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Video Game Genre Preference, Physical Activity and Screen-Time in Adolescent Boys from Low-Income Communities

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Abstract

Purpose: To examine the association between the types of video games played by adolescent boys and their participation in physical activity and recreational screen-time.

Method: Participants were 320 boys (mean age = 12.7, ± 0.5 years) from 14 secondary schools located in low-income areas of New South Wales, Australia. Outcomes included objectively measured height, weight and physical activity (accelerometers) and self-reported screen-time and video game genre preference. ANOVAs and linear mixed models were used to analyze the data.

Results: There was a significant game genre group effect for weekday counts per minute \( F (3, 242) = 3.66, p = .01 \) and moderate-to-vigorous physical activity \( F (3, 242) = 2.70, p < .05 \). Boys who preferred ‘sports and racing’ games were more active than those who liked ‘strategy’ games. There were also significant game genre group effects for weekday \( F (3, 316) = 4.03, p < .01 \) and weekend \( F (3, 316) = 3.25, p = .02 \) screen-time. Boys who preferred ‘role playing’ and ‘strategy’ games reported higher screen-time on weekdays and weekends, compared to those who preferred ‘sports and racing’ games.

Conclusion: This cross-sectional study has demonstrated that boys who prefer ‘sports and racing’ games are more active and report less screen-time than boys who prefer other types of video games.

Key words: Physical activity; Sedentary behavior; Youth; Video game; Screen-time; Obesity;
Implications and contribution

Adolescent boys’ who enjoy ‘sports and racing’ games participate in more physical activity preferences for different types of video games were associated with the time they engaged in physical activity and their total screen-time. Further longitudinal studies are needed to confirm these findings, but it appears that boys who enjoy ‘role playing’ and ‘strategy’ games engage in high levels of recreational screen-time.
Introduction

Screen-based recreation or ‘screen-time’, which refers to the use of screen devices (such as television, computers, gaming consoles, and tablets or smartphones) for the purposes of entertainment, represents the largest single contributor to leisure-time sedentary behavior among youth [1]. Current guidelines suggest limiting total screen-time to less than two hours per day [2], however, many adolescent boys exceed this limit [3], especially those living in low-income communities [4]. Excessive screen-time is associated with a range of adverse physical and psychological health outcomes among youth, including overweight and obesity, metabolic syndromes, insulin resistance and depression [5-7].

Video gaming is a unique form of screen-time with adolescent boys spending significantly more time video gaming than adolescent girls [5]. A study on time spent playing video games in adolescents found males averaged 18.6 hours per week, more than twice the weekly average for females [8]. As technology advances, the features and mechanics of video games (including smarter artificial intelligence and improved graphics and physics) become more elaborate, making video games an increasingly popular form of entertainment. For example, the advances in console design (improved processing, accessibility and downloading speeds) now feature internet connectivity allowing gamers to interact with friends in a potentially limitless ‘online’ game space and they can also interact with, and even speak to, players from around the globe.

Video gaming has also become increasingly appealing due to the variety of video game genres available [9]. Adolescents are attracted to certain video game genres and motivation for playing video games may be influenced by the users desire for challenge, competition, fantasy, social interaction, diversion, and arousal [8, 10]. As video games
become more successful at meeting player motivations and interests, prevalence and duration of video gaming may increase. However, certain video game genres have been found to be more ‘addictive’ and ‘compulsive’. For example, a recent study found adolescents who play ‘role playing’ games, particularly those playing online, were at increased risk of video game dependency [11]. This research along with evidence on the health consequences of excessive screen time provides a strong rationale for continued investigation within this domain.

Although previous studies have examined the association between video gaming and screen-time in adults [12], to our knowledge no one has examined the relationship between adolescent boys’ engagement with specific video game genres and their physical activity and screen-time. Therefore, the aim of this study was to examine the association between video game genre preference and physical activity and screen-time among a sample of adolescent boys from low-income communities. A secondary aim was to examine the association between physical activity and screen-time in the study sample.

Methods

Participants

Participants for the present study were adolescent boys taking part in a school-based obesity prevention intervention [13]. Ethics approval for the study was obtained from the University of Newcastle, New South Wales (NSW), Australia and the NSW Department of Education and Training ethics committees. State funded secondary schools located in low-income areas of NSW, Australia were identified and invited to participate in the ATLAS school-based obesity prevention intervention. Fourteen schools agreed to participate and adolescent boys in year 7 (first year of secondary school) at each of the study schools were screened for eligibility. Study participants were eligible if they reported failing to meet national physical activity or screen-time guidelines for youth.
(i.e., ≤ 60 minutes of moderate-to-vigorous physical activity [MVPA] per day or ≥ 2 hours of screen-time per day) [14]. Of the 997 students who completed eligibility-screening, 850 were considered eligible and 361 boys consented to be included in the study. Data for the present study is from baseline assessments conducted in November – December, 2012. Of the 361 subjects assessed, N = 320 provided valid data for video-game genre preference and formed the study sample for the present investigation.

