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A Preliminary Evaluation of a School-Based Media Education and Reduction Intervention

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Abstract While media education and reduction programs have been proposed to prevent adverse health and academic outcomes related to heavy electronic media use among school-aged children, few have been formally piloted and evaluated. We used a quasi-experimental design to evaluate the effectiveness of *Take the Challenge* (*TtC*), a school-based media education/reduction program for the primary prevention of sleep deprivation, dysfunctional social-emotional behaviors, and poor academic performance. Sixth- to eighth-grade students at a rural Midwestern U.S. middle school received the *TtC* program, while a similar school in the same district served as the comparison group. Health-related and academic measures were collected from students and teachers at both schools before and after the intervention. The primary outcome measure was student-reported electronic media use (television, video games, Internet). Secondary measures included student health behaviors (student-reported sleep, exercise, and outdoor play) and academic activities (teacher-reported homework and classroom performance). Compared to the comparison group, students receiving *TtC* slept more and reduced television viewing, background television time, after-school video gaming, and weekend Internet use. Teachers reported increases in the extent to which *TtC* students completed homework assignments and stayed on task in the classroom. Well-designed school-based programs such as *TtC* can reduce electronic media use among middle-school children and improve related health and academic outcomes.

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Background

The use of screen media such as television (TV), computers, and video games has been linked to a variety of negative physical and socio-emotional outcomes among children, including increased risk for obesity, reduced physical activity, decreased social competence, and impaired academic performance (Bickham, Blood, Walls, Shrier, & Rich, 2013; Gentile, Lynch, Linder, & Walsh, 2004; Gupta, Saini, Acharya, & Miglani, 1994; Ko, Yen, Liu, Huang, & Yen, 2009; Russ, Larson, Franke, & Halfon, 2009; Trinh, Wong, & Faulkner, 2015). TV viewing and the presence of a media device in a child's bedroom are associated with less sleep, poor sleep patterns, and the development of sleep problems into early adulthood (Falbe et al., 2015; Hale & Guan, 2015; Johnson, Cohen, Kasen, First, & Brook, 2004; Thompson & Christakis, 2005). Internet, cell phone, and video game use similarly contribute to going to bed later and having higher levels of tiredness, all of which can influence a child's development and health (Owens et al., 2014; Pieters et al., 2014).

Screen media use may negatively affect children's school performance (Sharif & Sargent, 2006) either through its association with problems related to attention (Gentile, Swing, Lim, & Khoo, 2012; Swing, Gentile, Anderson, & Walsh, 2010) or by disrupting or displacing reading time or homework (Wiecha, Sobol, Peterson, & Gortmaker, 2001), thereby placing young people at risk for the long-term health and social consequences of poor academic performance (Maguin & Loeber, 1996; Miller et al., 2007; Ross & Mirowsky, 1999; Wiecha, et al., 2001; Williams, Haertel, Haertel, & Walberg, 1982). Among school-aged children, homework time decreases as TV viewing increases (Vandewater, Bickham, & Lee, 2006). Parental limits on TV viewing are associated with more time spent reading, whereas a TV in the bedroom has been linked to less reading (Delmas et al., 2007).

Screen use has also been seen as interfering with opportunities for outside play and other activities that have physical and social-emotional benefits. While evidence from experimental interventions suggests that the observed link between TV viewing and obesity is not caused by a displacement of physical activity (Epstein et al., 2008; Pearson, Braithwaite, Biddle, van Sluijs, & Atkin, 2014), the vast amount of sedentary screen use experienced by American youth is a cause for concern for a number of potential negative health consequences (Iannotti, Kogan, Janssen, & Boyce, 2009). Overall, reducing screen media use may effectively increase the time young people spend pursuing activities linked to academic and social success and increasing sleep quality and duration.

