

## Child Goal Setting of Dietary and Physical Activity in a Serious Videogame

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### Abstract

**Objective:** To inform child obesity prevention programs, the current article identified what children thought were the most important goals, values, and perceived barriers related to healthy eating and physical activity (PA) within a serious videogame for health, “Escape from Diab” (Archimage Inc., Houston, TX).

**Subjects and Methods:** One hundred three children, 10–12 years of age, played “Escape from Diab.” During game play the children were presented with a menu of goals, values, and barriers from which they selected the ones most important to them. The children’s selections were transmitted to a central server and stored in a database. Frequencies were calculated and reported.

**Results:** The most important diet-related values and reasons for children were getting good grades and being healthy and fit. The most often reported barrier for fruit intake was that it does not fill you up, and for vegetable intake it was that availability at home was limited. Also, limited availability of bottled water at home was an often chosen barrier. PA-related important values and reasons were not missing school and having energy to do homework. Children preferred to limit sedentary activities for only 30 minutes rather than for 60 minutes. The most frequently mentioned barrier for reducing inactivity was “feeling too tired to do anything else.”

**Conclusions:** These findings provide important input for future obesity prevention videogames attempting to motivate children to set healthy diet and PA goals.

### Introduction

THE PREVALENCE OF OBESITY among children is alarming,<sup>1</sup> impacting both short- and long-term health.<sup>2</sup> Obesity results from energy intake exceeding expenditure.<sup>3</sup> Low-energy-dense diets are associated with lower energy intakes and body weight and may be achieved by adding water-rich fruits and vegetables (FV).<sup>4</sup> Increased water intake can displace sweetened beverage intake.<sup>5,6</sup> Reducing sedentary behavior<sup>7,8</sup> and increasing physical activity (PA)<sup>9</sup> are also important in the management of obesity. However, most children consume less than the recommended minimum of 9 FV servings per day,<sup>10</sup> consume high levels of sugar-sweetened beverages,<sup>11</sup> have more than the recommended 2 hours/day<sup>12</sup> of screen time, and are physically active for less

than the recommended 60 minutes of moderate to vigorous PA/day.<sup>13</sup> Thus, to prevent obesity, interventions should target increased FV and water intake and PA and decreased sedentary behavior.

Changing these health behaviors is challenging because behavior is influenced by many factors.<sup>14,15</sup> Behavioral theories identify procedures to modify these factors and can therefore inform the development of serious health videogames. The current study focuses on a serious health videogame named “Escape from Diab” (Diab) (Archimage Inc., Houston, TX), designed to lower risks of obesity by changing children’s diet and PA behaviors.<sup>16</sup> This videogame included procedures based on the Social Cognitive Theory (SCT)<sup>17</sup> and Self Determination Theory (SDT)<sup>18</sup> and was effective in increasing FV intake.<sup>19</sup>

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SCT proposes that behavior change is a function of enhanced skills and self-efficacy (i.e., confidence) in performing a new behavior.<sup>17</sup> SCT-specified behavior change procedures used in Diab were goal setting, problem solving, goal review, modeling, and skill development.<sup>17</sup> Goal setting in Diab focused attention on making specific behavior changes,<sup>20</sup> which has been shown to be effective in increasing children's FV consumption<sup>21-24</sup> and PA.<sup>25</sup> Goal setting includes two phases: Goal intentions and implementation intentions. A goal intention is the goal itself (e.g., increasing intake by 1 serving of fruit), whereas implementation intentions specify the where, when, and how of goal striving (i.e., an if/then plan related to goal attainment). Implementation intentions increase the likelihood that the behavior is enacted.<sup>26</sup> Barriers interfere with goal attainment and behavior change, and children perceive many barriers to healthy eating<sup>27</sup> and PA.<sup>28,29</sup> To overcome barriers and attain the desired goal, it is important to be able to effectively problem solve.<sup>30</sup> Problem identification and possible solutions were selected during the course of goal setting and thus became anticipatory problem solving. Goal review, which includes self-monitoring, obtained information about goal attainment progress.<sup>17</sup>

SDT posits three basic needs that drive behavior: Competence (i.e., skills, ability to perform a behavior successfully), autonomy (i.e., choice, control), and relatedness (i.e., connection to important others or ideals).<sup>18</sup> Diab sought to develop intrinsic motivation (i.e., engaging in the behavior for the joy or pleasure it brings) by enhancing competence, providing choice, and connecting goals to personal values (i.e., when connecting the individual's values to their personal behavior [i.e., relatedness]).

