

Correlates of video game screen time among males: Body mass, physical activity, and other media use

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ABSTRACT

This study examined the correlations between media use, body mass variables, and physical activity among 116 male undergraduates (white $n = 106$; African American $n = 5$, Latin American $n = 1$, Asian American $n = 2$, and 2 others). Length of video game play during one sitting was positively related to body mass index (BMI; $r = .27, p < .01$) and negatively correlated with frequency of exercise ($r = -.21, p < .05$) and days of walking ($r = -.22, p < .05$). Frequency of video game play was negatively correlated with length of exercising ($r = -.21, p < .05$). Years of video game play was negatively correlated with length of exercise ($r = -.21, p < .05$). These results were stronger among those who play online games. Hierarchical regression analyses indicated that video game use predicted BMI, accounting for 6.9% of the variance. The implications of the results are discussed.

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1. Literature review

Video game play is a ubiquitous activity in industrialized countries, particularly among males (Nielson Company, 2007; Yee, 2006). Research on the correlates and experimental impact of video game play primarily has focused on aggression (see Ballard, Hamby, Panee, & Engold, 2006 for a review). This study examines video game play among males in relation to body mass index, body fat percent, physical activity, and sedentary behavior. The link between media use and physical health correlates has been examined mostly in regards to television (TV), as until recently there have been higher rates of access for TV than video games (Motl, McAuley, Birbaum, & Lytle, 2006). Now most males (66%) in the U.S. have a video game console in the home and this rate is higher (88%) for teens (Nielson Company, 2007). Males spend significantly more time playing games than females (e.g., Roberts & Foehr, 2004).

Given the increasing use of video games, it is important to examine their potential health effects (Brown & Witherspoon, 2002). Media use is a risk factor for obesity across age groups (Jago, Baranowski,

Baranowski, Thompson, & Greaves, 2005; Proctor, Moore, Gao, Cupples, Bradlee, Hood et al., 2003; Thomson, Spence, Raine, & Laing, 2008). Obesity has increased steadily in developed countries over the last 20 years (Center for Disease Control (CDC), 2006). In the U.S., 15.5% of children, 15.3% of adolescents, and 30.5% of adults are classified as obese and even more are overweight (American Obesity Association (AOA), 2005).

While biological factors play a role in an individual's weight retention, much of the recent increase in obesity seems attributable to the fact that many Americans have increased their caloric consumption, but decreased their energy expenditure (Hill, Catenacci, & Wyatt, 2005). Physical activity may be declining because people are replacing physical activity with sedentary behaviors such as media use (Keim, Blanton, & Kretsch, 2004; Nelson, Gortmaker, Subramanian, Cheung, & Wechster, 2007). Few American adults (22%) engage in the recommended amount of physical activity, most (53%) do not participate in regular physical activity and many (25%) are not active at all (CDC, 2006). This is alarming as physical inactivity and obesity increase the risk of a host of health problems including diabetes, cardiovascular diseases, high cholesterol, and cancer (e.g., AOA, 2005; Hill et al., 2005). Psychological and social problems are also correlated with obesity across the lifespan (Medline Plus, 2006).

Most studies indicate that higher rates of media use are related to a greater likelihood of being overweight or obese (Gorely, Marshall, & Biddle, 2004; Heelan & Eisenmann, 2006; Jago et al., 2005; Nelson et al., 2007; Parsons, Power, & Manor, 2005; Proctor et al., 2003). Three mechanisms are hypothesized to explain why media use increases the likelihood of obesity (a) time displacement from physical activity,

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(b) increased caloric intake, and/or (c) decreased metabolic rate (Vandewater, Shim, & Caplovitz, 2004). The research examining these hypotheses is summarized below. Since most of the research to date has examined TV, that medium is the focus of this review. However, due to the more active and engaging nature of video games, the displacement hypothesis is the most relevant to this study.

