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INVITED COMMENTARY

The Health Benefits of Active Gaming: Separating the Myths from the Virtual Reality

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Abstract Video game play is a preferred leisure time activity of many children and adults. Video gaming is often viewed as the enemy of effective health promotion strategies owing to competition with for a finite availability for leisure time pursuits. However, recent advancements in active gaming (ie, video games that involve physical activity) have created a viable alternative for increasing physical activity and decreasing sedentary behaviors. This review outlines the potential for active gaming (particularly whole body gaming) to reach activity levels and intensities that are sufficient to reduce the risk for premature mortality and cardiovascular disease, and increase overall health and well-being. This review also looks at the anti-active gaming sentiment perpetuated by some individuals and organizations and how this stance is not supported by the preponderance of current literature. In fact, compelling literature (supported by numerous systematic reviews of the literature) demonstrates the health benefits of active gaming, and the suitability of active gaming for use in a menu of physical activity opportunities for children and adults alike. Collectively, this research supports active gaming as a viable means of improving physical activity levels and reducing sedentary behaviors in a wide range of individuals.

Keywords Active gaming · Exergaming · Leisure-time preferences · Physical activity · Video games

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Introduction

The health benefits of habitual physical activity are irrefutable [1–3]. Routine physical activity/exercise is an effective primary and secondary preventative strategy for premature mortality, and more than 25 chronic medical conditions (particularly diseases of the cardiovascular system) [1–3]. The World Health Organization has recently estimated that physical inactivity is the fourth leading risk factor for global mortality [4].

The health benefits of physical activity have been promoted widely including large population-based health promotion strategies incorporating physical activity and nutrition recommendations; unfortunately, the majority of adults from developed nations do not meet the international recommendations for physical activity (eg, at least 150 minutes of moderate intensity aerobic physical activity, or 75 minutes of vigorous intensity aerobic intensity physical activity, or an equivalent combination of moderate and vigorous intensity physical activity on a weekly basis). Moreover, children and youth are widely described as having less than optimal physical activity profiles [5]. There is also mounting evidence suggesting that the prevalence of physical inactivity is increasing (despite a marked increase in the promotion of the health benefits of physical activity) ultimately having significant implications for the prevention of noncommunicable chronic medical conditions (such as cardiovascular disease) [4]. The burden of physical inactivity upon contemporary society in terms of physical, emotional, and mental well-being is remarkable [1] as reflected eloquently in the various

articles contained in this series. As such, innovative approaches to the promotion of physical activity have been highly sought after.

Sedentary behaviors have increasingly been associated with an elevated risk for premature mortality and chronic disease [6]. The effects of sedentary behavior on health appear to be independent of physical activity [6–8]. It is widely held that physical activity levels are dropping while sedentary behaviors (such as sitting, television viewing, computer usage, digital gaming, and motorized transport) are increasingly placing the general population at an elevated risk for premature mortality and the development of chronic medical conditions (in particular cardiovascular disease). For instance, an average American will spend 8 hours engaging in sedentary behaviors [9]. The Centers for Disease Control and Prevention estimate that children (aged 8–18 yr) spend approximately 7.5 hr per day using entertainment technology (such as televisions, computers, video, and cell phones) [10]. Several international organizations have recently advocated the importance of reducing the time spent in sedentary pursuits, while increasing healthy lifestyle behaviors (such as routine physical activity and healthy eating) [11••].

Technological advancements have been linked to the decreasing physical activity levels and increasing sedentary behaviors seen in contemporary society for both adults and children [12]. The video gaming industry is a multi-billion dollar business [13]. It is estimated that video games are played in the majority of American households (approximately 70 %–90 %) [13, 14]. The video gaming industry is often viewed as the enemy of effective health promotion strategies owing to the potential for competition with a finite availability for leisure time pursuits. High electronic media usage (such as television viewing, video gaming, and computer usage) is often viewed as a direct competitor for leisure time physical activity. In particular, video gaming is seen as a key rival for outdoor-based physical activity [12]. A widely held belief is that individuals who engage in video gaming activities will have less leisure time activity available for other health promoting behaviors (such as engaging in physical activities). Reducing the volume of video game play is often deemed to be an effective strategy for the primary and secondary prevention of chronic disease. However, recent researchers have highlighted the potential health benefits associated when combining the attractive qualities of video gaming with physical activity [15–19]. It is believed that by incorporating the appealing properties of a highly popular sedentary behavior (such as video games) many individuals could be encouraged to exercise and/or engage in other healthy lifestyle behaviors [16–18, 20]. Recent work has demonstrated that the reinforcement of physical activity with sedentary behavior is an effective means of increasing physical activity participation [21, 22]. Moreover, the video gaming industry (widely regarded for its innovation) recognized the potential of combining exercise with video gaming (ie, active gaming). As such, there has been a marked increase in the number and options for active gaming. Systems, such as the Wii Fit, Kinect for Xbox 360, and PlayStation Move, are examples of this proliferation of active gaming platforms.