School-based curricula designed to reduce students' media use have the potential to diminish the negative effects of screen media use by interrupting any time exchange processes in which young people's media use displaces healthy or educational pursuits (Vandewater, et al., 2006). While most of these programs have met with mixed results, as illustrated in a systematic review (Wahi, Parkin, Beyene,

Uleryk, & Birken, 2011), the *SMART* (Student Media Awareness to Reduce Television) curriculum has been shown to be effective in reducing screen time and, in turn, improving health and behavioral issues including weight status (Robinson, 1999; Robinson & Borzekowski, 2006) and aggressive behaviors (Robinson, Wilde, Navracruz, Haydel, & Varady, 2001). Several of characteristics of the *SMART* curriculum may account for its success, including the use of social cognitive theory as the basis of the educational design and the utilization of classroom teachers as the deliverers of the educational lessons. While considered effective, the *SMART* curriculum has fairly limited reach targeting third and fourth graders and likely faces implementation challenges, as it was not intended to meet requirements of the Common Core. Furthermore, the effects of this program on other behaviors associated with health and academic performance are not known.

In our study, we evaluate the effectiveness of *Take the Challenge (TtC;* Delta-Schoolcraft Intermediate School District, 2003), a school-based, multi-disciplinary media education and reduction program for middle school students. Building on the success of the *SMART* program, *TtC* is integrated into school lessons and delivered by teachers as part of regular instruction, a strategy aimed at fostering commitment among teachers and successfully motivating students to reduce their screen media use. The objective of our study was to determine whether *TtC* reduces participants' use of screen media (i.e., TV, computers, and video games), increases health-related behaviors (sleep, exercise, and outdoor play), and improves academic performance (homework completion and focused behavior in class).

Method

Design

Two middle schools from the same rural area and school district in a Midwestern U.S. state participated in the evaluation during the fall semester of the 2008–09 academic year. Using a quasi-experimental design, school district staff arranged for students in grades 6–8 at one school to receive the *TtC* intervention in the fall semester and students at a second school to serve as a waitlist, no-intervention comparison group who received the intervention at a later date. Established academic calendars, rather than random assignment, determined which school received the intervention in the fall semester. That is, the administration at the intervention school was able to integrate the curriculum into their classroom work in the fall semester while the administration at the comparison school preferred to wait until the spring semester to administer the program, given constraints relating to their existing curricular plans. All students in grades 6–8 at each school received the curriculum as part of their regular classroom instruction, and all students were invited to be part of the evaluation. Demographic information for 6–8 grade students from both schools is provided in Table 1.

Before and after the administration of the *TtC* curriculum at the intervention school, participating students at both schools completed a questionnaire that assessed their media use behaviors, health behaviors, and school behaviors.

Table 1 Descriptions of populations of participating schools and response rates

	Intervention school	Comparison school
No. of 6–8 graders	241	570
No. (%) receiving free/reduced lunch or other government assistance	115 (47.7%)	250 (43.9%)
Aggregate attendance rate	94.3%	97.7%
Student mobility (% of students moving into or out of the school)	4.8%	2.3%
Race of all 6–8 graders by school [*n*, (%)]		
White or Caucasian	203 (84.2%)	527 (92.5%)
American Indian	35 (14.5%)	28 (4.9%)
Asian or Pacific Islander	2 (0.8%)	4 (0.7%)
Hispanic	1 (0.4%)	4 (0.7%)
Other	0 (0.0%)	7 (1.2%)
No. complete pretests (% of 6–8 graders)	157 (65.1%)	372 (65.3%)
No. eliminated pretest (% of pretests)	12 (7.6%)	12 (3.2%)
No. complete posttests (% of those with non-eliminated pretests)	143 (98.6%)	342 (95%)
No. eliminated posttests (% of posttests)	0 (0.0%)	6 (1.8%)
Analytic sample: non-teacher report (% of completed pretests)	143 (91.1%)	336 (90.3%)
No. incomplete teacher report data (% of those in the analytic sample)	0 (0.0%)	67 (19.9%)
Analytic sample teacher report (% of completed pretests)	143 (91.1%)	269 (72.3%)

Values for classroom size, free/reduced lunch, and race categories were provided by the school district

Teachers also answered two questions for each participant assessing their students' in-class and homework performance.