There are several reasons why media use may displace time that might be spent in other activities. Video game players may experience a sense of flow (i.e., pleasurable immersion in everyday activities) and lose track of time (e.g., Sherry, 2004). Or, excessive use of media might be symptomatic of psychopathology, such as depression (Shaffer, Hall, & Vander Bilt, 2000). Regardless of the reasons for media use, there is mixed evidence as to if media use displaces time that might otherwise be spent in physical activity. Motl et al. (2006) and Vandewater et al. (2004) found significant negative correlations between TV screen time and activity among adolescents. Lowry, Wechsler, Galuska, Fulton, and Kann (2002) found that time spent watching TV was significantly negatively related to physical activity and significantly positively correlated with weight. However, the latter effect was strongest among females. Others (Koezuka, Koo, Allison, Adlaf, Dwyer et al., 2006; Oppert, Kettaneh, Borys, Basdevant, Ducimetiere et al., 2005) report similar findings.

Some studies failed to indicate a negative relationship between media use and physical activity (e.g., Laurson, Eisenmann, & Moore, 2008; Parsons et al., 2005). Snoek, van Strein, Janssens, and Engels (2006) found a significant positive correlation between TV screen time and physical activity for undergraduates and Hagar (2006) found no relationship between TV screen time and physical activity after controlling for gender and BMI. Thus, the literature is unclear as to the impact of media use on physical activity. Lanningham-Foster et al. (2006) argue that most individuals are likely to replace media use with other sedentary behaviors rather than with more physically demanding activities. There is evidence that heavy users of one media type also tend to use other types of media heavily (Roberts & Foehr, 2004).

The second hypothesis posited to explain a relationship between media use and obesity is the “couch potato hypothesis,” which suggests that caloric intake increases during media screen time (Brown & Witherspoon, 2002; Snoek et al., 2006; Thomson et al., 2008; Van de Bulck, 2000). This hypothesis has only been examined with regard to television. Studies indicate that TV screen time is related to increased snacking, particularly in regard to energy dense (high in fat and/or sugar) snack foods and high calorie drinks (Gore, Foster, DiLillo, Kirk, & West, 2003; Snoek et al., 2006; Thomson et al., 2008; Van de Bulck, 2000). TV advertisements that promote high fat foods that are low in nutritional value are common (Powell, Szczypka, & Chaloupka, 2007; Thomson et al., 2008; Vandewater et al., 2004). Since product promotions are now linked to video games, this concern might generalize. People also eat meals while watching TV. Thus, while a significant portion of children’s daily caloric intake takes place in front of the TV screen, very little (<1%) of their caloric intake takes place while playing video games (Matheson, Killen, Wang, Varady, & Robinson, 2004; Roberts & Foehr, 2004). Thus, we do not focus on this hypothesis in the present study.

The third hypothesis regarding the association between media use and obesity posits that screen time results in decreases in metabolic rate (e.g., Klesges, Shelton, & Klesges). The only study examining this hypothesis was conducted by Klesges, Shelton, and Klesges (1993). This experiment found that regardless of weight status, metabolic rate decreases during TV viewing. Research on video games suggests that game play actually increases physiological arousal and metabolic function (Ballard et al., 2006; Mark & Janssen, 2008; Wang & Perry, 2006).

The relation between video game play and correlates of physical health is relatively unexplored, particularly among adults. We focus on individuals in emerging adulthood because (a) there has been a

dramatic increase in the number of adult gamers (Griffiths, Davies, & Chappell, 2003; Yee, 2006) and (b) there is a sharp increase in obesity in emerging and early adulthood. Prevalence rates of obesity increase by 17.7% from ages 18 to 29 years and by 24.4% from ages 30 to 39 years (Blanck, Dietz, Galuska, Gillespie, Hamre et al., 2006; CDC, 2006). We are focusing on male participants as males play video games substantially more than females (e.g., Nielson Company, 2007; Yee, 2006) and rates of obesity are higher among males in emerging adulthood (Nelson et al., 2007).

1.1. Statement of problem and hypotheses

This study tests the hypothesis that media use displaces time for physical activity. We focus on this hypothesis as it is the most likely to explain an association between video game play and obesity. We hypothesize that the amount of video game use will be significantly positively related to BMI and body fat percentage and negatively correlated with physical activity. We also expected that those who play more video games also engage in more use of other media.