Problem solving has been used in PA and diet interventions for preventing overweight,<sup>30-36</sup> but little is known about what values are most important for children, what diet- and PA-related goals children prefer to set, what problems children expect, or what solution they believe will work. Diab provided a unique opportunity for children to explore in a virtual world their important goals, values, and barriers. Thus, we were able to identify children's most important goals, values, and perceived barriers related to healthy eating, sedentary behavior, and PA so that this can be used in intervention development aimed at promoting child healthy eating and PA to prevent overweight.

## Subjects and Methods

### Design

The original study was an efficacy trial using a two-arm randomized control design. Children were randomly assigned to intervention ( $n=103$ ) or control ( $n=50$ ) groups. Intervention group children first played Diab and then "Nanoswarm: Invasion from Inner Space" (Nano), a companion videogame using the same behavior intervention architecture (also from Archimage Inc.). Control group children received a knowledge-enhancing Internet experience.<sup>19</sup> This study was approved by the Baylor College of Medicine Institutional Review Board, and all children and parents provided written informed consent and assent.

### The videogame

Diab was theoretically grounded (SCT and SDT) and designed to lower risks of obesity by changing children's diet

and PA behaviors. It was immersive<sup>37</sup> and comparable to the contemporary entertainment videogames. Children set diet and PA goals during game play. Goal setting included action and coping (anticipatory problem solving) implementation intentions,<sup>38</sup> a behavioral inoculation component involving a temptation not to make the behavior change followed by a motivational message involving the reasons statement linking the child-selected behavior change to a personally selected value,<sup>16</sup> and a goal behavior menu tailored to usual dietary or PA/physical inactivity (PI) behaviors. Data from playing Diab were transmitted to and retained in a central server. Details about Diab are described elsewhere.<sup>16,19</sup>

### Sample

Children were recruited primarily with advertisements on a radio station aimed at parents of children from a range of ethnic communities and races in Houston, TX. Inclusionary criteria were as follows: being 10-12 years of age, between the 50th percentile and 95th percentile for body mass index, fluent in English, allowed to play videogames, and having high-speed home Internet access (to permit transmission of process evaluation data). Exclusionary criteria were as follows: the child not speaking English (because both games were in English), having a medical condition that influenced diet, PA, obesity, or the ability to complete questionnaires, having a seizure disorder (reports of seizures from watching screen media), or being a member of a swim team (because of limits on use of accelerometers for the effect study). The current study reports only the intervention group when playing Diab ( $n=103$ ).

### Measures

Children were offered numerous choices (which were recorded) throughout goal setting. First, the player was offered a choice of which behaviors to set as a goal. In episodes 1-4 the behaviors were diet related, whereas in episodes 5-8 the behaviors were related to lowering PI within the context of increased activity. Players chose a specific behavior goal, the meal/snack at which to make the change or specific inactivity to reduce, and the days of the week to attempt this goal (Sunday-Saturday). The number of goals increased across episodes (one goal in sessions 1 and 5, two goals in sessions 2 and 6, and three goals in sessions 3, 4, 7, and 8) to provide challenge and increase the extent of change. Table 1 shows the steps in goal setting.

**Steps 1 and 2: Values and "reason" statements.** Players were presented with a menu of value statements from which they selected the one that was most important to them. They then selected a reason from a menu of value-specific reasons that best tied meeting the goal with their selected value. "Reason" statements (i.e., statements connecting values and goals) were later tailored in the game to player-selected values to enhance relatedness. For example, "getting good grades" was one value players could select. A possible reason connecting this value to their goal (e.g. "eating fruit for breakfast") was "it keeps you healthy so you can pay better attention at school." Value and reason statements were pre-tested with children. Table 2 shows the possible value options for both PA and diet. The possible options for reason statements are given in Supplementary Tables S1 and S2

TABLE 1. GOAL SETTING STEPS IN "ESCAPE FROM DIAB"