Sample

Pretest student questionnaires were completed by a total of 529 students across both schools—157 in the intervention group and 379 in the comparison group. Participants were removed from the sample without reference to their treatment condition if they provided responses considered unreliable based on long strings of identical responses for consecutive questions, time use responses that were outside the possible range of answers for the question, or failure to complete both a pretest and posttest questionnaire. The resulting analytic sample included 143 in the intervention group and 336 in the comparison group (see Table 1 for additional details). Additionally, only students whose teachers provided responses at both pretest and posttest waves were included in analyses for these items. The intervention analytic sample was younger than the comparison group (12.4 vs. 12.8 years; $p < 0.001$) and differed in ethnic composition (67 vs. 79% White; $p = 0.03$). Although the sample was primarily White, there was a notable percentage of Native American participants (10.3% intervention group and 4.4% comparison

group). The intervention and comparison samples did not differ according to percentage of children who were female (50.0% intervention group vs. 52.9% comparison group).

Intervention

TtC is a community-originated program developed by a local school district to serve the needs of its students (Delta-Schoolcraft Intermediate School District, 2003), with researchers acting as external evaluators. Originally derived from the *SMART* curriculum (Robinson, 1999; Robinson & Borzekowski, 2006; Robinson, et al., 2001), *TtC* shares many of its primary objectives and approaches. Like *SMART,* the purpose of *TtC* is to educate children about the health effects of excessive screen media use and to give them the experience of reducing their screen media exposure for a 10-day period. *TtC* utilizes *SMART's* approach to education and behavioral change that is based on Bandura's social cognitive theory and aims at reinforcing four component processes that influence observational learning—that is, learning by watching rather than direct experience: (1) emphasizing *attention* to the key educational messages; (2) enhancing *retention* of educational content; (3) providing *production* opportunities to translate knowledge into action; and (4) instilling *motivation* to take and sustain action (Bandura, 1986, 1997, 2004).

While *SMART* and *TtC* share a conceptual foundation, a general approach, and many objectives, the *TtC* curriculum contains content about media effects and media reduction targeting middle school students and was designed to be integrated into regular classroom activities in major subject areas (English/language arts, science, mathematics, and social studies). As the creator of *SMART* states, the original curriculum was designed to be relevant to third and fourth graders and needed to be adapted to be effective with other ages (Robinson & Borzekowski, 2006). *TtC* includes a 6-week curriculum with lessons based on national educational standards and aligned with the College and Career Ready Common Core Standards (Council of Chief State School Officers and the National Governers Association, 2010; Delta-Schoolcraft Intermediate School District, 2003; Porter, McMaken, Hwang, & Yang, 2011). For example, in the 6th grade science lesson "*Healthy Me!"* students learn about standard science topics (potential and kinetic energy) by understanding the connections among snacking, watching TV, potential energy, exercising, and kinetic energy. This curriculum, therefore, combines the instruction of media management skills with academic lessons, an approach regularly considered more effective and more likely to be implemented (Acker & Talbott, 2000). Across different school subjects, students complete activities designed to motivate them to reduce their media use. These include: (1) monitoring and analyzing their own and peers' self-reported media use; (2) reading and discussing published social science research on media effects; (3) developing and completing media time-budgeting forms; (4) identifying alternative non-media social and physical activities; and 5) creating media communication products to educate others about media literacy. *TtC's* primary lessons culminate with a 10-day school-wide screen-free event called *The Challenge* during which students return daily parent-signed slips verifying that the student did not use entertainment screen media on the

previous day. Together, the program strives to provide multiple messages across an array of subject areas that converge to provide participants with the skills and motivation necessary to be intentional users, rather than passive consumers, of media.

Prior to the launch of the program, *TtC* leaders obtained full approval of the program and assessment methods from school district administrators, principals, and teachers. Teachers attended a 1-day training in administering the program and implementing the study assessments. Parental consent was obtained for all participating students, and the Boston Children's Hospital Institutional Review Board approved data management and analyses.

