Active and Sedentary Video Game Time
Testing Associations With Adolescents’ BMI

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Abstract. This study used survey methodology to measure opinions of 13- to 15-year-olds (N = 176) about sedentary and active video games and the relative amount of time spent with those games, and evaluated correlations between time spent with those two types of games and the body mass index (BMI) of the respondent. Results showed no evidence of any correlation between BMI and relative time devoted to video game usage by type of game (active versus sedentary), nor any support for a correspondence between overall levels of time spent with video games and BMI. Yet, the data did point to a nonlinear association in which those who devoted more than 50% of the total time they spend with video games on sedentary games had a higher BMI than those who spent less than 50% of their video gaming time with sedentary games. Important gender differences also emerged in the adolescents’ opinions of active versus sedentary games.

Keywords: video games, adolescents, BMI, gender

In the past 3 decades, childhood obesity in the United States has more than tripled (Hedley et al., 2004; Kim & Lee, 2009). Obesity has been listed as one of the leading health risks in the United States, and approximately 1 in 3 children aged 6–19 years is currently either at risk for being overweight or is indeed overweight (Hedley et al., 2004). Obesity in childhood is one of the key predictors of obesity in adulthood and is associated with many health risks, including cardiovascular disease, insulin resistance and type 2 diabetes, increased blood pressure, and even death (Deckelbaum & Williams, 2001).

Physical inactivity has been identified as a major contributor to the childhood obesity epidemic (Janssen et al., 2005). Low levels of exercise and physical activity among youths are particularly associated with abdominal obesity, an important risk factor for the health of children and adolescents (Klein-Platat et al., 2005). A more sedentary existence is arguably becoming more common over time with the rising popularity of media as leisure-time choices of young people, and such a sedentary lifestyle may thus contribute to the obesity epidemic.

Video games are a media form that is growing in popularity among children and teens. Recent data from nationally representative samples show an average of 1 hr and 13 min per day spent playing video games among 8- to 18-year-olds, up from 26 min in 1999 and 49 min in 2004 (Rideout, Foehr, & Roberts, 2010). Adolescent boys are particular fans of console-based gaming, with higher rates of use than comparative groups (Rideout et al., 2010), and more favorable attitudes toward video and computer games have been recorded among males compared with females across age groups (Hartmann & Klimmt, 2006; Lucas & Sherry, 2004).

Historically, video game use has occurred in a scenario in which a child sits unmoving in front of a screen, not engaging in much physical activity aside from the manipulation of the hand-held controller. Yet, Nintendo’s Wii console can provide a more physically active gaming experience. The Wii has shipped an estimated 91 million units around the world according to the website of Vgchartz.com (2012a), bundled in most instances with the Wii Sports games, thereby ensuring wide circulation of these physically active games. The Kinect for the Xbox 360 console also features motion controls that detect body movements and has become the fastest selling electronic device in history, selling over 8 million units in its first 60 days on the market (Woollacott, 2011) and shipping over 17 million copies of Kinect Adventures! worldwide (Vgchartz.com, 2012b). The PlayStation Move allows for motion control, as well, and 15 million units had been shipped to retailers as of November, 2012, with popular games (again, some likely due to retail bundles) including active titles such as Sports Champions and Just Dance 3 (Lomas, 2012; Moriarty, 2012). With motion controllers in wide circulation and games that require large-muscle movement increasingly in use, this study will examine whether the relative amount of time a sample of adolescents spends with each type of video game – sedentary and active – associates with their body mass index (BMI), a frequently employed measure of healthy weight. The key distinction...
between active and sedentary video gaming is that the former requires gross body movement using a motion controller whereas the latter is confined to hand and wrist movement using a hand-held controller. The relative use of such evolving forms of gaming has important potential implications for the health and wellness of young people.

Literature Review

Childhood Obesity and Overall Media Use

Media consumption involving “screen-based activities” including televisions, computers, and video games has been implicated as one of the factors leading to childhood obesity. Some studies have found that screen time is, indeed, inversely associated with time spent in physical activity (Eisenmann, Bartee, & Wang, 2002; Tammelin, Ekelund, Remes, & Nayha, 2007). Thus, there is some evidence to support the allegation that for some children, screen media use displaces more physically beneficial activities (Daley, 2009). For example, in a sample of over 2,700 12-year-olds in France, Klein-Platat and colleagues (2005) found sedentary activities including television viewing were positively associated with waist circumference, a measurement of abdominal overweight and obesity.