2. Methods

2.1. Participants

Participants included 116 male students (*M* age = 19.54; ethnicity: white *n* = 106; African American *n* = 5, Latino *n* = 1, Asian American *n* = 2, and 2 others). Most (72%) participants were non-smokers. Some (32%) participants self-reported that they are athletes. Most of the participants volunteered for the study by signing up for a computerized participant pool that offered them opportunities for research participation in the Psychology Department at Appalachian State University; they received either extra credit or 1 h of course research credit. They had several options to obtain course credit. Some participants were recruited through the University Gaming Club; however, they did not receive credit for participating. All participants volunteered freely and had the right to withdraw from the study at any time without penalty.

2.2. Measures

2.2.1. International Physical Activity Questionnaire

The short form of the International Physical Activity Questionnaire (IPAQ, 2006) was administered. Seven self-report questions evaluate the number of days and amount of time spent in vigorous physical activity, moderate physical activity, and walking that the participant had engaged in over the last 7 days. Vigorous activities are defined as those that “take hard physical effort and make you breathe much harder than normal.” Examples include heavy lifting, digging, aerobics, or fast bicycling for at least 10 min. Moderate activities are defined as those that “take moderate physical effort and make you breathe somewhat harder than normal.” Examples include carrying light loads and bicycling at a regular pace for at least 10 min. Information about walking was gathered in a separate item. Test-retest reliability for the IPAQ is strong (Spearman Rho [r^2] = .80; IPAQ, 2006).

2.2.2. Activity survey

Participants completed a 9-item self-report activity survey to measure the amount of time spent involved in sedentary behaviors (i.e., playing video games, reading, watching TV) and in exercise. Participants rated their familiarity with video game play on a Likert scale from 1 (never play) to 10 (heavy gamer). Participants reported the frequency of their use of video games, TV, reading, and exercise using the following scale: (1) I never participate in this activity, (2) I participate in this activity less than once a month, (3) I participate in this activity about once a month, (4) I participate in this activity a

Table 1
Percentage of participants reporting physical activity.

Frequency of exercise	Vigorous	Moderate	Walking
No days per week	15.5%	18.1%	5.2%
One day per week	8.8	11.2	0.0
Two days per week	13.8	15.5	1.7
Three days per week	25.7	15.5	5.2
Four days per week	14.7	7.8	4.3
Five days per week	10.3	12.9	13.8
Six days per week	5.2	5.2	9.5
Seven days per week	6.0	13.8	59.5

couple times a month, (5) I participate in this activity about once a week, (6) I participate in this activity about 2 or 3 times a week, (7) I participate in this activity about 4 or 5 times a week, (8) I participate in this activity almost every day. For each activity, the participant reported the number of minutes that they typically remain engaged in the activity during one sitting. We also gathered data on use of particular genres of games (e.g., sports, massively-multiplayer online role-playing games (MMORPGs), first person shooters). This measure was constructed for this study, so there is no reliability data.

2.2.3. Height and weight

Each participant's height was measured using a standard tape measure mounted to the wall. The Taylor Body Fat Analyzer and Scale Model 5563 (Taylor Precision Products, 2004) was used to obtain weight and body fat percentage. Each participant's height, age, sex and self-reported athletic status (athlete or non-athlete) were entered into the scale. "Athlete" was defined in the Taylor instruction manual as 10 h of aerobic and/or anaerobic exercise per week. The scale uses bioelectrical impedance analysis (BIA), which sends a harmless electrical signal through fat and muscle of the body, to assess body fat percent and body water percent; the measure is accurate to 0.5% (Taylor Precision Products, 2004). Test-retest reliability of BIA measures is high among young adult males ($r = .96$; Dittmar, 2003). BIA is considered a more precise measurement of fat than BMI (Roubenoff, Dallal, & Wilson, 1995). We used both the BIA fat analysis and BMI in the data analyses. BMI was calculated using the formula: $\text{wt in lbs} \times 703 \div \text{ht in in}^2$ ($\text{wt in kg} \times 703 \div \text{ht in m}^2$).

2.3. Procedures

Small group sessions (1–9 participants) were conducted in a classroom by a female research assistant (RA). Participants were instructed of the aims and procedures of the study. Informed consent was obtained. Participants completed a demographic form and a counterbalanced packet of questionnaires. Afterwards, each participant was individually escorted to the lab by a male RA. Participants removed their shoes and socks and were confidentially measured for height, weight, and body fat percentage. Measurements were recorded by the male RA. Participants, except for the members of the gaming club, were given a research credit slip, their questions were answered, and they were thanked for participating. The procedure took 45 min to complete.

