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Editorial

Fight fire with fire? Promoting physical activity and health through active video games

Physical inactivity has been identified as one of the leading causes of many chronic diseases such as cardiovascular disease, type 2 diabetes, and obesity. Technology such as video games plays a complicated role in physical inactivity—much like a double-edged sword. Traditionally, video games have contributed to the epidemic of physical inactivity and have been blamed for individuals' sedentary lifestyles. On the other side, the newly emerged active video games (AVGs) have been increasingly used to promote physical activity (PA) and health among various populations. Briefly, AVGs (exergaming) refer to video games that are also a form of exercise. Indeed, the fast growth of AVGs (e.g., Wii U Sports and Xbox One Kinect) has led to the development of new interactive PA strategies, which in turn have had a great impact on field-based PA interventions in school, home, and community contexts.^{1,2}

AVGs generally capitalize on individuals' interest in computers and video interactions with the addition of exercise equipment to promote increased PA and decreased sedentary time. For example, Xbox One Kinect's Just Dance combines real physical dancing requiring fast body movements with energetic music and visuals. It has a video camera that captures players' actual movement and offers instant feedback as they dance. Laboratory research has provided substantial empirical evidence noting that AVGs require adequate energy expenditure comparable to light-to-moderate-intensity exercise. However, there is still a necessity to address the unique contributions of AVGs in promoting PA, actual and perceived motor skill behavioral changes, and resulting psychosocial benefits in different contexts. This special issue of the *Journal of Sport and Health Science* brings together a collection of latest research or reviews on the application of AVGs to promote PA that took place in the USA, France, and Australia, ranging from AVGs aimed at children to application of AVGs in rehabilitation among older patients.

The first 3 articles present commercially available AVGs used to promote PA, actual and perceived motor skills, and motivation among children and adolescents.^{3–5} Working with overweight and obese adolescent girls, Staiano and colleagues³ investigated the effects of a 12-week Kinect dance games intervention on self-reported PA, screen time, self-efficacy, and intrinsic motivation, as well as objective PA. The researchers found that girls in the intervention group reported significantly

increased PA, television viewing, self-efficacy, and intrinsic motivation than those in the control group. Yet no significant differences were identified for any of the accelerometer-determined PA variables (sedentary behavior, light PA, and moderate-to-vigorous PA (MVPA)). In the school setting, Gao et al.⁴ examined the effect of AVGs (Wii and Kinect) on children's accelerometer-determined sedentary behavior, light PA, MVPA, and energy expenditure over 2 years as compared with physical education. It is evident that AVGs had the same positive effect on those outcomes as physical education among elementary school children. When comparing children with autism with typically developed children, Edwards et al.⁵ suggested that playing Kinect games did not enhance actual object control skills for both groups. However, playing such games exerted a positive effect on perceived skill competence in children with autism but not in typically developed children.

Pasco et al.⁶ applied a newly designed mobile application-based exercise bike video game to promote college students' PA and situational interest and indicated that students in the intervention group yielded higher situational interest, sedentary behavior, and light PA but lower MVPA than controls. Notably, both groups displayed fairly high percentages of time in MVPA (intervention group 90% vs. control group 95%). Not surprisingly, findings of the aforementioned empirical studies are in accordance with previous studies indicating that AVGs can exert positive effects on individuals' motivation and perceived beliefs while keeping them physically active.⁷

Zeng et al.⁸ conducted a systematic review concerning the effectiveness of AVGs as a therapeutic tool in improving rehabilitative outcomes in older adults with chronic diseases. They found that although there is insufficient evidence to support the advantages of AVGs over standard therapy, AVGs have the potential to improve rehabilitation in physical, psychological, and cognitive outcomes in older patients. Thus, more research is called for among this population. Lastly, Baranowski,⁹ a pioneer scholar in exergaming, contributed a commentary paper summarizing the aforementioned original articles as well as pointing out the needs and directions for future studies. In particular, Baranowski reconsidered the “fun” component within exergaming in various populations and advocated adding story or narrative to exergaming with the goal of promoting PA and health in the future.

Therefore, although sedentary video games present negative effects to a healthy and active lifestyle, AVGs do have great

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possibility of facilitating PA promotion. That is, health professionals are striving to “fight fire with fire” — attempting to apply AVGs to promoting PA and health. Notably, as a result of the work of intrepid professionals in the past decade, AVGs have contributed tremendously to the understanding and promotion of PA behaviors among various populations.

1. Emerging augmented reality games

It is vital to note that augmented reality games including Pokémon Go and Zombies, Run! have successfully gained attention in recent years. In particular, after the release of Pokémon Go on July 7, 2016, it generated lots of public interest with an estimated 65 million users downloading the game within 1 week of its release.¹⁰ Augmented reality games are unique because they integrate the physical and virtual worlds into 1 interface using mobile devices applications (apps). Unlike the traditional sedentary video games that encourage solitary and sedentary activity, augmented reality games require players to walk around and explore their local surroundings such as parks, schools, gyms, and neighborhoods and therefore offer potential physical, social, and emotional benefits to players.¹¹ In this way, augmented reality games serve very similar functions to those of AVGs and consequently can be considered a type of AVGs that elicits PA behavior change. In fact, augmented reality games have been around since the early 1990s, and this technology has been gaining momentum in the past decade, particularly with the advancement of virtual reality and augmented-reality headsets. Prior to Pokémon Go’s arrival, another augmented reality game entitled Zombies, Run! achieved some popularity. This immersive game motivates players to get up off their couch and gets them fit with the help of zombies.

