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Children, video games and physical activity: An exploratory study

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Abstract: Media consumption and video gameplay can contribute to a sedentary lifestyle. Nevertheless, video games may have the potential to actually enhance children's physical activity. *Objective*: To explore the potential of video games to contribute to children's health and physical activity. *Study Group*: Twelve British children (seven female, five male) aged 8-11 years. *Methods*: Th children participated in daily video-game play during school lunch times for one week. Focus group interviews were employed, pre and post the game play week, to examine children's perceptions of video games in relation to physical activity and health. Physical activity was assessed during all game play periods using pedometry and heart rate monitoring. *Results*: Pre the game play period, all children reported that video games had a negative impact on health and physical activity. Post game play, children reported that active video gameplay was an attractive alternative to traditional forms of physical activity that might be more attractive to non-exercisers. The results during the gameplay period revealed that boys and girls accumulated 10% and 11% of the recommended number of steps/day for health and also engaged in an average of 11 minutes (or 46% of the monitoring period) sustained moderate to vigorous physical activity through active video gaming each day. *Conclusions*: Although video games have traditionally been regarded as a negative influence on children's physical activity, active video games may provide a viable alternative to traditional physical activity. Even a short duration of daily active video-game play can contribute significantly to children achieving the recommended daily volume of physical activity.

Keywords: Pedometer, obesity, video games, children

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INTRODUCTION

Participation in regular physical activity has been shown to influence positively a number of chronic diseases in adults, including coronary heart disease, obesity, diabetes, hypertension, and depression (1-2). Increasingly, research findings indicate that these disease processes may originate in childhood (3), and physical activity habits developed in childhood are also likely to track into adult life (4). More recently, research has indicated a clusterting of CHD (coronary heart disease) risk factors in children as young as 9 years old (5), and fatness has been cited as one of the strongest predictors of pediatric CHD risk (6). As the amount of physical activity and obesity are established risk factors for CHD (6), the examination factors that influence young people's physical activity and body fatness has become important in developing interventions aimed at health promotion and understanding how the modern day environment has an impact on children's health.

One particular influence on children's physical activity and health related behavior that has received substantial media and scientific scrutiny is computer and video-game play. Amongst sports science and health practitioners, media-based sedentary behaviors like TV viewing and leisure-time computer use are believed to compete for time that might otherwise be spent in physical activity, which might lead to obesity (7,8). Moreover, children today have been described as not only fatter than previous generations but also less active, less athletically skilled, less interested in physical activity, less self-disciplined (and therefore more likely to choose the 'easy' or 'soft' option, be it with respect to physical activity or food) and more addicted to technology (9). This change has subsequently led researchers to suggest that children's computer/video game behavior should be the subject of further scrutiny when examining health behaviors (7).

Clearly any sedentary activity, if undertaken in excess (whilst exercise is rarely or never taken), is likely to have a detrimental impact on energy expenditure and conversely, any activity (including sport) may have a negative impact on homework if disproportionate time is taken up by the activity and little time is left for study. Ironically, then, swimming could be a contributory factor in academic underachievement and studying could have a harmful impact on physical health. But the concern about video games in particular (as opposed to other activities undertaken in similar contexts) is based on the notion that players become so engrossed/immersed/'addicted' to playing games that they are likely to spend more time on this activity than on any other, if parents do not intervene. More recently, the introduction of active video games like the Nintendo Wii has offered the prospect of video-game play that promotes physical activity and may be useful as an exercise intervention for children who may not be motivated by traditional means of being physically active. Yet, despite the potential of active video-game play to promote physical activity, the efficacy of this mode of activity has not yet been examined by health and exercise practitioners.

Despite this state of affairs, the study of video games from a Media/Cultural studies perspective is reasonably commonplace and may have much to add when considering the role of video games in children's health behavior. This type of investigation may be an important source of information as video games are now being progressively more employed for education, job training, physical exercise, rehabilitation, psychotherapy, and more. Mayra (10) notes that children and adults spend a substantial portion of their life playing games—in many cases, spending more time with games than with television or other media. Games are now an integral part of our societies and lives. Games, therefore, deserve serious attention.

More specifically in relation to this paper, researchers have recently argued for video-game play as a form of 'new literacy' (11-12). Whilst their work does not explicitly address games in relation to physical health, it does engage with and challenge the 'discourse of derision' that surrounds this kind of play by suggesting a 'disconnect' between adult perception and children's (more active) virtual experiences in the 'flow' of video games.