Measurements

Assessments were conducted on school premises by trained research assistants. Physical measurements were conducted in a sensitive manner and questionnaires were completed in exam-like conditions using apple iPads. Demographic information including age, cultural background, language spoken at home, residential postcode (to assess socio-economic status) and indigenous status was reported by participants.

Height and weight. Height was measured using a portable stadiometer (Model no. PE087, Mentone Educational Centre, Australia) and weight was measured in light clothing, without shoes using a portable digital scale (Model no. UC-321PC, A&D Company Ltd, Tokyo Japan). Body mass index was calculated using the equation (weight [kg] / Height [m²]).

Screen-time. Recreational screen-time was measured using a modified version of the Adolescent Sedentary Activity Questionnaire (ASAQ) [15]. The modified ASAQ asks respondents to report the total time spent sitting using screens (of any kind) for anything other than homework on each day of the week. Evidence shows that adolescents often use multiple screen devices simultaneously [16, 17]. Consequently, self-reporting the time spent using individual devices and summing the times for each may result in inflated estimates of total screen-time. The modified ASAQ accounts for screen multi-tasking by measuring the ‘total time’ spent using screens regardless of the number of screen devices.
being used at once. Test-retest reliability for the screen-time items of the ASAQ have been found to be acceptable among a sample of adolescents (ICC .76 to .90) [15].

**Physical activity.** Physical activity was measured in accordance with standardized protocols [18] using triaxial Actigraph accelerometers (model GT3X+), worn by participants during waking hours for seven consecutive days, except when bathing and swimming. Data were collected and stored in 5-second epochs. Valid wear time for *weekdays* was defined as a minimum of 3 days of monitoring (Monday – Friday) with ≥ 8 hours (i.e., 480 minutes) of total wear time recorded. For *weekends* valid wear time was defined as ≥ 8 hours of total wear time recorded on at least one weekend day (Saturday – Sunday). The mean activity counts per minute (CPM) were calculated to provide a measure of ‘overall’ activity, while thresholds for activity counts were used to categorize physical activity into sedentary, light, moderate and vigorous intensity activity [19]. Using these cut points, the time spent in MVPA was calculated.

**Video game genre preference.** Participants were asked to list their three favorite video games and participants’ responses were then classified into genres using the Pan European Game Information (PEGI) online database [20]. As participants reported three of their favorite video games, the mode of the three video game genres was considered to indicate their genre preference. If all three genres were different, the genre of the first listed game was considered as their preference. The video game genres were collapsed into four genre ‘groups’ to simplify analyses. The following four genres were selected: i) ‘Action/Adventure’ – user plays as a character with puzzle-solving and/or real-time (direct control over characters)(e.g., Call of Duty); ii) ‘Sports and Racing’ – simulation of sport (e.g., FIFA 13) and simulation of racing (e.g., Forza Horizon); iii) ‘Strategy’ – puzzle-solving games, which can require problem solving and decision making to
progress through the game (e.g., Minecraft), and iv) ‘Role Playing’ – games where the
participant creates a character or chooses a character that has specific abilities. Games
may allow players a period of analysis before committing to a game action or real-time
decision making (e.g. World of Warcraft). It is important to note that many games are not
limited to a single genre and different versions of games belong to different genres.
Therefore, the PEGI database of games was used to allocate game genres based on the
most recent game edition.

Statistical analyses
Analyses were performed using IBM SPSS Statistics for Windows, Version 20.0 (2010
SPSS Inc., IBM Company Armonk, NY). The data were assessed for normality and the
physical activity and screen-time variables were transformed using the logarithmic
function. Analysis of variance (ANOVA) with Bonferroni post hoc procedures were used
to examine the association between participants’ video game genre preference and their
physical activity and screen-time. Multilevel linear mixed models were used to assess the
cross-sectional relationships between physical activity (i.e., MVPA and counts per
minute) and screen-time for weekdays and weekend days. Models included physical
activity as the outcome variable, screen-time and body mass index as fixed factors, and
school as a random factor. Alpha levels were set at $p < 0.05$.

Results
Participants were N = 320 adolescent boys aged 12.7 ± 0.5 years. The majority of
participants were born in Australia (95.9%) and spoke English at home (97.1%).
Approximately 12% of boys identified as being of Indigenous descent and the majority of participants were classified as low-to-middle socio-economic status based on their residential postcode. Accelerometer compliance was moderate with 237 (74%) participants providing valid data for weekday physical activity and 183 (57.2%) participants providing valid data for weekend physical activity.