Outcome Measures

Self-report questionnaires and teacher-report assessments were collected from both the *TtC* and comparison groups. Pretests were administered to the *TtC* group before the intervention and immediately after the screen-free event with approximately 7½ weeks between the pretest and posttest questionnaires. Due to scheduling difficulties at the comparison school, administration of the pretest occurred later in the semester and the time between the two questionnaires was approximately 2 weeks longer than for the *TtC* group. Questionnaires were identical for the two groups and assessed three categories of behaviors: media use, health behaviors, and school behaviors.

Media Use

Students self-reported what media they used "after school yesterday" and "last Saturday" (Roberts, Foehr, & Rideout, 2010). To ensure that "yesterday" referred to a school day, questionnaires were not administered on Mondays. We assessed use of three types of electronic media—television (TV), video games, and Internet (accessed by computer)—with choices including None, 15 min, 30 min, 1, 2, 3, 4, and 5+ h, with the selected values translated into minutes (using 300 min for 5+ h). To be consistent with previous student self-report media use surveys (Roberts, et al., 2010), we assessed frequency with which participants were exposed to ambient TV—TV on with no one watching and TV during meals—with a scale ranging from 0 (never) to 5 (always).

Health Behaviors

Participants provided information about the frequency and duration of certain health behaviors including playing outdoors, exercising, and sleeping. Questions assessing the amount of outdoor play used a scale identical to the media use questions (None—5+ h) and asked about after school and Saturday play. To measure exercise, participants reported the number of days over the last week that they spent at least 20 min exercising or performing a physical activity that made them sweat or breathe hard (Kann et al., 2000). Evidence suggests that young people can reliably estimate their sleep on week nights (Wolfson et al., 2003). Adapted from existing

sleep measures (Monk et al., 2003; Wolfson, et al., 2003), students were asked three questions that were used to calculate the duration of a typical night's sleep on a school night: (1) the time they usually go to bed; (2) the amount of time it takes them to fall asleep; and (3) the time when they usually wake up.

School Behaviors: Student Report

Students reported the amount of time spent doing homework or studying "yesterday" and "last Saturday," using the same scale as the media use questions. They also reported, in an open-response format, the duration in minutes of a typical homework session over the previous week.

School Behaviors: Teacher Report

Students' primary or homeroom teacher completed a brief assessment on their school behaviors. While the students in the participating schools rotated through different classes with different teachers throughout the day, their primary or homeroom teacher saw them daily and almost universally had them as students in a content class as well. Teachers were provided a form on which they recorded each student's study ID number and provided responses to the behavior questions for each student. Using an item adapted from the definition of "on-task behavior" (Chafouleas, Riley-Tillman, Sassu, LaFrance, & Patwa, 2007), teachers rated how often their students showed the following behaviors over the past week: (a) "stay on-task by being oriented toward the teacher and/or actively engaged in instructional activities," and (b) "complete all of their assignments, both homework and classwork." Responses were provided on a 5-point scale ranging from 1 (never) to 5 (always).

Data Analysis

We used general linear modeling with repeated measures to determine whether scores changed from pre- to post-intervention for each measure and whether they differed between treatment conditions. Child minority status (non-White vs. White), gender, and age were included as covariates in the analyses. Pretest and posttest estimated means (adjusted for the covariates) and their corresponding 95% confidence intervals as well as mean change scores are provided for each measure.

Results

Media Use

TV Viewing

After-school TV viewing by the *TtC* group declined at the posttest by almost 17 min, whereas it increased among the comparison group by more than 22 min

resulting in a significant difference between the groups (see Table 2 for all findings reviewed in this section). Both groups decreased their Saturday TV viewing, but the *TtC* group reduced their viewing by a greater amount (25.7 vs. 2.6 min).

Ambient TV Use

The *TtC* group reduced its tendency to watch TV during meals and to leave the TV on even if no one was watching. The comparison group remained fairly stable on both these behaviors across the two measurement points.

Internet and Video Game Use

Participants in the *TtC* group reduced their Internet use on Saturdays by an average of approximately 22 min, which was significantly larger than the almost 5 min decrease of the comparison group. For after-school video game use, the *TtC* group's use remained relatively constant, but the comparison group demonstrated a significant increase of about 16 more minutes a day on average.