Although no doubt exists that video-game play, particularly in the past, is a sedentary activity, the stark fact is that many young people spend as much time playing games as they do their on their homework (13). Recent figures estimate that 82% of 9-19 year olds own at least 1 games console and that 70% of children play games online (13). Thus, video games appear to be an indicative feature of children's lives in the western world. Although video games have been the subject of a more intense 'moral panic' in relation to children's physical activity, obesity, and health in general, a potential may exist for active video-game play to promote health and physical activity habits in children. Therefore, the aim of this paper was to examine the potential for active video-game play to enhance children's health using both qualitative and quantitative approaches.

METHODS

Participants

Twelve British school children (seven female, five male), aged 8-11 years from a Primary School in central England volunteered to participate in this study following informed parental consent and institutional ethics approval.

Procedures

Children participating in this study engaged in active video-game play during school lunch breaks over the course of one week. All games played were accessed through a Playstation® 2 console and Eye Toy USB camera, which sits on top of a monitor and captures the image of the player, which is then located in the action of the game on screen. Thus, the player does not use a handheld keypad but instead moves the body to move the avatar and positions the hands in space in relation to where the 'buttons' are on the screen (a different level of hand/eye/body coordination is required to perfect this). Before participating in the active game play, the children completed sessions focus group interviews to examine their perceptions of video games in relation to physical activity and health. Dominant discursive themes arising from these interviews were then used as the basis for individual interviews the week after their active video-game play experience.

Measurement of physical activity during game play

Physical activity levels were also monitored during the week of active video-game play, using both heart rate monitoring and pedometry.

Heart rate monitoring

The frequency, intensity, and duration of physical activity were estimated from continuous heart rate monitoring. A self-contained computerized telemetry system (Polar Advantage, Polar Electro Oy, Kempele, Finland) was used to record the heart rate minute by minute. Each child was monitored during school lunch time. Before commencing data collection, we explained all procedures to the child. The coded transmitter was attached to a pediatric elastic strap and secured on the chest of each child. The elastic strap was then adjusted so that the grooved electrode areas contacted the skin and the belt felt comfortable for each child. The wrist receiver (watch) was then set with a recording interval of 60 seconds. To prevent accidental or intentional interference in the recording of heart rate, we placed a custom built protective cover over the watch unit. A flexible wristband was then placed over the complete unit to discourage children from interfering with the watch unit and ensured it felt comfortable too.

At the end of each lunch break, the heart rate monitors were returned to the laboratory, where they were interfaced with a laptop computer, and all data files were downloaded using the Polar Advantage Interface for analyses. Polar Precision Performance Software (Version 2.0) for windows was used to analyze the stored data. Incomplete data sets were disregarded. The following measurements were recorded: sustained periods of moderate to vigorous physical activity (MVPA) > 139 bpm (beats/min) of 5 min duration, 10 min duration, and 15 min duration. Additionally, the average time and percentage of time spent in MVPA > 139 bpm was also recorded as a percentage of the total recorded period. The use of 139 bpm as the threshold representing activity that is of moderate intensity or greater was based on prior studies establishing that with this age group, moderate activity such as brisk walking, generates a heart rate of about 140 bpm (14). This threshold has been widely used by previous authors as a general marker of moderate intensity activity that accrues health benefits (14). This threshold was used to interpret the heart rate data in this study.

Pedometry

Ambulatory physical activity was determined using a sealed, piezo-electric pedometer (New Lifestyles, NL2000, Montana, USA) worn during the lunch period. Before the monitoring period, the children were familiarized with the pedometers (all children had prior experience wearing pedometers as part of school science classes), and body mass (kg) and height (m) were directly measured using a Stadiometer and weighing scales (Seca Instruments, Germany, Ltd) to input into the pedometer. The research staff attached the pedometers at the start of each break and collected them at the end of the break. Step counts were stored in the internal memory of each pedometer, enabling the recall of each step count when the pedometers were returned to the laboratory. The body mass index was determined as kg/m^2.

Data analysis

The data were analyzed in a number of ways. The percentage of time spent in MVPA was determined by heart rate monitoring, and the average step counts during video-game play were calculated by pedometry. The number of steps taken during video-game play was converted to a percentage of the steps/day cut-off points for health for children recommended by Tudor-Locke et al (15). Qualitative data from focus group interviews pre and post video-game play were analyzed using discourse analysis.

RESULTS

Interviews before active video game play

Qualitative data before the exercise: a focus group discussion with the students was recorded and revealed that most of the participants had access to a games console at home, which in most cases was shared with other family members. The children were not 'expert' gamers, and where they did describe a preference for a game genre, were generally unable to describe more than one game in the genre. The school used in this study was in a 'mixed' socioeconomic area, so whether the reasons are economic is unclear, but from the data, clearly the children taking part had relatively little experience of gaming for their age. From the focus group discussion, three dominant discursive themes emerged.