On the other hand, other studies have found screen time to be unrelated or modestly related to physical activity (Taveras et al., 2007) or to adiposity (Danielzik, Czerwinski-Mast, Langniise, Dilba, & Muller, 2004; Purslow, Hill, Saxton, Corder, & Wardle, 2008). In the Rideout et al. (2010) data, no significant associations were found between overall amount of media use and self-reported time spent in physical activity. In those data, heavy media users spent an average of 1 hr 59 min per day engaging in physical activity, compared with 1 hr 43 min for moderate media users and 1 hr 44 min for light. Time spent with video games and computers, specifically, has been shown to be only a modest predictor of obesity (Rey-Lopez, Vicente-Rodriguez, Biosca, & Moreno, 2008).

There is also an indication that screen time and time spent engaging in physical activity are not mutually exclusive, and the latter can moderate the role of the former in promoting overweight or obesity (Ortega, Ruiz, & Sjostrom, 2007; Yen et al., 2009). For instance, Steele, van Sluijs, Cassidy, Griffin, and Ekelund (2009) found children who met recommendations of 2 hr or less of screen time and of 60 min or more of moderate intensity physical activity per day were 31% less likely than their counterparts who met neither recommendation to be overweight or obese.

Finally, the demographic characteristics of adolescents also appear to play a role. Data in the United States suggest the risk of overweight or obesity is inversely associated with household income among non-Latino White boys and girls (Ogden, Lamb, Carroll, & Flegal, 2010). However, the same national statistics show the majority of obese children and adolescents are not low income, and obesity rose between the mid-1990s and 2008 among young people of all income levels (Ogden et al., 2010).

Physically Active Video Games

Because children’s activity choices are usually governed by their sense of enjoyment (with “fun” listed as the top reason kids engage in physical activity; Epstein, Beecher, Graf, & Roemmich, 2007), there is a particular need for active leisure-time options that young people will deem entertaining. Since traditional, sedentary media are generally perceived as enjoyable, one potentially fruitful technique is “to replace passive screen time with active screen time” (Biddiss & Irwin, 2010, p. 669). Research has shown that “energy expenditure more than doubles when sedentary screen time is converted to active screen time, [and] such interventions might be considered for obesity prevention and treatment” (Lanningham-Foster et al., 2006, p. 2535).

There has been a recent surge in studies that have measured energy expenditure among children and adolescents during game play of active, nonsedentary video games (see Biddiss & Irwin, 2010, for a review). They each utilize some combination of studying heart rates and/or energy expenditures while playing Wii Bowling, Wii Boxing, Wii Tennis, Dance Dance Revolution, or other active games, compared with other activities such as walking and compared with playing more classically sedentary video games. The studies reach similar conclusions: Active games do indeed promote moderate amounts of energy exposure and increases in heart rate. The amount of energy expended
with active video games is similar to that expended during such activities as skipping, jogging, and climbing stairs (Biddiss & Irwin, 2010). A recent meta-analysis showed that moderate physical activity levels have been achieved through active gaming, as measured by metabolic equivalents (Barnett, Cerin, & Baranowski, 2011).

A number of additional studies have moved this area of inquiry out of the laboratory and into the home, to determine the longer term implications of use of active video games for physical activity levels. A study conducted in New Zealand showed that children who have daily access to active video games do engage in higher amounts of physical activity than children without such access (Mhurchu et al., 2008). Additional preliminary inquiries have similarly found that playing active video games in the home promotes increases in physical activity (Chin A Paw, Jacobs, Vaessen, Titze, & van Mechelen, 2008) as well as decreases in sedentary screen time (Maloney et al., 2008; McDougall & Duncan, 2008).

Nevertheless, there appear to be practical limits to the potential benefits of active games, as well. Baranowski and colleagues (2012) found no differences in physical activity over a period of 5 weeks among children aged 9–12 years who were given access to a Wii console and either two active or two sedentary games. In a meta-analysis by Barnett and colleagues (2011), there were differences in energy expenditure likely attributable to the type of game played (in other words, not all “active games” promote the same amount of physical activity), and young people’s use of active video games was found to decline over time, thereby reducing potential health benefits. Although there is great potential for active games to increase physical exertion, therefore, some questions arise regarding whether they do so on a day-to-day basis (Biddiss & Irwin, 2010).

There is the additional complexity regarding what constitutes an active versus a sedentary game-playing experience. Many of the games used in the studies reviewed above employed games that are decidedly physically demanding (like Dance Dance Revolution or Wii Fit), yet other games using newer console technology have some active elements but can be played sitting down (like Guitar Hero or Rock Band) and/or may not require heavy exertion. In past research, the use of motion-based controllers has been the defining feature of less sedentary, more active gaming (Barnett et al., 2011; Lanningham-Foster et al., 2006). However, Lyons and colleagues (Lyons et al., 2012) found that simply using motion controllers to play typically more sedentary games (in this case, action games) does not lead consistently to more energy expenditure. There was only limited evidence, for one of three games played, for the motion controller condition to produce greater energy expenditure than the traditional controller condition when subjects played action games. Barnett and colleagues have similarly noted that “AVGs (active video games) can be played at a range of intensities” (2011, p. 733).