Considerable recent research has demonstrated the potential health benefits of active gaming (exergaming). For instance, we demonstrated in a series of studies that active gaming led to greater exercise enjoyment (affective attitude), increased exercise adherence, improved health status, and greater metabolic requirements when compared with traditional cycle-based training [16–18, 20]. In our experience the metabolic requirements were well above that required for health benefits exceeding the recommendations of international guidelines for physical activity (which are considerably above the minimal threshold for health benefits) [3, 11••]. We also demonstrated that active gaming has the potential to create an immersive experience that distracts from fatigue and reduces the perceptions of effort at a given exercise intensity (particularly during moderate intensity exercise) [18]. Others have also demonstrated that active gaming (particularly gaming that involves whole body exercise) can lead to significant metabolic requirements and health benefits [23, 24]. Importantly, active gaming generally leads to metabolic requirements above that seen during traditional sedentary video gaming and/or television viewing [25–27].

Experts in pediatric care and obesity prevention/treatment have also recently promoted active gaming as a "novel and child friendly form of physical activity" [28]. Playing active video games has been shown to improve body composition (mediated by changes in aerobic fitness) in overweight or obese children [29, 30]. Researchers have also recently proposed that active video gaming may be an effective solution to the increased energy intake often observed when playing standard sedentary video games [31]. Playing active video games regularly has also been shown to increase the overall physical activity levels of children [32].

There are several peer-reviewed narrative and systematic reviews of the literature on the potential health benefits of active gaming and/or playing video games designed to promote healthy lifestyle behaviors [15, 33, 34••, 35, 36, 37••, 38, 39]. These reviews consistently demonstrate the potential health benefits (from multiple domains) of activities involving video gaming. For instance, Baranowski and colleagues identified the ability of video gaming to provide a mechanism for delivering health behavior changes in a significant proportion of children and adults. They also highlighted how messaging could be delivered in an "engaging and entertaining format." The authors emphasized how recent video games designed for health promotion have incorporated the immersive, attention-maintaining, and engaging properties of playing video games. Similarly, Guy et al. [15] revealed

recently that video games have the potential to promote healthy behavior (eg, increased physical activity and nutritional knowledge). Collectively, this research has significant implications for those seeking health changes on a population level. Other systematic reviews have also consistently demonstrated the potential health benefits of active gaming [19, 34••, 35, 37••, 38]. Consistent in these studies is the finding that many active gaming models are sufficient to elicit moderate (and even vigorous) intensity physical activities. There is also a growing body of literature demonstrating marked physiological and psychological benefits of engaging in active gaming. As such, there is a compelling argument for the inclusion of active gaming in the menu of physical activity choices for the promotion of health and well-being.

The physical activity promotion world is particularly skeptical when new technologies are introduced. As with any new and innovative approach, many will react with uncertainty. When we first started our exploration of active gaming we were met with skepticism from our contemporaries. However, as our randomized controlled trials were completed and numerous other studies were accomplished we increasingly observed a general appreciation of the potential of active gaming. On the whole, the physical activity world has recognized the potential health benefits of appropriately designed active gaming programs. Leading health organizations (such as the American Heart Association) have also recognized the significant potential of active gaming for addressing the burden of obesity and chronic disease in contemporary society. For instance, the American Heart Association entered into a strategic partnership with Nintendo of America, endorsing Wii active video games [40] and together recently convened an international panel to examine the effects of active gaming on health-related skills, enhancing self-esteem, and self-efficacy, facilitating social support, and causing behavioral change [41]. However, there has also been a relatively small cohort of organizations and individuals that have adamantly challenged active gaming as a viable option for physical activity and health benefits. It is important to address some of the inconsistencies in this viewpoint.

