off 4 Healthy Minds' (S4HM) intervention on recreational screen-time in adolescents.

Methods. Cluster randomized controlled trial with study measures at baseline and 6-months (post-intervention). Eligible participants reported exceeding recreational screen-time recommendations (i.e., >2 h/day). In total, 322 adolescents (mean age = 14.4 ± 0.6 years) from eight secondary schools in New South Wales, Australia were recruited. The S4HM intervention was guided by Self-Determination Theory and included: an interactive seminar, eHealth messaging, a behavioral contract and parental newsletters. The primary outcome was recreational screen-time. Secondary outcomes included mental health (i.e., well-being, psychological distress, self-perceptions), objectively measured physical activity, and body mass index (BMI). Outcome analyses were conducted using linear mixed models and mediation was examined using a product-of-coefficients test.

Results. At post-intervention, significant reductions in screen-time were observed in both groups, with a greater reduction observed in the intervention group (−50 min/day versus −29 min, $p < 0.05$ for both). However, the adjusted difference in change between groups was not statistically significant (mean = −21.3 min/day, $p = 0.255$). There were no significant intervention effects for mental health outcomes, physical activity or BMI. Significant mediation effects for autonomous motivation were found.

Conclusions. Participants in both the S4HM intervention and control groups significantly reduced their screen-time, with no group-by-time effects. Enhancing autonomous motivation might be a useful intervention target for trials aimed at reducing adolescents' recreational screen-time.

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1. Introduction

Excessive recreational screen-time is associated with numerous adverse physical (Escobar-Chaves et al., 2010; Tremblay et al., 2011) and mental health (Tremblay et al., 2010; Strasburger et al., 2010) outcomes in youth. Despite international guidelines recommending young people

limit their recreational screen-time to <2 h/day (Mark and Janssen, 2008), between 70 and 80% of Western youth exceed these recommendations (Mark et al., 2006; Owens et al., 2013; Morley et al., 2012). As excessive screen-time is a major public health issue in many Western countries, there is a need for scalable interventions that can reach a large proportion of the youth population. According to a recent meta-analysis of screen-time interventions, home-based interventions have been more successful than those conducted in schools (Marsh et al., 2014). However, few of the included studies targeted adolescents, and it is therefore unclear which intervention approaches are most effective for this priority population. While parental involvement is considered an important determinant of success in youth screen-time interventions (Marsh et al., 2014), engaging parents in such interventions remains challenging (Ingoldsby, 2010). Schools have the facilities and personnel to support the implementation of interventions (Hills et al., 2015), but

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may also have value as an avenue for accessing and engaging parents. Indeed, embedding health promotion interventions within schools may give health promotion programs the exposure and credibility needed to convince parents to participate. Moreover, there is a rationale for evaluating interventions that meaningfully incorporate parental engagement within school-based programs.

Evidence suggests theory-based screen-time interventions have been more effective than those that do not report a theoretical framework (Maniccia et al., 2011). Therefore, an additional priority for interventions should be the application of behavioral theories, and the evaluation of theoretical mediators of behavior change. Self-determination theory (SDT) is a motivational theory which posits that human motivation and behavior are influenced by the satisfaction (or thwarting) of individuals' basic psychological needs for autonomy (sense of choice or volition), competence (sense of capability or mastery) and relatedness (sense of connectedness with others) (Ryan and Deci, 2007). According to SDT, satisfaction of these psychological needs will promote autonomous (or self-determined) forms of motivation. Autonomous motivation reflects more 'internalized' reasons for engaging in (or avoiding) a behavior. For example, an individual may decide to maintain an active lifestyle or limit their alcohol consumption due to the perceived health or social benefits. Autonomous motives are considered to be more strongly related to behavioral enactment than controlled motives, which involve engaging in or changing behavior on the basis of external demands or social pressures (Ryan and Deci, 2007). Accordingly, behavior change strategies that enable individuals to feel their decisions are self-endorsed (rather than imposed) should result in a greater likelihood of initial behavior change and ongoing behavior maintenance (Ryan and Deci, 2000).

The aim of the present study is to evaluate the efficacy of the 'Switch-off 4 Healthy Minds' (S4HM) intervention, a novel and theoretically based screen-time intervention for adolescents. We hypothesize that adolescents in the S4HM intervention will report significantly lower levels of recreational screen-time at 6-month post-intervention, compared to those in a wait-list control group. In addition, we hypothesize that changes in screen-time over the study period will be mediated by changes in adolescents' autonomous motivation to limit their screen-time.