Furthermore, little is known about the relative appeal or use of sedentary compared with active video games among young people of differing demographic characteristics, and what little prior research exists on the topic appears to provide conflicting evidence. Active video games have been found to be perceived as less enjoyable than more sedentary games among young adults (aged 18–35 years), thereby posing an obstacle for their use in energy expenditure and physical fitness (Lyons et al., 2011). Simons, Bernaards, and Slinger (2012) surveyed 179 pairs of Dutch adolescents aged 12–16 years who had access to active video games in their homes and found no differences by parent education, sex, or ethnicity among those who played the active games regularly and those who did not. There was a significant age difference, in which regular active game users were slightly younger than nonregular active game users. Boys in the sample spent more time with nonactive games than the girls, and in general the amount of time devoted across sexes to active games (an average of 80 min per week) was much smaller than the amount of time devoted to nonactive games (224 min per week). Among those who regularly played active games, the percentage of young people whose self-reported physical activity levels complied with national recommendations was 85%, whereas among those who did not play active games regularly, 67% complied. In Canada, O’Loughlin, Dugas, Sabiston, and O’Loughlin (2012) surveyed 1,200 10th and 11th graders in the Montreal area and found those who played active video games (24% of the sample) were more likely to be female than male, and 14- to 15-year-olds (49% were active game users) were more likely to play active games than those 16 or older (24%). There were no significant differences by race, mother’s education level, or household income. Active video game players did not differ from nonactive game players in BMI, but they did report being more stressed about their weight or dissatisfied with their physical appearance.

This review of the literature identifies a number of gaps in knowledge that the current study attempts to address. First, the focus in the present study on video games, specifically, rather than screen time, more generally defined, allows for a thorough examination of a medium that is increasing in popularity and in its occupation of young people’s time and that now incorporates two very different modes of physical movement in its use (more versus less active). Second, the role of day-to-day, relative levels of use of both active/nonsedentary and more traditional/sedentary video games in young people’s BMIs remains unexplored in samples in the United States. Most prior research has addressed one or the other of these types of games, with mixed evidence for sedentary games contributing to physical inactivity and corresponding conditions of overweight among children and strong evidence for active games, when used in a laboratory setting, to contribute to substantial amounts of energy expenditure through physical movement. But, the in-home, day-to-day devotion of an adolescent’s time as divided between the use of sedentary and active games is not yet fully understood, particularly in its potential link with BMI. Finally, attitudes of adolescents toward the role of video games in their own health and fitness have not been well researched to date, particularly in the United States, and the current study will address this omission. Thus, the current study adds external validity to the body of knowledge by tapping into relative use of the
two major forms of games in young people’s daily lives and their corresponding attitudes regarding the two types of games.

Although there is some discrepancy in the research to date, the majority of prior studies have found a significant link between sedentary screen time, time which is increasingly occupied not just by television but also by video games (Rideout et al., 2010), and both lower physical activity levels and higher BMIs, waist circumference, and adiposity among youth (Biddiss & Irwin, 2010; Eisenmann et al., 2002; Tammelin et al., 2007). In fact, video games use (but not television use) was found to predict overweight status among youths when adjusting for ethnicity and SES (McMurray et al., 2000). The relationship between screen media time and these outcomes may be moderated by overall levels of physical activity (Ortega et al., 2007; Steele et al., 2009; Yen et al., 2009). Yet, nonetheless, the original association is typically found. At the same time, the evidence is mounting that, when used, active video games account for significant levels of exertion and exercise (McMurray et al., 2000). The relationship between screen time use and adolescents’ BMI (O’Loughlin et al., 2012), additional studies have found that frequent use of active games in the home is associated with higher physical activity and/or lower sedentary screen time (Maloney et al., 2008; McDougall & Duncan, 2008; Mhurchu et al., 2008; Simons et al., 2012). Therefore, the following prediction is made:

**Hypothesis 1 (H1)**: The more of their video game playing time adolescents devote to sedentary video games, the higher their BMI, whereas the more of their video game playing time adolescents devote to active video games, the lower their BMI.