Health Behaviors

Exercise and Sleep

Students in the *TtC* group slightly increased the frequency of their exercise while those in the comparison group decreased their frequency leading to a significant difference between the two groups. The *TtC* group also reported sleeping longer at the posttest wave than at the pretest—approximately 10 min more a night—a significantly different change from the comparison group's 11 min reduction in sleep. At the posttest, the intervention group reported sleeping approximately 25 min more a night than the comparison group.

School Behaviors

According to teacher reports, students in the *TtC* group increased the frequency with which they completed homework and classwork assignments and stayed on task or engaged in instructional activities. This increase was significantly different from the comparison group that showed no change between the two measurement points.

Discussion

Take the Challenge (TtC), a school-based media education and reduction program, successfully reduced screen media use and improved academic and health-related behavioral outcomes. Compared to their peers in the comparison school, middle school students participating in the *TtC* intervention showed significant reductions in active TV viewing, background or passive exposure to TV, and weekend Internet use. After-school video game and Internet use were unchanged in *TtC* participants

Table 2 Comparisons between intervention and comparison groups' mean change in media use behaviors and outcomes

	Intervention school			Comparison school			Intervention/comparison differences	
	Pretest *M* (95% CI)	Posttest *M* (95% CI)	Mean change	Pretest *M* (95% CI)	Posttest *M* (95% CI)	Mean Change	*F* (*df*)	*p*
Media use								
TV viewing (min per day)								
After school	65.8 (54.8–76.8)	49.0 (38.0–59.9)	− 16.8	59.5 (52.3–66.7)	82.2 (75.0–89.4)	22.7	28.1 (1459)	< 0.001
Saturday	88.9 (75.5–102.3)	63.30 (49.9–76.7)	− 25.6	80.92 (72.3–89.6)	78.3 (69.7–87.0)	− 2.6	6.1 (1457)	0.014
Ambient TV[a]								
TV on with no one watching	2.7 (2.4–2.9)	2.1 (1.9–2.3)	− 0.5	2.5 (2.3–2.6)	2.6 (2.4–2.7)	0.1	19.2 (1465)	< 0.001
TV during meals	2.5 (2.2–2.2)	2.0 (1.7–2.3)	− 0.5	2.0 (1.9–2.2)	2.1 (1.9–2.3)	0.1	14.9 (1468)	< 0.001
Internet (min per day)								
After school	37.9 (26.0–49.9)	36.4 (24.5–48.4)	− 1.5	55.0 (47.2–62.8)	65.8 (58.0–73.7)	10.8	2.9 (1460)	0.088
Saturday	63.7 (49.8–77.7)	42.3 (28.3–56.2)	− 21.5	59.8 (50.8–68.8)	55.0 (46.0–64.0)	− 4.8	4.7 (1459)	0.032
Video games (min per day)								
After school	20.2 (19.9–32.3)	22.0 (12.5–31.5)	1.8	26.1 (19.9–32.3)	42.5 (36.3–48.7)	16.4	4.8 (1460)	0.029
Saturday	34.7 (23.1–46.4)	33.5 (21.9–45.2)	− 1.2	37.6 (30.1-45.1)	42.9 (35.4–50.4)	5.3	0.8 (1463)	0.370
Health behaviors								
Outdoor play (min per day)								
After school	78.5 (66.9–90.1)	98.1 (86.5–109.6)	19.5	34.2 (26.6–41.7)	47.0 (39.4–54.6)	12.8	0.8 (1459)	0.368
Saturday	154.7 (138.1–171.4)	145.8 (129.1–162.4)	− 9.0	84.9 (74.1–95.7)	71.6 (60.8–82.4)	− 13.3	0.2 (1459)	0.692
Exercise (days/week)	4.8 (4.4–5.1)	4.8 (4.5–5.1)	0.1	4.6 (4.4–4.8)	4.3 (4.1–4.5)	− 0.3	4.0 (1429)	0.046
Sleep on a school night (hrs)	8.5 (8.3–8.7)	8.7 (8.4–8.9)	0.2	8.4 (8.3–8.6)	8.2 (8.1–8.4)	− 0.2	5.8 (1444)	0.017
School behaviors: student report								
Homework/study (min per day)								
After school	35.7 (27.8–43.6)	35.4 (24.4–43.3)	− 0.3	42.4 (37.3–47.6)	52.4 (47.3–57.6)	10.0	3.3 (1454)	0.072

