

## Games and Childhood Obesity

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**O**BESITY IS THE MOST COMMON nutrition-related health problem among adults<sup>1</sup> and children<sup>2,3</sup> around the world.<sup>4</sup> In U.S. middle schools with lower incomes and higher percentages of ethnic minority populations, 50% of the students were overweight or obese.<sup>5</sup> Obese children have a substantially increased risk of being obese as an adult, beginning around 10 years of age.<sup>6</sup>

Although it is not clear what aspects of diet predispose<sup>7</sup> or protect from<sup>8</sup> obesity, higher levels of physical activity have been identified as being protective of obesity.<sup>9</sup> Recommendations for child physical activity specify 60 minutes/day or more of moderate-vigorous activity, at least 3 days per week.<sup>10</sup> While it appears likely that more and more intense physical activity than existing guidelines is necessary to obtain health benefits,<sup>11</sup> most children are not performing at the existing guideline levels.<sup>12</sup> Although some younger children may attain these levels, their level of activity declines with age.<sup>13,14</sup> School-<sup>15</sup> and family-based<sup>16</sup> interventions have tried to minimize this decline but generally have not been effective, similar to family-based interventions for diet.<sup>17</sup> Innovative methods are needed to engage and excite children about healthier diet and physical activity and to increase the likelihood that they will want to perform these important behaviors.

The videogame is an entertainment medium that readily engages children (and many adults),<sup>18</sup> and serious videogames show promise of helping children change behaviors.<sup>19</sup> Videogames have been designed to promote physical activity, either by (1) making progress in the game contingent on body movement (usually called exergames or active videogames<sup>20</sup>) or (2) applying behavior change procedures (e.g., goal setting, motivational messaging) to children while they are immersed in game play (we'll call this "change gaming"). Active videogames tend to involve participants in action without much of an organizing or motivating story line. Change gaming, alternatively, tends to have a central organizing story (e.g., cut scenes that advance the story line) into which automated behavior change procedures can be inserted.<sup>19</sup> Others have promoted physical activity using active videogames by applying external contingencies on game play.<sup>21</sup> Active videogames have been used for many purposes.<sup>22</sup>

Behavior change programs need to be predicated both on a conceptual framework of how change occurs and on procedures for promoting changes in these mechanisms.<sup>15</sup> Combining concepts from self-determination, social cognitive,

immersion/transportation, and elaboration likelihood theories, a theoretical framework has been proposed that specifies how change is likely to occur from playing serious videogames and what procedures likely promote change at each point in the change pathway.<sup>23</sup> "Fun" was a component in that explanatory framework. Although this framework is interesting, even provocative, there is no empirical evidence within the context of change gaming directly supporting that model. Both controlled laboratory studies and field investigations using sophisticated measures of the underlying constructs are needed to verify the pieces that work and how to improve our understanding of the rest.

A recent review of the active videogame literature<sup>22</sup> revealed ample evidence that an appropriately motivated player can get a moderate workout, but inconsistent evidence about whether, or under what circumstances, active videogames contributed to a child's physical activity. That review appropriately called for more and better research testing theory-informed models of whether and how active videogames led to increased physical activity or decreased sedentary behavior and whether increased activity during a game was compensated for later with proportionally lower activity.

The inability to find mediators<sup>24</sup> of change game interventions (T. Baranowski's research group's unpublished data) reveals that either games are effecting behavior change through unintended paths we don't understand, or the documented changes were the result of mere chance or measurement errors. It would be valuable to conduct studies that document the extent to which different change procedures used in serious videogames influence targeted mediators for different behaviors in different age, gender, ethnic, and socioeconomic groups.<sup>25</sup> These would provide a library of findings that future change game designers could consult procedures to select likely to be effective for use in their games.

The articles in the current issue of *Games for Health Journal* address several of these issues. Lu et al.<sup>26</sup> conducted a systematic review of the literature on games and adiposity/obesity among children. They identified that 40 percent of studies included impacted an indicator of adiposity, but these were all with children who were overweight or obese at the start (i.e., treatment, not prevention).

For game developers interested in incorporating behavior change procedures into their games for diet or physical activity, Simon et al.<sup>27</sup> presented details on the design of the self-control behavior change procedures, including goal setting, problem solving, and values tailoring, and reported

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which menu options the players most frequently selected. The details in this article should facilitate others designing self-control type change games for health behavior change.

Reading and Prickett<sup>28</sup> showed that a game for the Xbox Kinect (Microsoft®) gaming system can elicit moderate intensity physical activity for short periods of time and that accelerometers underestimated the level of intensity. The underestimation of intensity should get a lot more attention.

Norman et al.<sup>29</sup> explored what aspects of active videogame play influenced the intensity and duration of physical activity over a 4-week period. Using an operant conditioning theoretical framework, they randomly assigned students to one of four videogames that varied on their level of reinforcement (i.e., aspects designed to increase the frequency of the player's behavior) and aversive contingencies (i.e., aspects designed to decrease the player's behavior) combined. Using accelerometers, one of the most objective currently available methods for assessing physical activity, they found that although overall minutes of all day moderate-vigorous physical activity decreased across the 4 weeks, it increased with the two games offering more contingencies and decreased with the two games offering fewer contingencies. This suggests that contingencies in active videogames need to be more carefully studied and may offer promise of increasing moderate-vigorous physical activity in children.

Mellecker et al.<sup>30</sup> identified psychosocial, physiological, and embodiment aspects of "fun" or "enjoyment" from playing active videogames and from being physically active. They identified needed research to better specify or understand what fun is and to encourage incorporating this knowledge into the design of future active videogames to increase both the intensity and duration of game play and thereby physical activity. Young investigators, pay attention!

Radecki et al.<sup>31</sup> presented a Clinical Brief on their effort using virtual reality simulation and gaming principles to train pediatricians in motivational interviewing, a highly discussed intervention procedure that enables clinicians to intently listen to their patients and to motivate them to self-identify, likely to be effective change procedures. We look forward to publishing future outcome evaluations of the use of this game and its impact on children's diet, physical activity, and adiposity.

The Roundtable Discussion<sup>32</sup> on gaming and obesity included authors who have published on diverse aspects of this topic. It placed games for health within the context of the sedentariness of much of game play and identified how future games for health might minimize sedentariness. Although it appears likely that sedentary game playing contributes to obesity, the pathway of effect may be through diet; a new generation of active videogames was advocated that gives more attention to story, behavior change, and social game play, and whether active videogaming takes time away from regular physical activity was advocated as a key issue requiring intensive research.

One reasonably large active videogame study ( $n=322$ ) showed that playing active videogames decreased child adiposity.<sup>33</sup> The senior author of that study, Ralph Maddison, is highlighted in the Profile<sup>34</sup> in this issue and was a member of the Roundtable Discussion herein.<sup>32</sup>

Finally, Ilja Michaelis<sup>35</sup> reported from Europe on several recent publications on serious games for health, primarily in Germany. Thank you, Ilja, for the enthusiastic interpretation!

Games have been designed to decrease adiposity by increasing physical activity directly (active videogames), through inserting behavior change procedures (change gaming), or by adding theory-based adjuncts to active, diet, or combined videogames. Although active videogames have been demonstrated to offer a moderate- or higher-level workout for those motivated to do so, playing them does not automatically lead to increased physical activity. Research is needed on how to enhance the physical activity from active videogames (e.g., adding story, increasing contingencies, varying alternative gamification procedures, more clearly understanding the "fun" from exergaming) or how to design new games that involve physical activity.<sup>36</sup> What an exciting time in which games for health designers and researchers are privileged to live.

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