Once again, prior studies have shown a positive relationship between screen time and likelihood for obesity (Eisenmann et al., 2002; McMurray et al., 2000; Mhurchu et al., 2008; Tammelin et al., 2007). Yet, additional evidence calls that relationship into question or shows that it is more complicated than it may appear (Danielzik et al., 2004; Morgenstern et al., 2009; Ortega et al., 2007; Purslow et al., 2008; Rideout et al., 2010; Steele et al., 2009; Taveras et al., 2007; Yen et al., 2009). Nonetheless, because some prior studies have found such a link, it will be examined in the current study, as well, in the form of a research question.

**Research Question 1**: Will there be a statistical relationship between overall amount of time spent with video games (regardless of type) and BMI?

Finally, most of the studies on this topic to date have used time use surveys or laboratory experiments, thus leaving relevant attitudes among young people about video game use and health and fitness relatively unexplored. The current study will address this gap by measuring pertinent views among young people, explored via an additional research question. The sex of the participant will figure prominently in these analyses, as prior studies have found differences in adolescent males’ and females’ preference for and use of computer and console games (Hartmann & Klimmt, 2006; Lucas & Sherry, 2004; Rideout et al., 2010) and active video games, in particular (O’Loughlin et al., 2012).

**Research Question 2**: What opinions do male and female adolescents have about active versus sedentary games, including whether or not they have implications for their own health and fitness?

**Methods**

This study used survey methodology to measure adolescents’ uses and opinions of active and sedentary video games, as well as to correlate given responses with the BMI of the respondent. The question of whether children utilize video games as a form of exercise was investigated, and opinions of the two different types of games (active and sedentary) were solicited. Thus, this study explored the potential for both positive and negative associations of gaming on weight-related health and wellness issues in young people.

**Sample**

A survey was administered to a nonrandom, convenience sample of 13- to 15-year-olds (N = 176), an age group that has been found to be relatively high active video game users in past research (O’Loughlin et al., 2012; Simons et al., 2012). Once permission was granted after correspondence with the school’s principal, and Human Subjects procedures were approved, the informed consent form and survey were distributed to students at a middle school in a suburban location in a mid-Atlantic state. The survey was administered by eighth-grade teachers during a brief homeroom period. According to data displayed on Education.com and gathered in 2008, the racial and ethnic distribution among the school population was, on average, 66% White, 27% Asian or Pacific Islander, 4% Latino, 3% Black or African American, and less than 1% Native American. The town the school serves is affluent, with a median annual household income in 2008 of approximately US $160,000, according to the Internet source Citydata.com. Although youths from high-income households are not at the highest risk for obesity, they are at risk nonetheless (Ogden et al., 2010), and they have been found to spend just as much time as their lower income counterparts playing video games in general (Common Sense Media, 2011; Roberts et al., 2005) and playing active video games in particular (O’Loughlin et al., 2012).
Operationalization

To determine key demographic factors, respondents were asked to report their age and sex at the end of the survey. The very last items on the survey asked respondents to provide their height and weight. Prior analyses have validated the use of height and weight self-report by finding significant correlations across multiple studies between self-reported and directly measured height and weight among adolescents (Sherry, Jeffers & Grummer-Strawn, 2007). In the current study these figures were used to calculate each respondent’s BMI, by multiplying weight (in pounds) by 703, then dividing by their height (in inches) squared.

Measuring Amount and Type of Video Game Use

To measure time spent with video games, respondents were asked to report how often they played video games, with response options including “never,” “very rarely,” “once per week,” “twice per week,” “3–4 times per week,” “5–6 times per week,” and “more than 6 times per week,” as well as to report the number of minutes they spend during a typical playing session. Such estimates of self-report of amount of exposure have been found in past research to correlate significantly with estimates derived from detailed diary data, considered the gold standard in estimating media use (Fikkers, Valkenburg, & Vosen, 2012), as well as with parent estimates of adolescents’ video game exposure (Kronenberger et al., 2005). Of particular relevance to the current study, Van Schie and Wiegman (1997) found a correlation of .61 between early adolescents’ self-reports of video game use and such use as measured by media use diaries.

A definition was given as to what makes a video game sedentary or nonsedentary, and examples were provided. (The term nonsedentary was used in the survey rather than active in order to be juxtaposed against sedentary and to avoid priming positive responses to the word active.) For the purpose of this study, a sedentary/active game was defined as one that requires gross body and large muscle movement with a motion controller, compared with a sedentary game which is limited to hand and wrist movement as accomplished through button-pushing on a hand-held controller, in keeping with prior literature (Barnett et al., 2011; Lanningham-Foster et al., 2006; Mears & Hansen, 2009; Simons, Bernaards, & Slinger, 2012). Respondents were asked to report, of the total amount of time they spend playing video games, what percentages of time they spent playing sedentary and nonsedentary games, respectively, so that the proportion devoted to each added up to 100% of total video game playing time.