2. Methods

2.1. Study design and participants

The study was conducted and reported in accordance with the Consolidated Standards of Reporting Trials (CONSORT) Statement (Schulz et al., 2010; Moher et al., 2010), and the methods have previously been described in detail (Babic et al., 2015). Ethics approval for the study was obtained from the University of Newcastle, Newcastle-Maitland Catholic Schools Office and the Diocese of Broken Bay. All Catholic secondary schools (N = 20) located in the Hunter region of New South Wales, Australia were invited to participate, and the first eight schools to provide written consent were accepted (Fig. 1). Students in Grade 7 at the study schools completed an eligibility questionnaire, which asked them to report their total time spent using screen devices for the purposes of recreation on a typical school day. Students failing to meet national screen-time guidelines (i.e., >2 h/day) were considered eligible and invited to participate, and the first 40 students from each school to return signed consent letters were included. The intervention was evaluated using a parallel group cluster randomized controlled trial (RCT) design. Prior to baseline assessments, schools were matched on key demographic variables (e.g., size, location and socio-economic status) and randomly allocated to the S4HM intervention group or a wait-list control group. The S4HM group received the intervention over a 6-month period, whereas the control group were asked to continue with their usual behaviors and school curriculum. At the end of the study period the control group was offered the S4HM program.

Baseline assessments were conducted at the study schools by trained research assistants between April and June 2014 and follow-up assessments were conducted between October and December 2014. Basic demographic information (i.e., sex, country of birth, language spoken at home) and self-report measures were collected in exam-like conditions using an online survey and Apple iPads, and physical measures were conducted discretely by a same-sex assessor (Table 2).

2.2. Intervention components

The S4HM intervention components were guided by SDT, targeted both students and their parents, and were designed to be scalable. A detailed description of each intervention component can be seen in Table 1. At the beginning of the study period, students participated in an interactive seminar delivered at the school by a member of the research team. The purpose of the interactive seminar was to provide students with a rationale for behavior change, by outlining the potential consequences of excessive screen viewing, as well as the health and social benefits that could be gained by limiting recreational screen viewing to healthy levels. During this interactive seminar, students were also taught how to self-monitor their screen-time and were given instructions on appropriate screen-time goal setting.

The primary intervention component in the present trial was eHealth messaging. Intervention participants received informational and motivational messages twice per week from their preferred social media and messaging systems (i.e., Twitter, Facebook, Kik, email or text messages). The messages were framed to satisfy students' basic psychological needs for autonomy (e.g., "Many Australian adolescents spend more time on screens on the weekend. Why not plan your weekends in advance?"), relatedness (e.g., "Have a competition with ur m8. Who can go the longest without checking their social media account (Facebook/twitter etc.)"), or competence (e.g., "If you're watching TV or using the computer, don't forget to walk around and stretch. It's easy and good 4 u, u can do it!").

In addition to the student-level strategies, S4HM also targeted the home environment by sending information to parents. Over the study period, parents were mailed a total of six newsletters (i.e., one per month) that included information on the consequences of excessive screen-time and practical strategies for setting limits on screen viewing in the family home. The third newsletter included a behavioral contract, and parents were encouraged to involve their child in the creation of a customized contract, that included clear screen-time goals, as well as rewards/consequences for satisfying or not satisfying the terms of the contract. Newsletters for parents encouraged the planning of individual consequences if screen-time remained excessive, for example "loss of privileges to TV, iPad, phone etc. for a period of time". Notably, the strategies provided to parents in the newsletters encouraged parents to interact with their teen in a 'needs supportive' manner and to manage conflict arising from attempts to reduce recreational screen-time, e.g. "Explain to your teen why it is important to limit their screen-time". Parents are 'needs supportive' when they support their children's sense of autonomy, interact with their children in a warm and responsive manner, and support and encourage self-expression (Deci and Ryan, 1985).

2.3. Primary outcome

A detailed description of the study measures is available elsewhere (Babic et al., 2015). Recreational screen-time was assessed using the Adolescent Sedentary Activity Questionnaire (ASAQ) (Hardy et al., 2007). The ASAQ required respondents to self-report time spent using different screen devices on each day of the week, including weekends. Specifically, participants were asked to report time spent using television, video/DVD, computer, and tablet/smartphone for entertainment purposes on a usual school week. The final item (i.e., tablet/smartphone) was not part of the original

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