Table 2 continued

	Intervention school			Comparison school			Intervention/comparison differences	
	Pretest *M* (95% CI)	Posttest *M* (95% CI)	Mean change	Pretest *M* (95% CI)	Posttest *M* (95% CI)	Mean Change	*F* (*df*)	*p*
Saturday	13.4 (6.6–20.2)	8.5 (1.8–15.3)	− 4.9	27.4 (23.0–31.8)	13.7 (9.3–18.1)	− 13.7	3.1 (1457)	0.081
Typical homework session length (min per day)	63.5 (50.2–76.1)	42.0 (29.1–55.0)	− 21.4	67.7 (59.2–76.2)	65.0 (56.5–73.6)	− 2.7	3.4 (1445)	0.065
School behaviors: teacher report[b]								
Homework/classwork completion	4.3 (4.1–4.4)	4.5 (4.4–4.7)	0.3	4.2 (4.1–4.3)	4.2 (4.1–4.3)	− 0.0	15.6 (1404)	< 0.001
On task/engagement	4.1 (4.0–4.3)	4.3 (4.2–4.5)	0.2	4.1 (4.0–4.2)	4.1 (4.0–4.2)	− 0.0	11.5 (1403)	< 0.001

After school activities were assessed for the previous day. Saturday activities were assessed for the previous Saturday. Means are adjusted for race, gender, and age of participants

[a]0–5 point scale (0-never; 1-hardly ever; 2-less than half of the time; 3-about half of the time; 4-most of the time; 5-always)

[b]1–5 point scale (1-never; 2-rarely; 3-sometimes; 4-often; 5-always)

and increased significantly among comparison students. *TtC* participants slept significantly more, increased the frequency with which they completed homework and classwork, and spent more time on task in the classroom. The effectiveness of *TtC* may be attributable, in part, to its integration into established curricula, classroom activities, and evaluation metrics, providing students with a performance- rather than values-based logic for altering entertainment media use. Implemented by students' current teachers, delivered through instruction in major subject areas, and meeting core educational standards, this preventive strategy that incorporated critical thinking and media reduction activities into existing curricula holds promise for interventions designed to reduce negative effects of screen media use on young people's academic performance and physical and mental health.

Building upon the success of the *SMART* curriculum (Robinson & Borzekowski, 2006) and approaches described in previous studies (Salmon et al., 2011), *TtC* focuses on fostering balanced media use through education and skills training in order to support a 10-day screen-free event. In response to the evolving electronic environment, *TtC* targets entertainment screen media in addition to television. *TtC* participants spent less time using computers to access the Internet on Saturdays and showed stable amounts of video game play on school days that were significantly different from the increases in video game play observed in the comparison group. Overall, the impact of the *TtC* intervention was stronger and more consistent for TV than for interactive media. This may simply be because students used TV more than interactive media, or because established and effective approaches to TV reduction may not be fully applicable to interactive and mobile media use. Interactive media range from largely passive reception of content to active communication and content creation, thereby serving a different purpose from TV and potentially requiring a different strategy for education and management. It is important, therefore, for programs such as *TtC* to evolve new techniques that allow young people to identify and reduce the types and patterns of use that have the highest health risks.

Participation in *TtC* was associated with improved school behaviors related to homework completion and classroom behavior. Since increased TV viewing has been linked to reductions in homework time (Vandewater et al., 2006), we expected that reducing TV viewing would increase time spent on homework. In our study, however, students in the *TtC* group reported *decreasing* the typical time they spent doing homework by approximately 21 min per day. At the same time, their teachers reported *increased* frequency of completed homework and classwork. It is possible that *TtC* students in the program completed their homework assignments more rapidly and effectively by removing media distractions that compete for cognitive resources (Pool, Koolstra, & Voort, 2003; Rubinstein, Meyer, & Evans, 2001; Wood et al., 2012).