3. Results

The primary data analyses consisted of Pearson correlation and linear regression analyses. These analyses are described following the descriptive statistics.

3.1. Descriptive statistics

3.1.1. Time spent on physical activities

Data regarding physical activity was gathered from the activity survey and the IPAQ. Reported frequency of exercising among

participants was relatively high: 27.6% of participants reported exercising almost every day, 21.6% reported exercising 4–5 times per week, and 31% reported exercising 2–3 times per week; only 18% reported exercising only once per month or less. Specific data regarding vigorous activity, moderate activity, and walking are reported in Table 1.

3.1.2. Media use

Frequency of playing video games, watching TV/DVDs/etc., and reading is reported in Table 2. On average, participants rated their familiarity of video games based on a scale of 1 (never play) to 10 (heavy gamer) as $M = 6.47$ ($SD = 2.19$). Participants had played video games for an average of 11.43 years ($SD = 6.08$). The mean amount of time playing video games during one sitting was just over an hour ($M = 63.36$ min, $SD = 41.03$). The mean amount of time playing video games during one sitting was just over an hour ($M = 63.36$ min, $SD = 41.03$). Participants reported frequent engagement in other media use (see Table 2). The typical length for a session of reading was about an hour ($M = 57.93$ min, $SD = 45.98$). Average view time for TV/DVDs/etc. was 77.81 min ($SD = 36.67$) per week.

3.1.3. Height and weight data

Participants ranged in height from 5'5" to 6'4" ($M = 6'1\frac{1}{2}$ "; $SD = 2.54$). Participants ranged in weight from 119 to 360 lbs ($M = 180$ lbs; $SD = 39.02$). BMI ranged from 16.65 to 49.50 ($M = 25.36$; $SD = 5.35$). According to the criteria set by the AOA (2005), a BMI score of <20 is classified as underweight, BMI of 20.1–25 as normal weight, BMI of 25.1–29.9 as overweight, and BMI >30 as obese. Based on these criteria 51.4% of participants were of normal weight, 9.5% were underweight, 23.3% were overweight, and 15.6% were obese.

3.2. Correlational analyses

3.2.1. Overview

Pearson correlation coefficients were computed between each participant's body fat, BMI, sedentary behavior, and physical activity. A subset of these data was used to test the hypotheses. A complete correlation matrix is provided in Table 3 for the convenience of the reader. We focus on the correlations that examine the hypotheses that the amount of video game play is (a) significantly positively related to BMI and BIA, (b) negatively correlated with physical activity, and (c) positively correlated with other media use.

3.2.2. Video game play, BMI, BIA, and exercise variables

BMI and BIA were weakly but significantly related to one another ($r = .21, p < .05$). Likewise, there were small but significant correlations between game play variables, BMI, and BIA. Frequency of video game play was not significantly related to either measure, but length of video game play during one sitting was significantly, positively related to BMI ($r = .27, p < .01$). In exploratory analyses examining particular types of game play, we found that the frequency of MMORPG play

Table 2
Percentage of participants reporting media use.

Media type	Video games	TV/DVDs	Reading for fun
<i>Frequency of use</i>			
Never	.9	.9	6.9
Less than once a month	6.0	1.7	6.9
About once a month	2.6	.9	14.7
A few times a month	12.9	4.3	13.8
About once a week	11.2	6.9	10.3
2–3 times per week	25.9	16.4	23.3
4–5 times per week	17.2	19.8	5.2
Almost every day	22.4	49.1	19.0

Table 3

Pearson correlation coefficients between BMI, body fat percent, video game play variables, and exercise variables.