The participants all agreed with a range of negative statements about the impact of playing video games too often on physical health. The participants articulated a range of received ideas about other harmful effects of video games in response to being asked—why do you think some people worry that children spend too much time playing video games?—but they took ownership of these statements themselves (in other words, the children were asked to comment on public concerns but took the question to require their own personal concerns). Some examples were, "*Their eyesight can get messed up and you will keep on thinking about Playstation instead of work*"..... "*Cause you try to copy*".... "*Your more focused on the game, you lose concentration, also we get less exercise*".

In relation to these variations on 'effects', the most common games listed as current favorites were Mortal Kombat (18), Harry Potter (3+), Resident Evil 4 (16), LA Rush (12), X-Men (12), Grand Theft Auto: San Andreas (18), Simpsons (7+), and Cricket 2005 (3+). Legally, these children should have been playing only two of these eight games, and whilst earlier data about access to consoles suggests that these games were owned by older siblings or friends, this is still evidence that the classification system is ineffective in gate-keeping access to the kinds of games that are central to the 'discourse of concern'. In particular, Grand Theft Auto has been the subject of a censorship campaign, due to its violent content and its representation of crime, vice and prostitution.

'Happy' was the word most commonly used to describe how participants feel when playing these games.

Physical activity during game play

The average bout of lunchtime video game activity was 24 min. During this time, the results indicate that boys accumulated 1503 steps and girls accumulated 1313 steps, equating to 10% and 11% of the recommended number of steps/day for health for boys and girls (15). Likewise, the average heart rate was 148 bpm for the whole group during the period of active video game play. Within the monitoring period, the children also engaged in an average of 11 min (or 46% of the monitoring period) sustained MVPA. The descriptive data for the period of active video-game play according to gender groups is presented in table 1

Table 1. Descriptive data for the period of active video-game play according to gender groups (n = 6 per group)

	Steps (mean±SD)		Ave HR (mean±SD)		Min MVPA (mean±SD)	
Boys	1503	453.3	145.7	6.5	10	1
Girls	1303	230.1	151	19	12.6	5.1

Interviews post active game play

Each member of the group was interviewed separately after the week of a long, active video-game play period. The questions asked returned them to the themes uncovered in the first series of interviews to see what difference the intervention had made to their perceptions of games and health. In every case, the students were overwhelmingly positive about the experience in terms of enjoyment, despite the physical challenge presented, as the following comments demonstrate.

> *I don't like running outside cos I have to go out and come back in but with this I can just run inside and its more fun" (year 4)*

> *It was fun and it gets your heart beating really fast. On my last round (of hurdles) I felt like I was going to be sick" (year 6).*

> *There's a lot of people who do computer games but they don't do exercise and they could have a go at it and probably lose a lot of weight" (year 6).*

> *They would play it cos they can do running and throwing and jumping all through the computer and don't have to go anywhere to do it (year 4).*

All participants named the Eye Toy athletics games as their favorite and listed running, jumping hurdles, and throwing the discus and javelin as the highlights. When asked whether they would continue to play these games in such an intensive way in their own time, and whether they felt that children who are not enthusiastic about exercise could be engaged by physical activity through this medium, they all answered affirmatively in both cases. Nevertheless, these responses cannot be decoupled from the immediate gratification the intervention had offered them.

DISCUSSION

The results of this study indicated that active video-game play can provide a promising stimulus for children to accumulate physical activity during school time. Both heart rate monitoring and pedometry revealed that active video-game play could provide a significant part of the children's recommended daily physical activity for health. In regard to heart rate monitoring, active video-game play resulted in favorable physical activity profiles that are comparable to or better than the heart rate values recorded for regular daily physical activity or regular school lunch time physical activity (14,16). Heart rate data during active game play is also greater than the average heart rates reported following a play-ground marking intervention in children (17). This finding is significant for health and educational planning and policy because school break and lunch times offer children their main opportunity to be physically active during the school day. In this instance, the use of active video-game play appears promising as an alternative method to enhance children's physical activity. Considering that physical activity during active game play is greater than general break/lunch time activity and physical activity following playground-based interventions, it may be prudent for the scientific, health and educational communities to consider the potential uses of active video gaming in promoting physical activity or attracting children who are not physically active to exercise in a different way. This view is particularly so when given recommendations that environmental interventions that are ecologically sound may be best placed to influence children's physical activity (18).