In addition to improvements in homework and classwork, teachers reported increases in sustained attention and time-on-task in the classroom performance of students after *TtC*. This may be at least partially attributable to the average 25 min of extra sleep that the *TtC* group experienced compared to their peers who did not receive the curriculum. Insufficient rest is linked to deteriorations in academic performance and behavioral function (Ravid, Afek, Suraiya, Shahar, & Pillar, 2009; Taras & Potts-Datema, 2005; Wolfson & Carskadon, 2003). While our study was

too brief to show measurable psychological changes, the persistence of these short term changes may provide participants in programs such as *TtC* the reciprocal enhancement of emotional well-being and self-efficacy that has been found with improvement of academic performance among early adolescents (Roeser, Eccles, & Sameroff, 1998). Additional research that follows students in *TtC* over a longer time is necessary to determine if the observed immediate academic changes persist and translate into increases in well-being.

Results of our study indicate that participants in *TtC* changed some behaviors that have been associated with weight status among young people. While we did not examine links between TV viewing and increased risk of obesity, this association has been consistently established in other work (Dietz & Gortmaker, 1985; Katzmarzyk et al., 2015; Mamun, O'Callaghan, Williams, & Najman, 2013). *TtC* participants significantly reduced their TV viewing both after school and on weekends, indicating that this program has the potential to affect the weight status of middle school students. There is also some evidence that *TtC* helped participants sustain their levels of moderate to intense exercise—their frequency of exercise increased slightly while the comparison group's level of exercise decreased. To some extent this finding is inconsistent with results from other media reduction programs in which TV viewing was reduced but participants' rigorous physical activity did not increase (Epstein et al., 2008; Robinson, 1999). Evidence suggests that when screen time is reduced, it is much more likely to be replaced with other in-home sedentary activities than with strenuous physical exercise (Robinson, 1999). In our study the observed difference in exercise frequency was driven by a reduction in the comparison group—participating in *TtC* did not increase young people's physical exercise. However, the focus of the curriculum on identifying alternative activities to media use and the rural setting of the study may have helped participants avoid the reduction in exercise experienced by the comparison group. Considering that *TtC* did not increase physical exercise, it may be that structural factors related to children's households, neighborhoods, and family life are more robust determinants of physical activity participation than their amount of screen media use (Boehmer, Lovegreen, Haire-Joshu, & Brownson, 2006; Ding, Sallis, Kerr, Lee, & Rosenberg, 2011; Lake & Townshend, 2006).

When people eat while watching TV, they eat greater total quantities of food (Bellissimo, 2008; Braude & Stevenson, 2014) and consume more fat and fewer fruits and vegetables (Boutelle, Birnbaum, Lytle, Murray, & Story, 2003). Participants in *TtC* reduced the amount of time that TVs were on during meals and while no one was watching. While not tested directly, this behavioral change could translate into reduced risk of poor nutrition and obesity. Furthermore, reducing a stimulus that competes with family members for young people's attention may decrease the risk of poor parental attachment that has been associated with excessive media use (Richards, McGee, Williams, Welch, & Hancox, 2010). Encouraging as they are, these conclusions are based on findings from a single-item, self-report measure. Additional research using more comprehensive methods to investigate the effects of media reduction programs on family processes, including parent–child interactions and the social environments of homes and mealtimes, is necessary to more fully understand these influences.

As previously mentioned, *TtC* participants slept longer during the intervention, increasing their mean sleep duration to about 8 h and 40 min per night. While still

falling short of the recommended 9 or more hours per night recommended for their age (Matricciani, Blunden, Rigney, Williams, & Olds, 2013), *TtC* participants slept more than 25 min longer than their peers in the comparison group. Given the growing body of evidence associating obesity risk with inadequate sleep (Lytle et al., 2013), the increased sleep realized with *TtC* has the potential to be powerfully protective of students' physical and mental health.

