Introduction

The Physical Activity Guidelines for Americans (U.S. Dept. of Health and Human Services, 2008) suggests children participate in 60 minutes of moderate physical activity daily to enhance health by reducing risk factors for disease and increasing the possibility of healthy adulthood. However, only 26% of Vermont youth grades 8-12 meet this requirement (Vermont Department of Health, 2008). Thirty-eight percent of high school students spend more than three hours a day in front of a screen (e.g., television, computer, or video games) and an additional 10% of students spend more than five hours per day (Vermont Department of Health, 2010). A new generation of video game consoles and video games that require active full body movements, called exergaming, has emerged (e.g., Nintendo’s Wii system). These consoles, which use children’s interest for screen-time, may prove to be beneficial to help children meet their daily exercise requirement depending on the level of activity the games promote. The literature was reviewed to find research articles to answer the question: Do children meet the recommended Physical Activity Guidelines for Americans for moderate intensity aerobic activity by playing active video games?

The literature reviewed

A literature search was conducted in multiple search engines for peer-reviewed articles in credible journals about the exercise intensity of active video games consoles in children. There has been an explosion of research in this area in the past few years. The search revealed two recent systematic reviews (Biddiss & Irwin, 2010; Foley & Maddison, 2010), which were not reviewed for the purposes of this fact sheet. Articles describing single research studies were chosen based on the highest level of evidence. Overall, sample sizes were small, with one exception. Maddison and colleagues (2009) completed a randomized control trial using exergaming to reduce overweight and obesity in children; however, the results are still pending and are expected to be published in 2011. Three articles were selected based on study participants, the variety of games studied, study setting (i.e., home vs. laboratory) and the outcome measures used.
Twenty-four lean and obese children aged 8-12 participated in a laboratory-based investigation to evaluate the energy cost of playing the Nintendo’s Wii Boxing game relative to sedentary video games and walking on the treadmill. This case-control study measured the child’s heart rate, oxygen consumption, and rate of perceived exertion. The results of this study were consistent with the findings of previous research and showed that Wii Boxing increased heart rate and VO2 relative to sedentary video games. This study contributes new information with the finding that Wii Boxing raised heart rate and VO2 greater than treadmill walking at 1.5mph. In addition, the increased heart rate and oxygen consumption reflected minimally clinically important differences. The metabolic equivalent to playing Wii boxing in this study meets the Physical Activity Guidelines for Americans for moderate activity. Both lean and obese children liked and were motivated to play Wii Boxing. Wii Boxing may be a suitable means to help increase daily physical activity especially if it is used to replace sedentary video games. Although these results are promising, the study has limitations. First, the sample size was relatively small and the authors neglected to include information about the sample, which makes translation to practice difficult as it is unclear to whom the result can be generalized. Also, intervention was in 10-minute intervals, which may not reflect ‘real-life’ exergaming. Clinical Implication: The clinician could use this study as quality evidence to support using the Wii Sports Boxing program as part of a child’s fitness program. In addition there is marginal evidence that the Wii system is well liked by children and they are motivated to use it.

This randomized control trial included 60 predominantly white middle class 7-8 year olds with normal BMIs. The study aimed to determine whether the Nintendo’s Wii video game Dance Dance Revolution (DDR) can be effectively used at home to increase activity levels to moderate or vigorous and reduce sedentary screen time. Children were randomly assigned to an intervention group which had unlimited access to DDR at home for 28 weeks or to a wait list control group that waited 10 weeks before receiving their DDR game. Outcomes were measured at baseline, 10 and 28 weeks using an accelerometer, self-report on screen time, and pedometers. The authors found the DDR group increased their vigorous physical activity by 6 minutes per day in the first 10 weeks of the study while the control group showed no increase. In this healthy population, this change was small and not statistically significant between groups. However, the DDR group significantly reduced their sedentary screen time in the first 10 weeks. The design of the study precludes making a causal association between the increase in vigorous activity and participation in DDR. Other forms of physical activity were not measured and this may account for between group differences. Overall the results from this study are limited due to seasonal bias, unknown reliability & validity of measurement tools, and small sample size.

Thirty-seven middle-school children of varying weight were included in this school-based study that investigated energy expenditure when playing Nintendo’s Wii Sports Package. They measured the length of time the children played each game when given free choice, and measured the differences in energy expenditure between the games included in the Wii Sports (i.e., tennis, bowling, golf, baseball, boxing). In this before & after study design, the authors took baseline measures at rest followed by measurements during 20 minutes of playing Wii Sports. The authors found that all of the children played baseball the most and golf the least. They also found no differences in childrens’ choices of games among BMI categories (healthy, overweight, obese).
Heart rate was increased above baseline for all games except golf and bowling. All games led to an increase in energy expenditure above baseline except golf. Energy expenditure differed among BMI groups in tennis, bowling, and baseball with children in the obese group showing more energy expenditure than those in the healthy and overweight groups. The authors concluded that only boxing met the criteria for moderate exercise intensity across all BMI groups. The authors also demonstrated preliminary support for baseball and bowling as moderate exercise for obese children. However, these results should be considered cautiously because the quality of this study is significantly limited by sampling bias, lack of participant information, statistical methods chosen, small sample size, no power calculation, and the lack of psychometric information about the tools used to measure outcomes.

**Take Home Message**

As a whole, these studies found beneficial effects for children who participated in exergames. Of the exergames studied, all increased heart rate and energy expenditure over baseline, but at varying levels. Only Nintendo’s Wii Boxing & Dance Dance Revolution met the criteria for moderate physical activities for all children regardless of BMI. However, study results showed preliminary trends that suggest Wii baseball and bowling may meet the moderate physical activity criteria in children who are overweight or obese. Children who were overweight or obese had higher energy expenditures when playing Wii games.

However, the studies had limitations which impact our understanding of who the results can be generalized too, the settings where the video games are more suited, which type of active video game to use, and the long term benefits of their utilization. Thus, clinical applications of these studies’ results should be done with caution with clinicians who are looking for creative ways to increase moderate activity levels for children. The clinician needs to consider that each game provides a different level of activity so generalizability to active video gaming overall is limited.

It is noteworthy that stronger evidence currently exists in the literature including a randomized controlled trial due for publication in 2011 (Maddison et al. 2009) and two systematic reviews (Biddiss & Irwin, 2010; Foley & Maddison, 2010). Although the authors of these reviews recommended that stronger studies are needed, they also concluded that there is support for active video gaming as a form of light to moderate physical activity. Games that included both upper and lower body movements were more likely to provide moderate physical activity.

When these articles are considered with the current body of evidence in the literature, clinicians can confidently consider the use of exergaming as an option for children to increase their heart rates and energy expenditure. Children may benefit from light physical activity even though it may not meet the physical activity guidelines, as light physical activity has been shown to promote health in adults. When recommending exergaming to increase moderate/vigorous activity in children, clinicians should carefully consider which specific games have evidence to meet that requirement and take into account that a child’s BMI factors into their energy expenditures using these games.

**References**