Measuring Opinions and Perceptions

Several opinion questions followed, including “Which type of game do you feel is More fun/Easier/More realistic/More exciting/More challenging/More involving/Better to play in groups/Better to get exercise,” with responses of “sedentary games (coded as a 1),” “nonsedentary games (coded as a 2),” and “both equally.” A composite measure was created from six of these items that measured positive and negative attitudes, after eliminating the “better for exercise” item to isolate more general attitudes from those directly associated with health and fitness, and after eliminating the “better to play in groups” item because doing so increased the reliability of the index to Cronbach’s α = .84. The “both equally” responses were treated as missing data, and responses were averaged across the items for which respondents indicated a preference for either sedentary or nonsedentary games. Thus, on the composite item, scores closer to 1 indicate a relative preference for sedentary games and scores closer to 2 a preference for nonsedentary/active games. Respondents were also given the opportunity to communicate whether or not they believed video games in general had a positive and/or a negative effect on physical health and fitness, as yes or no answers, and then to report whether they believed video games had a positive or negative effect (again, measured using two separate items) on their own physical health and fitness. They were also asked directly, “How much exercise do you feel you are getting while playing video games?” with responses “very much,” “some,” “a little,” and “none.” Finally, respondents were asked whether or not they exercised and/or played sports regularly outside of gym class (with yes or no options). These measures were kept short and straightforward due to the limitations on time for administration of the survey in the adolescents’ homeroom period.

Results

Descriptive Statistics and Sex Differences

Respondents totaled 176 adolescents, aged between 13 and 15 years. Of these, 59.7% were males and 39.2% females (n = 105 male, 69 female, 2 missing data). The mean BMI for boys was 20.16 (n = 93, SD = 3.13), and for girls, it was 19.20 (n = 65, SD = 2.50). Of the respondents, 96% owned a video game console at home (n = 169 yes, 7 no); 99% of boys and 91.3% of girls. Some of the most popular consoles to own were the PlayStation 2 and 3, XBox 360, and the Wii.

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1 However, a slight tendency among females and among those who are overweight to under-report weight has also been recorded (Sherry et al., 2007).

2 The BMIs calculated for the sample compared quite closely to national averages in the United States. The 50th percentile in the Centers for Disease Control and Prevention’s BMI chart for 13-year-olds is 18.5–18.75, for 14-year-olds 19–19.5, and for 15-year-olds 19.75–20 (Centers for Disease Control and Prevention, 2012). The median BMI in the current sample for 13-year-olds was 19.48, slightly above the national median but still registering at around the 55th percentile. The median BMI in the current sample for 14-year-olds, 18.72, was at approximately the 45th percentile. There was only one 15-year-old in the current sample.
Results showed that boys tended to play video games more often than girls did (see Table 1), with 55.1% of girls reporting that they played “very rarely,” and 65.7% of boys “3 times a week or more.” Boys estimated that, on average, when they play video games, they spend an average of 95.52 min per session (SD = 73.20) whereas girls reported an average of 56.59 min (SD = 52.65), t = 3.45, p < .001. Results showed a considerable difference in the amount of time spent playing sedentary compared with nonsedentary/active types of video games for males and females. Boys reported playing sedentary games for an average of 56.9% of their total playing time, while playing nonsedentary/active games for just 19.7% (\( \chi^2 = 21.97, p < .001 \), Cramer’s V = .36). Girls, on the other hand, reported playing sedentary games only 46.9% of the time, and nonsedentary/active games for just 14.3% (\( \chi^2 = 46.58, p < .001 \), Cramer’s V = .53).

Opinions

The boys and girls in the sample responded similarly to the items measuring whether or not they believed that video games as a whole had positive effects on health and fitness, thereby providing data to explore the second research question. Approximately half, 51.9% of boys and 55.2% of girls, indicated that they believed games were likely to have a positive effect on health and fitness (\( \chi^2 = 12.78, p < .001 \), Cramer’s V = .27), with 39.1% (n = 27) of the girls reporting that they had used video games specifically for exercise, as opposed to 15.2% (n = 16) of the boys who reported doing so.