Opponents of active gaming have frequently taken a too simplistic and unfortunately narrow approach to the examination of the effects of active gaming on healthy lifestyle behaviors. Often researchers have emphasized studies demonstrating the relatively light intensity requirements of many active video games that require minimal bodily movement for success. However, in focusing on only the light intensity activities, these individuals have missed the wide array of active gaming opportunities for children and adults. Moreover, they have overlooked the various health benefits of active gaming that have been demonstrated in the literature. As an academic, scientist, and advocate for healthy lifestyle behaviors it is difficult to reconcile the recent fervent attempts by some groups to downplay the potential importance of active gaming for health. As outlined above, there is now overwhelming evidence supporting the potential for whole body active gaming to have metabolic requirements that are of moderate-to-vigorous exercise intensity [17, 18]. Multiple systematic reviews and a body of literature that is growing daily support this contention. It is clear that some active video games have lower metabolic requirements; however, focusing solely on these active video gaming options does little to advance the field or health promotion (particularly for young children and adults that prefer technology-based leisure time pursuits). Also, with any physical activity (such as walking) there is a wide range of intensities that can be performed. It is ultimately up to the user to determine what type and intensity they chose to play; this is the same choice that we all make when deciding to go for a light walk or engage in a more vigorous activity.

It is also important to highlight the paradox that exists in the promotion of enhancing physical activity while reducing sedentary behaviors. Numerous systematic reviews of the literature have demonstrated the dose–response relationship between physical activity and health status [11••]. Even low doses (ie, low volumes and intensities) of physical activity are associated with a significant reduction in the risk for cardiovascular disease and premature mortality. In fact, health benefits are seen at volumes of physical activity/exercise that are markedly below international recommendations for physical activity. This is clearly articulated in the systematic reviews of the literature [11••] that have been used to justify recent physical activity guidelines [42]. Unfortunately, the fact that light intensity activities can lead to significant health benefits is often left out of messaging. The evidence, including the literature that was used to develop international guidelines for physical activity, simply does not support the contention that light intensity physical activities have no health benefits. Interestingly, a careful review of the activities provided in many health promotion initiatives highlights the inclusion of light intensity physical activities (such as light walking, gardening) that have the same metabolic requirements of many lower intensity active video games. The inclusion of these activities while at the same time excluding active gaming options is not based on evidence-based best practice. Moreover, numerous health promotion specialists have advocated the reduction of sedentary behaviors. It is clear that active gaming can replace traditional sedentary behaviors with more active alternatives, often times of a moderate to vigorous intensity directly challenging detractors of active gaming. It is not clear why certain advocates for reducing sedentary behavior are also staunch opponents of active gaming. This stance is in direct contradiction to their own research and position statements that advocate the reduction of sedentary pursuits. It is clear that an “anti-active gaming” stance will capture significant attention from the media; however, an overwhelming body of literature simply does not support this “anti-active

gaming" stance. For instance, in Canada, leading computer scientists, exercise professionals, clinicians, and psychologists have demonstrated clearly the potential health benefits of active gaming from a wide range of perspectives (see GAMFIT initiative) [43].

In conclusion, the majority of individuals from developed countries are not engaging in optimal levels of physical activity placing them at an increased risk for the development of multiple chronic diseases and premature mortality [1, 2]. Compelling and growing research supports the incorporation of the appealing properties of a highly popular sedentary behavior (ie, video games) into the promotion of physical activity. There are considerable advantages of active gaming including the ability to be used in wide range of settings (eg, homes, community centers, schools, outdoors), and the ability to be adapted to a wide range of physical and mental abilities. Moreover, the remarkable presence of gaming systems within North American homes (particularly in comparison with the limited amount of fitness equipment in homes today) provides a perhaps ideal setting for a large population wide approach to the promotion of healthy lifestyle behaviors. The future challenge for the gaming and health promotion experts will be the development of optimal active gaming platforms for physiological and psychological well-being.

It is important to emphasize that active gaming is merely one option in becoming more physically active. It is certainly not the only option, and may be more desirable (and therefore effective) in certain individuals and populations. Active gaming is simply an alternative and viable means of addressing the burden of physical inactivity and sedentary behavior in contemporary society. When used effectively active gaming can lead to marked health benefits for a wide range of clientele. It is important to separate the myths from the (virtual) reality; active gaming can lead to a marked physiological stimulus that is of health benefit for children and adults. The evidence demonstrates clearly the ability of active gaming to meet and/or exceed activities levels and intensities associated with health benefits for a wide range of individuals. As advocates for health change, we should be aware of the potential health benefits of active gaming and work with the video gaming industry to optimize the development of these gaming platforms.

Compliance with Ethics Guidelines

Conflict of Interest Darren Warburton declares that he has no conflict of interest.

Human and Animal Rights and Informed Consent This article does not contain any studies with human or animal subjects performed by any of the authors.

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