Caution is needed, however, when making definitive conclusions based on the 12 children participating in this study. The current study also has certain limitations. Firstly, the power dynamics between visiting researchers with exciting games and primary school children are crucial contextually, and the students' statements cannot be understood as neutral. Clearly, the children had enjoyed the active gameplay intervention, but their statements about the more far-reaching potential of kinesthetic games may be less plausible. For example, one student described himself as a keen rounders player but claimed in the aftermath of this project that he would rather play an Eye Toy game than play rounders outside. Further research might test this attitude by giving him the choice. Secondly, our study used the same 'laboratory' approach that Media scholars are critical of when used by psychologists to 'prove' the negative effects of games. Thirdly, our study does not provide evidence of longevity. We do not know whether these children would continue to exercise in this way in uncontrolled, self-managed contexts and for how long. We suspect that novelty was a major factor. Further research in this area might make use of other methods of data collection (eg game play diaries) to this end.

CONCLUSIONS

The concern expressed by sports scientists over the immersion of young people in games and other electronic media makes sense only to the extent that overindulgence in any activity at the expense of physical activity will have a negative effect on ones health. The results of this study offer some support for the assertion that active video-game play could be used as an impetus to increase physical activity and enhance children's health. This is the first study the authors are aware of that has investigated the impact of active video-game play using both qualitative and quantitative approaches and taken from both a scientific paradigm and a cultural studies perspective. Nevertheless, because of the exploratory nature of this study with a small sample of British children, no definitive conclusions can be drawn and further, larger scale research investigating the impact of active video-game play on children's health is required to corroborate these tentative conclusions.

REFERENCES

1. Blair SN, Kohl HW, Barlow CE, Paffenbarger RS, Gibbons LW, Macera RS. Changes in physical fitness and all cause mortality. JAMA 1995;273: 1093-8.
2. Blair SN, Connelly JC. How much physical activity should we do? The case for moderate amounts and intensities of physical activity. Res Q Exerc Sport 1996;67:193-205.
3. Thomas NE, Baker JS, Davies B. Established and recently identified coronary heart disease risk factors in young people. Sports Med 2003;22:633-50.
4. Harro M, Riddoch C. Physical activity. In: Armstrong N, Van Mechelen W, eds. Paediatric exercise science and medicine Oxford, UK: Oxford Univ Press, 2000:77-84.
5. Wedderkopp N, Froberg K, Hansen HS, Riddoch C, Andersen B. Cardiovascular risk factors cluster in children and adolescents with low physical fitness. The European Youth Heart Study. Ped Exer Sci 2003;15:419-27.
6. Thomas NE, Cooper SM, Williams SP, Baker JS, Davies B. Relationship to fitness, fatness and coronary heart disease risk factors in 12-13 year olds. Ped Exer Sci 2007;19:93-101.
7. Mota J, Ribeiro JC, Santos PM, Gomes, H. Obesity, physical activity, computer use and TV viewing in Portuguese adolescents. Ped Exer Sci 2005;18:113-21.
8. Andersen RE, Crespo CJ, Bartlett SJ, Cheskin LJ, Pratt M. Relationship of physical activity and television watching with body weight and level of fatness among children—results from the third national health and nutrition examination survey. JAMA 1998;279: 938-42.
9. Gard M, Wright J. The obesity epidemic. Science morality and ideology. London, UK: Routledge, 2005.
10. Ma yra, M. The Third Digital Games Research Association International Conference "Situated Play". [accessed 24 April 2007] available at http://www.digra.org/digra_conference/2007tokyo/digra 2007
11. Gee J. What video games have to teach us about learning and literacy. New York, NY: Palgrave, 2003.
12. Johnson S. Everything bad is good for you. London, UK: Penguin, 2003.
13. Ar mstrong N, Welsman J, Kirby B. Longitudinal changes in 11-13 year old' physical activity. Acta

Paediatr 2000;89:775-80.
14. T udor-Locke C, Pangrazi RP, Corbin CB, Rutherford WJ, Vincent SJ, et al. BMI-referenced standards for recommended pedometer-determined steps/day in children. Prev Med 2004;38:857-64.
15. Ridgers N, Stratton G, Fairclough S. Assessing physical activity during recess using accelerometry. Prev Med 2005;41:102-7.
16. Stratton G. Promoting children's physical activity in primary school: An intervention study using playground markings. Ergonomics 2000;43:1538-46.
17. Sallis JF, McKenzie TL, Elder JP, Hoy PL, Berry CC, Zive M, et al. Sex and ethnic differences in children's physical activity: Discrepancies between self report and objective measures. Ped Exer Sci 1998;10:277-84.