<table>
<thead>
<tr>
<th>Table 1. Frequency of video game (VG) playing by sex</th>
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<tbody>
<tr>
<td><strong>Frequency of VG playing</strong></td>
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<tr>
<td>Never</td>
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<tr>
<td>Very rarely</td>
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<tr>
<td>Once/week</td>
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<td>Twice/week</td>
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<td>3-4 times/week</td>
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<td>5-6 times/week</td>
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<td>&gt;6 times/week</td>
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**Note.** \( \chi^2 = 71.27, p < .001 \), Cramer’s V = .64

<table>
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<th>Table 2. Opinions of types of video game playing by sex</th>
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<tr>
<td><strong>Which type of video game is...</strong></td>
</tr>
<tr>
<td><strong>More fun</strong></td>
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<tr>
<td>Sedentary</td>
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<tr>
<td>Nonsedentary</td>
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<tr>
<td>Both</td>
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<tr>
<td>( \chi^2 = 56.61, p &lt; .001 ), Cramer’s V = .58</td>
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<tr>
<td><strong>More realistic</strong></td>
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<tr>
<td>Sedentary</td>
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<td>Nonsedentary</td>
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<td>Both</td>
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<tr>
<td>( \chi^2 = 21.97, p &lt; .001 ), Cramer’s V = .36</td>
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<tr>
<td><strong>More exciting</strong></td>
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<td>Sedentary</td>
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<td>Both</td>
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<td>( \chi^2 = 46.58, p &lt; .001 ), Cramer’s V = .53</td>
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<td><strong>More challenging</strong></td>
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<td>Sedentary</td>
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<td>Nonsedentary</td>
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<td>Both</td>
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<td>( \chi^2 = 22.67, p &lt; .001 ), Cramer’s V = .37</td>
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</table>

**Better to play in groups**

| **Better to play in groups** | | |
| Sedentary | 42.7 | 14.7 |
| Nonsedentary | 40.8 | 60.3 |
| Both | 16.5 | 25.0 |
| \( \chi^2 = 14.89, p = .001 \), Cramer’s V = .30 |

**Better to get exercise**

| **Better to get exercise** | | |
| Sedentary | 8.8 | 13.2 |
| Nonsedentary | 87.3 | 82.4 |
| Both | 3.9 | 4.4 |
| \( \chi^2 = 0.89, ns \), Cramer’s V = .07 |

**How much exercise do you get from VG playing?**

| **How much exercise do you get from VG playing?** | | |
| Very much | 2.9 | 16.2 |
| Some | 14.3 | 23.5 |
| A little | 30.5 | 36.8 |
| None | 52.4 | 23.5 |
| \( \chi^2 = 19.88, p < .001 \), Cramer’s V = .34 |
Examining Video Game Use Associations with BMI

To begin to test H1, the percentile chart developed by the Centers for Disease Control and Prevention (CDC; 2012) was used to classify respondents into underweight, average, and overweight categories based on their BMI and their sex and age. No differences occurred within these groups with regard to proportion of their gaming time spent on sedentary games (or, inversely, on nonsedentary/active games), although the means were arrayed in the direction predicted in H1 (see Table 3). Similarly, there was no evidence of a correlation between respondents’ BMI and the proportion of their video gaming time they devoted to sedentary (or, again, by definition to nonsedentary/active) games, r = .096, p = .24, ns. The lack of correlation occurred, as well, when the sample was divided by sex, when the respondents who did not play video games at all or who did not own a video game console were removed from the analysis, and when age was taken into account. On the other hand, in an additional analysis, respondents were categorized into those who spend less than 50% of their gaming time on sedentary games (n = 46) and those who spend more than 50% (n = 104). The mean BMI among those in the former group was 19.15 (SD = 2.28), whereas the mean BMI among those in the latter group was 20.03 (SD = 3.08), t = −1.95, p = .054. Despite this result, however, on balance, H1 must be rejected.

Results pertaining to the first research question, regarding the potential for overall amount of time spent with video games to correspond with BMI, were also not in support of such an association. In general, the higher the overall amount of time a respondent spent playing video games, the higher the percentage of that time was spent with sedentary games (r = .49, p < .001) and, of course, conversely, the lower the percentage of that time that was spent with nonsedentary/active games, r = −.49, p < .001. Thus, type of game use was associated with greater overall use of video games, and traditional, sedentary games claimed the largest proportions of respondents’ time. However, the correlation between number of minutes played per video gaming session and BMI was not significant (r = −.06, ns in the entire sample, r = −.04, ns among those who own a video gaming console), nor was there evidence of any association between amount of playing and respondents’ BMI.

Associations With Other Forms of Exercise

First, the results showed that respondents with higher physical activity levels did have a lower BMI, an important validity check in the data. Those who self-reported engaging in exercise or sports regularly had a mean BMI of 19.60 (SD = 2.83), whereas those who self-reported that they did not so engage had a mean BMI of 21.24 (SD = 3.34), t = −2.15, p < .05.
Interestingly, among those who did exercise or play sports regularly, 68% of their gaming time was devoted to sedentary games (32% to nonsedentary/active, $SD = 30.72$). Among those who did not exercise or play sports regularly, a smaller percentage of their gaming time, 54%, was devoted to sedentary games (46% nonsedentary/active, $SD = 33.45$). The difference approached statistical significance, $t = 1.92, p = .06$, and thus there was no reason to conclude, based on these data, that those who spend more of their gaming time with sedentary games have more generally sedentary lifestyles, extending to sports participation or exercise.