Video game genre preference and physical activity

There was a significant effect of genre preference on weekday physical activity. Significant effects were found both for overall activity $F(3, 242) = 3.66, p = .01$ and for MVPA $F(3, 242) = 2.70, p < .05$. Post hoc tests indicated that boys who preferred sports and racing games accumulated higher levels of overall activity ($M = 576$ CPM ± 149 versus $M = 460$ CPM ± 112) and more MVPA ($M = 72$ mins/d ± 22 versus $M = 58$ mins/d ± 16) than boys who liked strategy games. No significant differences were found between any of the other genre groups nor were there any significant differences found for weekend physical activity.

Screen-time and video game genre preference

Video game genre preference had a significant influence on both weekday $F(3, 316) = 4.03, p < .01$ and weekend $F(3, 316) = 3.25, p = .02$ screen-time. On weekdays, the ‘role playing games’ group reported significantly higher screen-time than the ‘sports and racing games’ group ($M = 197$ mins/d, ± 145 versus $M = 98$ mins/d ± 59). On weekends, the ‘strategy games’ group reported significantly higher screen-time than those in ‘sports and racing games’ group ($M = 206$ mins/d ± 150 versus $M = 123$ mins/d ± 99).

Differences between all other genre categories were not statistically significant.

Association between physical activity and screen-time

Unstandardized regression coefficients and 95% confidence intervals (CIs) for log transformed variables are reported. After adjusting for BMI, the associations between
weekday screen-time and overall activity ($\beta = -0.04$, 95% CI = -0.09 to 0.01, $p = .13$) and MVPA ($\beta = -0.04$, 95% CI = -0.10 to 0.02, $p = .19$) on weekdays were not statistically significant. Significant inverse associations were found between weekend screen-time and both overall activity ($\beta = -0.13$, 95% CI = -0.22 to -0.03, $p = .01$) and MVPA ($\beta = -0.13$, 95% CI = -0.25 to -0.01, $p = .04$) on weekends.

- Table 2 –

Discussion

The primary aim of this study was to explore the association between video game genre preference, physical activity and screen-time in a sample of adolescent boys attending schools in low-income communities. We found that boys who preferred ‘sports and racing’ games were more active during the week, compared to boys who reported a preference for ‘strategy’ games. In addition, there was a significant game genre group effect for weekday and weekend screen-time. Boys who preferred ‘role playing’ and ‘strategy’ games’ reported significantly more screen-time than boys who preferred ‘sports and racing’ games’.

The effect of genre preference on screen-time observed in the present study is consistent with research conducted with adults [12]. Among a large sample of adult gamers, it was found that gaming time differed significantly between genre groups [12]. Furthermore, the risk of experiencing “problem video game play” disorder, a condition in which video gaming behavior is considered pathological, was found to be significantly higher among those within specific genre categories, and highest among ‘role playing gamers’[12]. Though dependent on the period of the week, our results showed higher levels of screen-time among those with a preference for ‘strategy’ and ‘role playing’
games, compared with those preferring ‘sports and racing’ games. This may be explained
by the nature of the game play within each genre. For example, ‘strategy ’ and ‘role
playing’ games may require greater determination, calculations and time to succeed as
there may be more tedious challenges, AI, obstacles and plots in the game. Thus, a clear
contrast in the duration of game play required before the game is finished or can be saved
[21]. In the case of ‘role playing games’ it has been identified that character/avatar
development can be a long persistent process [22]. In addition, the ‘addictive’ nature of
specific genres might contribute to increased gaming duration through individuals losing
a sense of time as they engage in the fantasy elements of the game itself [22].
Alternatively, it is possible that youth with a preference for ‘sporting’ games are attracted
to this genre due to an existing interest in sport and physical activity. Consequently, these
individuals may seek out opportunities to engage in ‘real’ physical activity in their leisure
time and simply supplement this interest with video games delivering the same subject
matter. Interestingly, recent research has demonstrated that screen-time is inversely
associated with motivation to limit screen-time [23]. Accordingly, boys that enjoy sports
and racing games may be aware of the consequences of excessive screen-time and/or
value active alternatives resulting in self-regulation of screen-time behavior. Whether the
differences in total screen-time observed between genre groups can be explained by
differences in video gaming time alone, or by differences in the overall patterns of
screen-use across multiple mediums is beyond the scope of this study. However,
considering that television use is the largest single contributor to total screen-time [24], it
is likely that time spent video gaming occurs in addition to engagement with other screen
devices and may be reflective of a more sedentary behavior profile.