The newly available augmented reality games are promising in bringing potential health benefits to the users, particularly among children and adolescents. For example, Pokémon Go encourages a physically active lifestyle and promotes active learning as well as interaction with local neighborhoods and historic sites. The game also enhances social interaction by playing against nearby players. Additionally, the game may exert a positive effect on mood and emotion.¹¹ Despite the attractiveness and benefits of aforementioned augmented reality games, readers should be aware of the adverse consequences of these games such as physical harm, economic burden, and crime.¹¹ Overall, augmented reality games can improve positive PA behavior, socialization, and emotion. These active games have the potential to promote PA and other aspects of health in the naturalist contexts. As the technology advances, the efficacy and effectiveness of emerging augmented reality games deserve further investigation.

2. Practical implications and directions for future studies

Although the growing frequency of publications about AVGs indicates their increased popularity, AVG research is still lagging given the rapid development of the gaming industry and the large volume of AVGs on the market. According to Gao et al.,¹ research design and other methodological issues of previous AVG studies need improvement—especially as AVGs have more frequently

been taken from laboratories to field-based contexts such as schools, homes, and health clinics. Empirical studies have supported that AVGs in field-based contexts, when implemented with careful planning and guidance, are efficacious in offering physical, psychosocial, and cognitive benefits. In this regard, AVGs offer more benefits than downsides with regard to the promotion of individuals’ PA and health outcomes.

Although increased PA from playing AVGs can contribute to daily recommendations of PA duration, solely depending on AVG as a PA promotion strategy is not realistic because the light- to moderate-intensity of PA generated from AVG play is, at times, insufficient to help individuals meet the recommended PA levels needed for optimal health benefit. That is, AVGs hold promise as an ideal intervention to replace sedentary activities such as sedentary video games but not traditional PA and sports. This has public health implications to inform health care stakeholders regarding AVG interventions. Specifically, health professionals may integrate AVGs into schools and homes to help individuals develop healthy lifestyle habits—striving only to replace sedentary behavior but not traditional sports and PA with AVGs. Meanwhile, as evidenced by the data-based studies in this special issue, the fun component (i.e., intrinsic motivation, interest) of AVGs should be taken into consideration when implementing AVG programs. In other words, AVGs need to be constantly upgraded or updated to hold individuals’ interest and ensure sustainability with regard to PA behavior changes. Given the fun component embedded into the games, AVGs are desirable as a promising addition to promote PA by replacing these sedentary behaviors. Additionally, in many studies, individuals’ levels of PA intensity decrease significantly simply owing to multiple transitions between game play. In fact, game players can configure the game in workout mode prior to the PA session to maximize exercise time while minimizing transition time. This can be accomplished through some game consoles such as Dance Dance Revolution and Xbox One. Finally, although beneficial outcomes from AVG-based exercise or rehabilitation programs are possible, we should recognize that the full potential of AVGs in field-based contexts might have been underestimated owing to a variety of limitations inherent in many published studies.

Future research and practice should take into account these limitations to unravel and exploit the maximal effectiveness of AVGs. Simply stated, high-quality and well-designed research is warranted to investigate how various AVGs may affect individuals’ health-related outcomes from a longitudinal perspective. Some recommendations for future research across different contexts are (1) to investigate the extent to which AVGs can promote children’s learning and maintenance of new movement skills and cognitive skills (e.g., concentration); (2) to ascertain the effectiveness of using multiplayer mode in comparison to single player mode in field-based contexts and online settings; (3) to examine the role of online game communities (i.e., Xbox One) in changing individuals’ PA behavior changes; (4) to examine the long-term effectiveness of AVG playing at home settings for PA promotion using high-quality randomized controlled trials, and the potential benefits of family/group play and potential barriers in such settings; (5) to investigate AVG use in young children

(3–6 years old) and its subsequent effectiveness; (6) to determine whether individuals with access to AVGs actually replace their sedentary time with AVGs; (7) to quantify the role of AVG playing in contributing to individuals' daily PA participation; (8) to investigate the long-term effectiveness of playing AVGs in nonstructured and structured settings; (9) to develop and implement serious games or storytelling games that promote PA and health; (10) to examine the effects of multiple sports-based AVGs and different AVG consoles on specific movement skills; (11) to examine the efficacy of augmented reality games on individuals' PA behavior and health outcomes, including patients with chronic diseases; (12) to examine the effectiveness of home-based, patient-implemented, AVG-based rehabilitation as compared with clinic-based rehabilitation research; (13) to assess the effectiveness of AVG-based rehabilitation on certain rehabilitative outcomes and the differential effects on gender, age, and socioeconomic status; and (14) to explore the feasibility of uploading AVG data to online portals where health care professionals retrieve and monitor data and can provide relevant feedback to increase the effectiveness of the rehabilitation programs.

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