	1	2	3	4	5	6	7	8	9
1–BMI	–	.21#	.14	.27*	.06	–.19*	–.08	–.01	–.17
2–Body fat %	.21#	–	.11	.15	.03	–.11	–.08	–.20#	–.18
3–Frequency of game play	.14	.11	–	.28*	.40**	.00	–.21#	–.02	–.07
4–Length of game play	.27*	.15	.28*	–	.03	–.21#	–.06	–.15	–.22#
5–Years of play	.06	.03	.40**	.03	–	.08	–.21#	–.14	.02
6–Frequency of exercise	–.19*	–.11	.00	–.21#	.08	–	.35**	.26*	–.07
7–Length of exercise	–.08	–.08	–.21#	–.06	–.21#	.35**	–	.13	.00
8–Days of moderate activity	–.01	–.20#	–.02	–.15	.14	.26*	.13	–	.18
9–Days of walking	–.17	–.18	–.07	–.22#	.02	–.07	.00	.18	–

$p < .05$, * $p < .01$, ** $p < .001$.

(e.g., World of Warcraft) was significantly positively correlated with BMI ($r = .29$, $p < .01$). No other genre was related to BMI or BIA.

Several small but significant correlations were found between measures of video game play and physical activity. Frequency of video game play was significantly negatively correlated with length of exercising ($r = -.21$, $p < .05$). Length of video game play during one sitting was significantly negatively correlated with both frequency of exercise ($r = -.21$, $p < .05$) and days of walking ($r = -.22$, $p < .05$). In exploratory analyses examining specific genres of game play, we found that the frequency of playing sports games was significantly, positively related to the frequency of exercise ($r = .23$, $p < .05$) and days of vigorous physical activity ($r = .27$, $p < .01$). Conversely, length of playing MMORPG games was significantly, negatively related with frequency of exercise ($r = -.49$, $p < .01$). No other specific genre was significantly related to exercise variables.

While not related to the hypotheses, we found a few weak but significant correlations between BMI, BIA, and exercise variables. BMI was significantly negatively correlated with frequency of exercising ($r = -.19$, $p < .05$) but was not significantly correlated with any of the other activity variables. BIA was significantly negatively correlated with days of moderate physical activity ($r = -.20$, $p < .05$) but was not significantly correlated with any of the other activity variables.

3.2.3. Other media use correlations

We also examined if video game play was correlated with other media use: this is important to help test the displacement hypothesis. We found that frequency of video game play was not related to the use of other media (i.e., reading for enjoyment or watching TV, DVDs, etc.). However, length of video game play during one sitting was significantly, positively related to time spent reading for enjoyment ($r = .59$, $p < .001$) and significantly, but negatively related to watching TV, DVD, VHS, or films ($r = -.29$, $p < .01$). Neither reading nor watching video media was significantly correlated with BMI or BIA.

3.3. Regression analyses

Three hierarchical regression analyses were used to further examine the relationship between media use, BMI, and exercise. In the first regression, BMI served as the dependent variable. Frequency of exercising, length of exercising and frequency of using non-game visual media (TV, DVDs, etc.) were entered as predictor variables in the first step; duration of game play in a typical session and frequency of game play were added in the second step. The factors in step one did not account for a significant amount of the variance. However, after controlling for these factors, video game use predicted BMI, accounting for 6.9% of the variance. See Table 4 for summary data. In terms of individual coefficients, duration of typical game session was significant ($\beta = .31$, $p < .05$).

In the second regression, frequency of exercise served as the dependent factor. Frequency of using non-game visual media (TV, DVDs, etc.) was entered as a predictor variable in the first step; duration of game play in a typical session and frequency of game play

were added in the second step. Of these, only frequency of watching visual media (TV, DVDs, films, etc.) predicted the frequency of exercise, accounting for 5.6% of the variance ($\beta = .24$). See Table 3 for summary data.

Duration of typical exercise session served as the dependent variable in the third regression. Frequency of using non-game visual media (TV, DVDs, etc.) was entered as a predictor variable in the first step; duration of game play in a typical session and frequency of game play were added in the second step. None of the predictors accounted for a significant amount of the variance in duration of typical exercise session.

Finally, for those who were MMORPG players ($n = 26$), a curve estimation regression was calculated using BMI as the predictor variable and a composite of the frequency and duration of MMORPG play as the independent variable. This regression was significant ($R^2 = .22$, $F(1,24) = 6.52$, $p < .05$). See Fig. 1 for the regression line.

4. Discussion

The primary goal of this study was to examine the relationship between video game use and BMI, exercise, and other media use. We hypothesized that the video game use would be (a) significantly positively related to BMI, (b) negatively correlated with physical activity, and (c) positively correlated with other media use.