In addition to an effect on screen-time our findings show that genre preference
has an influence on physical activity. Both ‘overall’ activity levels and the quantity of
MVPA on weekdays was found to be significantly higher among those who preferred ‘sports and racing’ games group compared with those who preferred ‘strategy’ games. The mean difference in MVPA between these two groups was approximately 14 minutes per day, representing a difference of close to a quarter of the daily recommendation [2]. According to the displacement hypothesis, time spent in sedentary behaviors displaces time that could be spent engaging in health-enhancing physical activity [25]. However, many studies have found a weak association between sedentary time and physical activity in adolescents [26, 27], suggesting that youth can be active and exceed the screen-time recommendations [27, 28]. It must be noted that despite the abundance of research on the association between physical activity and screen-time, there is limited research on the association between physical activity and the unique aspects of screen-time, such as video game genre preference. Our findings therefore, address an important gap in the literature. As mentioned previously, adolescents with a preference for sport-focused video games likely do so due to their existing interest in sport and physical activity. This interpretation is supported by evidence from a study of sports gamers, which showed that the majority of sports gamers played sport and that most reported their favorite sporting game was based on the same sport as the one they actually played [29]. This may explain to difference in levels participation in physical activity between the genre groups. The lack of a significant finding on weekend days may be the result of a loss of power as accelerometer compliance on weekends was considerably worse than on weekdays (i.e., 57% versus 74%). More research is required to confirm the effect, or lack thereof, of game genre preference on weekend physical activity.

A secondary aim was to examine the association between screen-time and physical activity to determine whether screen-time displaces time spent being active. Finally, significant inverse associations were observed between screen-time and both
‘overall’ activity and MVPA on weekends. However, the associations for weekdays were not statistically significant. Numerous studies have examined the association between physical activity and screen-time in youth, but the findings have been equivocal [30, 31]. A longitudinal study conducted in the U.S. over a two year period, found that a reduction in screen-time was associated with an increase in the frequency of physical activity during early adolescence [32]. Conversely, a recent study of Spanish adolescents found video gaming was positively associated with light physical activity on weekend days [33]. Although, the association between weekday screen-time and physical activity in the present study was not statistically significant, significant inverse associations were found between weekend screen-time and physical activity. While this may appear to be contradictory, these findings actually support rather than contest evidence of a displacement effect. Youth are subject to similar environmental circumstances during weekdays, spending a considerable portion of their time at school, predominantly without access to video games or other screen-devices. In addition, they are exposed to physical education on a compulsory basis meaning that they may accumulate more physical activity during this time [34]. Differences in activity levels on weekdays may arise during the afternoon period prior to dinner when youth can choose whether to spend their time sedentary or active. However, this represents only a small portion of the day. Conversely, weekends are characterized by considerably more discretionary time during which youth have access to the variety of screen-based media available in the family home. In this respect, there is greater scope for variation in activity levels due to the large degree of choice available to adolescents. For example, MVPA is commonly achieved through sport participation [35], which generally occurs on weekends. An adolescent may achieve the recommended quantity of MVPA through sports participation alone whereas a non-participant would have to engage in unorganized physical activity of similar duration to
gain a comparable amount of MVPA. By consequence, weekends allow for the
association between physical activity and screen-time to be observed outside of the
imposed stimuli present during weekdays. Our findings, at least for weekends, support
those of other investigators suggesting that screen-time displaces physical activity.

Strengths of the present study include objective assessment of physical activity
and correction for media multi-tasking through the use of the modified ASAQ. However,
the former also introduced a limitation. Due to poor compliance with physical activity
monitoring on weekends, analyses of the associations between genre preference and
physical activity during this period may have been underpowered, resulting in the lack of
a significant finding. In addition, there was a large disparity between the number of
subjects in each of the video game genre groups, with the vast majority (68%) of boys
ascribed to the ‘action/adventure games’ group and considerably smaller numbers
forming the remaining groups. This may have also influenced our power to detect
significant differences. Lastly, study participants were adolescent boys from low-income
communities and therefore, were not representative of the wider population. Therefore,
these findings must be interpreted with caution and may not be generalizable to other
groups.

Conclusion

Our findings suggest that video game genre preference has an effect on weekday and
weekend screen-time and weekday physical activity. Furthermore, our data indicates that
time spent engaged in screen-based recreation on weekends may displace physical
activity in adolescent boys living in low-income communities.
References


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Note. Values are mean, SD unless otherwise reported

* One participant did not report language spoken at home

b Two participants did not report cultural background

c Socioeconomic position determined by population decile using Socio-Economic Indexes For Areas of relative socioeconomic
disadvantage based on residential postcode (1 = lowest, 10 = highest). Two participants did not report residential postcode
Table 2. Screen-time and physical activity according to video game genre preference (one-way ANOVA).

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Note. AA = action/adventure games; SR = sports/racing games; SG = strategy games; RP = role playing games

*p < .05