There were no differences between those who reported regular activity in sports and exercise and those who did not, in how many minutes they spent gaming in each session (Yes Exercise, $M = 77.38, SD = 60.78$; No Exercise, $M = 95.00, SD = 115.63, t = -1.05, ns$). There was a slight difference in how often respondents played games in general for those who reported they did exercise regularly (Yes Exercise, $M = 4.14, SD = 1.86$) compared with those who reported they did not (No Exercise, $M = 3.40, SD = 1.66$), but the means were in the opposite direction from what would be predicted by a media effect, and the probability level merely approached statistical significance ($t = 1.83, p = .08$).

**Discussion**

Childhood obesity in the United States and other places around the world is vitally important, as it is a contributing factor to many of the health risks that young people face today (Hedley et al., 2004). Much has been made of the potential for newer forms of video games to use motion controllers to expend energy while gaming and therefore to have positive implications for weight- and adiposity-based health risks (Barnett et al., 2011; Biddiss & Irwin, 2010). Conversely, time spent with the still-popular, more traditional form of games in which the user typically sits and merely activates buttons on a hand-held controller may have negative implications for maintaining a healthy BMI, and thus be associated with higher health risks (Daley, 2009), and, indeed, “screen time” more generally defined to include television and DVD viewing as well as sedentary video and computer gaming has been found to be associated negatively with physical activity levels (Eisenmann et al., 2002; Tammelin et al., 2007). However, the current study showed that in this sample of affluent teenagers, there was little evidence for a link between time spent with video games in general – or relative amount of time spent with active versus sedentary games – and BMI. One analysis showed evidence of a nonlinear association between BMI and spending 50% or more of one’s time with sedentary games, yet there were no linear associations detected in correlation analyses nor any differences seen in proportions of time spent with active versus sedentary games among those classified according to CDC charts as overweight, average, or underweight by BMI score.

Furthermore, in the current sample, neither type of video game (active versus sedentary) use nor overall amount of video game use corresponded with the likelihood of the respondent engaging in regular exercise or sports activities. In fact, there was a trend approaching significance in the opposite direction.

Perhaps the lack of support for associations between sedentary versus active gaming or overall amount of video game use and BMI is not surprising in the context of the prior literature. A handful of prior analyses had suggested regular use of active games in the home can be modestly associated with physical activity during gaming and therefore, presumably, with associated health benefits (Chin A Paw et al., 2008; Maloney et al., 2008; McDougall & Duncan, 2008; Mhurchu et al., 2008) or that active video game playing adolescents are more likely to comply with recommendations for physical activity (Simons et al., 2012). One prior study found that video game use positively predicted adolescents’ BMI when adjusting for ethnicity and SES (McMurray et al., 2000). Yet, other studies have found screen time, in general (as opposed to video gaming time or active video gaming time) to be unrelated to physical activity levels (Rideout et al., 2010; Taversas et al., 2007), adiposity (Danielzik et al., 2004; Purslow et al., 2008), or obesity (Rey-Lopez et al., 2008). And still others have found the role of screen time to be moderated by overall physical activity levels among youths (Ortega et al., 2007; Steele et al., 2009; Yen et al., 2009) or found the role of time spent with video games to be outweighed by time spent with television in associations with BMI (Morgenstern et al., 2009). And in perhaps the closest parallel to the study at hand, among Canadian adolescents, O’Loughlin et al. (2012) found no differences in BMI among regular active video game users compared with infrequent active video game users.

Furthermore, more recent studies have found young people do not necessarily use active video games much, even if they have access to them, and the use of those games tends to decline over time (Baranowski et al., 2012; Barnett et al., 2011; Simons et al., 2012). Indeed, sedentary games dominated the video game playing time among the current sample of adolescents. Still other studies have called into question the amount of intensity of physical activity that is achieved across multiple types and titles of ostensibly active games (Barnett et al., 2011) or games played with motion controllers (Lyons et al., 2011). Finally, there is the potential for young people’s attitudes toward particular types of games to be an obstacle to their use in maintaining a healthy BMI, since sedentary games have been deemed to be more fun than active games among 18- to 35-year-olds in prior research (Lyons et al., 2011) and among the adolescent boys in the current sample. The prior evidence points to the role of physical activity in achieving and maintaining a healthy weight (Janssen et al., 2005; Klein-Platat et al., 2005), and the critical issue appears to be the ability of the nonsedentary/active games to allow for considerable energy expenditure on a day-to-day basis (Barnett et al., 2011; Biddiss & Irwin, 2010).