These hypotheses were partially supported. Those who typically engaged in longer sessions of video game play did have higher BMI. The strongest correlations were between BMI and MMORPG play. Further, while the frequency and duration of video game play in general were negatively correlated with at least one exercise variable, this effect was stronger among MMORPG players. Thus MMORPG play was more strongly correlated with both higher body mass and lower levels of exercise than other types of game play. In addition, playing more sports games was related to exercising more.

Table 4

Regression tables for BMI and frequency of exercise.

Dependent variable: BMI	R	R ²	Adj. R ²	F change	p value ^a	Unique Var.
Model 1: Watching TV/DVDs + Length of Exercising + Frequency of exercising	.18	.03	.00	1.14	.34	2.1%
Model 2 (Model 1 +): Frequency of video game use + Length of average sitting of video game play	.32	.10	.06	4.08	.02	6.9%
Dependent variable: Frequency of exercising	R	R ²	Adj. R ²	F change	p value ^a	Unique Var.
Model 1: Watching TV/DVDs	.24	.06	.05	6.73	.01	5.6%
Model 2 (Model 1 +): Frequency of video game use + Length of average sitting of video game play	.28	.08	.06	1.42	.25	2.4%

^a Significance of the F change.

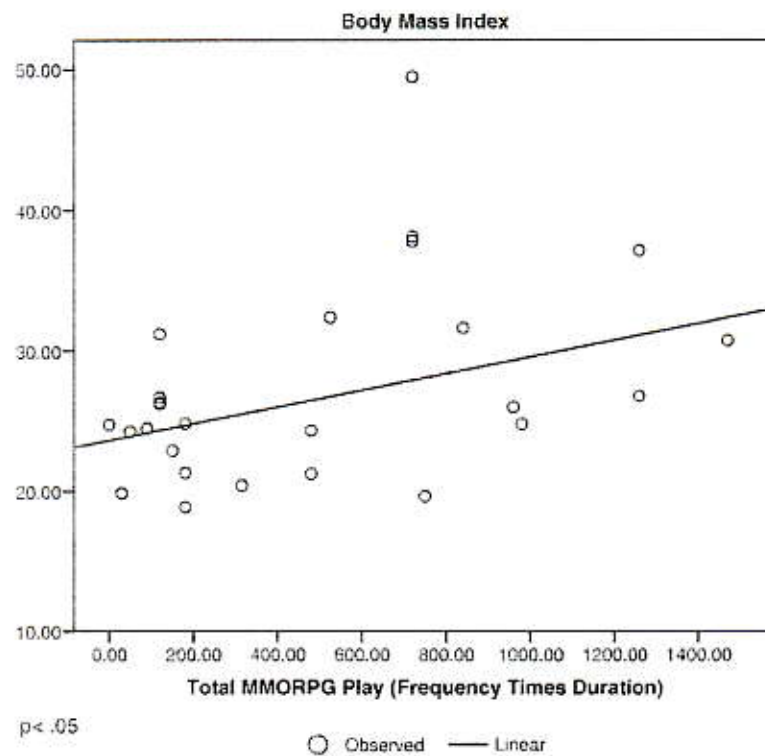


Fig. 1. Regression of total MMORPG play (frequency \times duration) on BMI. (Please note that due to the apparent impossibility of embedding landscape-oriented pages in between portrait-oriented pages in Word, Tables 3 and 4 follow the figure.)

These findings suggest that it is not video game play per se that is related to health factors, but that specific types of game play interact differentially with aspects of health. There might be several explanations for these findings. Perhaps one's motivation for playing video games mediates the relationship with other factors, such as eating or exercise. There may also be individual differences in personality, sociability, or activity preferences in those who choose to play games online, as opposed to those who mostly play console games that mediate the relationships between game play, BMI, and physical activity. Or, contextual factors related to different types of gaming might factor in. For example, time spent playing a lengthy session of online computer games, which often move slowly and are controlled with one hand, is more conducive to snacking than playing console games, which require rapid manipulation of a controller using both hands. Further, sessions of online play tend to be longer than sessions of console play and may be more likely to interfere with other activities.