Overall, the pattern of results we reported indicates that participants in the *TtC* program improved several behaviors that are linked to beneficial health outcomes. Currently, however, conclusions that *TtC* has short- or long-term health benefits are speculative. Additional large-scale media reduction interventions that target middle school students and implement multi-domain, longitudinal, field experiment evaluations are necessary to determine if the short-term behavior changes observed in our study translate into enduring preventative health benefits.

Several limitations of our study require consideration. First, the *TtC* intervention and comparison middle schools were assigned to their condition based on their own scheduling demands. Although the schools were from the same geographic area and school district and comparable on the majority of baseline variables, *TtC* students were younger, less likely to be White, and attended a smaller school than students in the comparison group. Previous studies that have conducted random assignment have had similar between-group differences in baseline demographics, even when both schools were matched socio-demographically and scholastically (Robinson, 1999). Furthermore, these variables were included as covariates in the analyses to help account for these differences. Nonetheless, unobserved school characteristics such as teacher engagement with the curriculum or school culture that is accepting (or rejecting) or a media reduction curriculum are likely to alter the effectiveness of interventions such as *TtC*. Future studies should include multiple schools and full random assignment to help account for such differences.

Second, there were scheduling problems that led to asynchronous administration of the questionnaires between schools. Observed differences between schools might be attributable, in part, to when questions were asked. This is especially true for media use activities performed on a specific day (Saturday or yesterday) because the two conditions were not referencing the same day. Weather, community events, or other similar date-dependent occurrences could have impacted one of the treatment conditions and not the other. However, most of the findings were evident both between the two groups (when the schedule could have played a role) and within the *TtC* intervention group (when the schedule was not relevant).

Further, teachers who administered the questionnaires and completed the teacher reports, taught a portion of the *TtC* curriculum, and were not blind to the intervention condition assigned to their school. Social desirability may have biased *TtC* teachers' reporting of post-intervention student behaviors. Similarly, *TtC* students may have been motivated to give responses consistent with the goals of the program. Also, outcomes were measured using student self-reports and teacher ratings of participant behaviors, and such measures may be susceptible to recall and other biases. However, similar outcome measures are frequently used in child health and behavior studies and their face validity and predictive validity have been established (Robinson et al., 2001).

Lastly, we did not collect sufficient information to accurately identify the nested structure of the data. As such, we were unable to account for the clustering of children within the different classrooms in which they received the curriculum or of teacher effects on the observed differences. Future studies that have multiple schools in each condition can further advance the field by documenting and accounting for these influences.

These limitations should be considered when judging the applicability of findings from our study to other populations. However, the broad nature of this research—as a quasi-experimental evaluation of a school-based and teacher implemented media-reduction and education campaign—does contribute to the field. While additional work that tests *Take the Challenge* is clearly needed to fully understand its effects, the results reported here provide a preliminary indication that the combination of media education and reduction of media use employed by this curriculum holds promise. To generate clearer answers to questions of if, how, and why specific features of media management interventions like *TtC* work to improve health and development outcomes, future studies should work with larger, formally randomized populations; include more observational, physical, and psychological measures; and follow participants over longer periods of time to determine whether the effects of media education and reduction are lasting and can change long-term health and developmental outcomes

Schools, where children and adolescents spend much of their waking time, have great potential for intervening to address harmful health and developmental influences of young people's intense and increasing engagement with entertainment media. The responsibility of schools is not only to educate students in the basic academic areas of math, reading, writing, and science, but also to support their social-emotional growth, providing students with the knowledge and skills they need to live responsible, socially productive, healthy, and safe lives (Greenberg et al., 2003). Because *Take the Challenge* is based on National Academic Standards and is integrated into the day-to-day academic curriculum, it provides schools with the opportunity to advance these goals while further educating and preparing students to be healthy, productive, and successful citizens of the Digital Age.

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Compliance With Ethical Standards

Conflict of Interest The authors declare that they have no conflict of interest.

Ethical Approval Ethical approval for the data management and analyses obtained from the Boston Children's Hospital's Institutional Review Board. Individual School and School District approval was obtained for the administration of the evaluation materials.

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