If there is a health benefit in the association with energy expenditure through nonsedentary/active games,
the prevailing conclusion according to the current data is that girls are more likely to gain this benefit than boys. Similar to O’Loughlin and colleagues’ (2012) findings in Canada (but contrary to Simons and colleagues’, 2012, findings in The Netherlands), girls in the current sample spent more of their gaming time playing nonsedentary/active games than boys. They also reported using games specifically for exercising more, and perceived that they got more exercise from games than boys. They expressed opinions that looked much more favorably on nonsedentary/active games than on sedentary games, rating them more realistic, more exciting, more challenging, and better to play in groups more than boys did, in contrast with prior studies showing greater affinity toward video games in general among males (Hartmann & Klimmt, 2006; Lucas & Sherry, 2004). In fact, since prior research has found that being “fun” is the top reason kids engage in physical activity (Epstein et al., 2007), it is important to point out that girls in this sample found nonsedentary/active games more fun than sedentary, but boys expressed the opposite view. To have health benefits across sexes, therefore, nonsedentary/active games will have to increase their appeal to adolescent males. Based on the results of their meta-analysis, Barnett and colleagues (2011) have similarly concluded that “If PA (physical activity) benefits are to be achieved, consideration of the motivations that attract players to video games and sustain their involvement should be an important part of future AVG (active video game) design” (p. 734).

The overall lack of support for video gaming – active or sedentary – being associated with adolescents’ BMI raises the question of what factors do predict tendencies toward overweight or obesity among young people. In a longitudinal study following adolescent girls over a period of 4 years, Stice, Presnell, Shaw, and Rohde (2005) found depressive symptoms, perceived parental obesity, self-reported dietary restraint, and “radical weight-control behaviors” (which included induced vomiting and abuse of laxatives) each predicted obesity onset. As mentioned above, SES is also a risk factor and is associated with high fat intake and low consumption of fruits and vegetables (Krebs-Smith et al., 1996). Other risk factors for child or adolescent obesity are parental food preferences (Fisher & Birch, 1995; Ray & Klesges, 1993) and short sleep patterns (Nixon et al., 2008). It is possible in this case, therefore, that any potential role of time spent with video games being associated with BMI is overshadowed by these other factors.

There are important limitations to consider when interpreting the results of this study. First, the sample was limited to a single, affluent location and the respondents themselves were rather racially and socioeconomically homogenous. Although the BMI distribution of the current sample approximated national averages, and there is little reason to suspect differences in amount or type (active versus non) of gaming by income in adolescents (Common Sense Media, 2011; O’Loughlin et al., 2012; Roberts et al., 2005), future research in this area should employ a more diverse sample, especially because low-income youth are at a greater risk for being overweight (Ogden et al., 2010). Second, there are limitations associated with operationalization of variables. Some concepts – including participation in sports/physical activity outside of gaming – relied on a single item for operationalization, some were measured at nominal or ordinal levels, and still other potentially important variables in adolescents’ time use – including time spent with television and other media forms – were not measured in the current study at all, due to limits on the time available for survey administration during the adolescents’ school day. Also, there is debate regarding the best way to measure a tendency toward overweight and obesity, with competing measures – not used here, given the self-report nature of the methodology and associated limitations of time – including waist circumference or adiposity. Self-report is also a limitation, although psychometric studies have largely substantiated the use of adolescents’ self-report of video game exposure (Fikkers et al., 2012; Kronenberger et al., 2005; Van Schie & Wiegman, 1997) and of height and weight (Sherry et al., 2007). Finally, future research should advance more precise measures of sedentary and nonsedentary/active games, in which, perhaps, games are arrayed on a continuum rather than categorized as simply active or sedentary, and thus avoid the pitfalls associated with varying intensity of exertion within “active” games. Indeed, the devotion of time to different types of video games could be measured in future research, as well, by asking respondents to list their favorite games and classifying those games according to physical exertion required.

Nonetheless, the results of the study most certainly raise the issue of additional analyses to further explore these critical issues. With video game use continuing to rise among young people in the United States (Rideout et al., 2010) and with important distinctions within the medium itself (i.e., sedentary versus nonsedentary/active uses) that have potential implications for health, it is essential to devote research attention to video games. Nonsedentary games, which generally require the user to engage more physically and actively in the game, are still largely a new type of media, and one that is continuing to grow, as interactive platforms for Nintendo, Xbox, and PlayStation consoles are enjoying massive popularity and record sales, and additional research is necessary to fully understand their implications for public health.

References


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