Not all media use predicted lower levels of exercise. In fact, the frequency of watching visual media (TV/DVDs) was actually the best predictor of exercise. This is consistent with a finding by Snoek et al. (2006), who found a significant positive correlation between TV screen time and physical activity for undergraduates. This finding is likely related to the failure to find significant relations between body mass and visual media use in this population of participants.

The final hypothesis, that as video game play increased other media use would also increase, was supported only in terms of time spent reading. The amount of time spent playing video games during one sitting was negatively related to the frequency of watching TV or movies. Thus, time spent reading and playing video games might displace time for other visual media.

Overall, our results suggest that high levels of game play are related to lower levels of exercise and higher body mass. Given that our participants are young adults, this is concerning, as the health and exercise habits developed in emerging adulthood are tied to exercise

habits and health status as adulthood progresses (e.g., Seidell, Nooyens, & Visscher, 2005). However, these results suggest that there is not a simple effect of media use displacing time that might otherwise be spent exercising, as Vandewater et al. (2004) suggest. Our results indicate that people may displace one type of media use with another and that different game genres may displace activities differentially. For example, there was a stronger negative correlation between MMORPG play and exercise than game play as a whole. Further, playing sports games was related to increased levels of exercise. Choice of genre may reflect other underlying individual differences. Those who play sports games may have a more inherent interest in physical activities. On the other hand, MMORPG players are more introverted and less open to new experiences (Ballard, Noggle, Reilly, & Gray, 2008) and become so involved in their games that they make sacrifices in other areas of their lives (Yee, 2006). So, they may either be less inclined to exercise or more willing to sacrifice exercise to have more time to play games.

There are a few potential limitations of the study. First, as the participants consisted of only male college students, generalizability is limited. Second, there are inherent problems with retrospective self-report data; however, the measures used were relatively reliable. Finally, the correlational nature of the study precludes making causal statements regarding the relationship between video game play and body mass and exercise. Future studies could address these limitations by having participants maintain a log of video game play, eating (including snacking), and exercise. Longitudinal studies could be used to examine how video game use and health factors such as physical activity, media use, and weight status change over time.

Research should also focus on interventions aimed at implementing healthier approaches to media use. Lanningham-Foster et al. (2006) suggest that most individuals are not going to replace media with more physically demanding activities. Therefore, it is important for health care professionals and game designers to link media and physical activity together through mediums such as interactive

gaming. Physically interactive gaming devices can replace sedentary gaming with whole body movement. For example, Dance Dance Revolution (DDR) requires players to follow increasingly complex dance patterns on a weight sensitive mat and the Nintendo Wii offers a variety of games (e.g., golf, tennis, and boxing) that require the participant to mimic the motions of each activity with a hand-held remote (Nintendo Wii, 2007). Several studies have found significantly higher energy expenditure and/or physiological reactivity during these more active types of video game play than during more sedentary game play (e.g., Exner, Papatheodorou, Baker, Verdager, Hluchan, & Calvert, 2009; Lanningham-Foster et al., 2006; Linnithan, Houser, & Fernhall, 2006). Thus, while real exercise is preferable, virtual activities are better than sedentary activity and might create increased interest in real activities (University of Michigan Health System, 2008; Mhurchu, Maddison, Jiang, Jull, Prapavessis, & Rodgers, 2008; Maddison, Mhurchu, Jull, Jiang, Prapavessis, & Rodgers, 2007).

In conclusion, our results indicate that the amount of video game screen time is related to body mass variables and physical activity. Thus, excessive video game play could be related to health risks. This seems even more likely of excessive MMORPG play. Regardless, since obesity is a growing problem, parents and educators should aim to foster increased physical activity among children; decreasing the amount of time allowed for media screen time and encouraging more active behaviors would likely have beneficial effects.

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Contributors

All of the authors contributed to the design of the study and to collecting data. Dr. Ballard and Melissa Gray conducted literature searches and Melissa Gray provided a summary of many of these articles and wrote a rough draft of the literature review. Dr. Ballard conducted the statistical analysis, wrote the formal paper, and prepared the manuscript for submission. Jenny Reilly and Matthew Noggle gave feedback on drafts of the submission. All authors contributed to and have approved the final manuscript.

Conflict of Interest

All of the authors declare that they have no conflicts of interest.

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