| <i>Intention, step</i> | <i>Description</i>                                                                                                                                                                                                                                                  |
|------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Goal                   |                                                                                                                                                                                                                                                                     |
| 1                      | Value selection: Select a value (e.g., getting good grades) important to you from a menu.                                                                                                                                                                           |
| 2                      | Reason selection: You are told that eating FV (Ep 1–4) or being less inactive (Ep 5–8) can help you with [selected value]. Select a reason (e.g., keeps you healthy so you miss less school) that makes the most sense to you (from a menu specific to each value). |
| 3                      | Goal selection: Select goal (specify FV at a specific meal, or PA/PI at a specific time from a menu reflecting usual practice).                                                                                                                                     |
| Implementation         |                                                                                                                                                                                                                                                                     |
| 4                      | Day selection: Pick one day (of the next 4 days) to attempt your goal.                                                                                                                                                                                              |
| 5                      | Repeat steps 3 and 4 if setting more goals, dependent on Ep. (Ep 1 only has one goal to set. Episode 2 sets 2 goals, Episode 3 and 4 set 3 goals. This repeats: Ep 5, 1 goal; Ep 6, 2 goals; Ep 7, 3 goals; Ep 8, 3 goals.)                                         |
| 6                      | Displays summary of goals and reasons                                                                                                                                                                                                                               |
| 7                      | Behavior inoculation: Guard ("bad guy") tries to tempt you to not meet goal; Delinda ("good guy") tells you to remember why this goal is important to you (tailored to reason statement).                                                                           |
| 8                      | Motivation affirmation: Still willing to meet goal? Yes or no. If Yes, continue. If No, go to next segment.                                                                                                                                                         |
| 9                      | Anticipatory problem solving: Select single most likely problem you may face (from a menu).                                                                                                                                                                         |
| 10                     | Solution selection: Select solution (from a menu specific to that problem) that is most likely to work for you.                                                                                                                                                     |

Ep, episode; FV, fruits and vegetables; PA/PI, physical activity/physical inactivity.

(Supplementary Data are available online at [www.liebertpub.com/g4h](http://www.liebertpub.com/g4h)).

**Step 3: Diet and PA/PI goals.** Table 3 shows the possible diet and PI goals. Because decreasing inactivity was more closely related to obesity than increasing activity,<sup>39</sup> goal options targeted decreasing inactivity (e.g., "Play video- or computer games for 30 less minutes").

**Step 9 and 10: Barriers and solutions.** Players developed an implementation intention to overcome anticipated barriers to goal attainment. Players were presented with a menu of

common child-reported barriers (Table 4) to healthy diet or activity choices and were prompted to choose the one they anticipated encountering. Next, a menu of possible solutions was presented, and the player was asked to choose one he or she was willing to try for that problem. The complete list of all possible solutions is given in Supplementary Table S3. Examples include "Ask parent/guardian to buy your favorite fruit or 100% juice more often" or "Take a paper towel or napkin with you." At the beginning of the next episode, players reported if they met the goal (i.e., goal review) and any problems they encountered, which was used for problem solving.

Prior to inclusion in the videogame, the barriers and solutions were pretested with children through cognitive interviews to make sure the barriers and solutions were perceived as believable and realistic by the player (i.e., personally relevant) and were easily understood.<sup>16</sup>

TABLE 2. POSSIBLE OPTIONS FOR VALUES FOR DIET AND PHYSICAL (IN)ACTIVITY GOALS

- Getting good grades
- Being healthy and fit
- Being physically strong
- Being athletic
- Being responsible
- Being a good person
- Being successful
- Being spiritual
- Feeling good about yourself
- Being attractive
- Being mature
- Pleasing your parent/guardian
- Being good at something
- Being respected by your friends at school
- Being respectful
- Being respected by your teachers at school
- Being sure of yourself
- Being happy
- Being in control of yourself
- Being independent
- Having friends
- Being energetic

## Results

### *Background characteristics of participants*

In total, 103 children played Diab. The sample included primarily 10 year olds, slightly more boys, slightly more white children than other ethnicities, and those whose parents mostly had a college degree or higher (Table 5).

### *Diet*

**Values and "reason" statements.** Children mostly selected getting good grades and being healthy and fit as values. The values "being in control of yourself," "being sure of yourself," "being independent," "pleasing your friends," "being good at something," and "being respected at home" were not selected by any of the children. Most frequently selected "reason" statements, connecting their values to their selected goal (Table 6), also emphasized school performance and health (e.g., "Keeps you healthy so you pay better attention at school").

TABLE 3. POSSIBLE OPTIONS FOR DIET AND PHYSICAL INACTIVITY GOALS

| Goal                | Option                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
|---------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Diet                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| Fruit/juice         | <ul style="list-style-type: none"> <li>• Eat one more portion of fruit for your after-school snack</li> <li>• Eat one more portion of fruit or 100% juice for breakfast on a school day</li> <li>• Eat one more portion of fruit when eating out at places like fast food restaurants, cafeterias, or buffets</li> <li>• Eat one more portion of fruit for dessert after dinner on a school day</li> <li>• Eat one more portion of fruit for your snack on a non-school day</li> <li>• Eat one more portion of fruit for lunch/school lunch</li> </ul> |
| Vegetables          | <ul style="list-style-type: none"> <li>• Eat one more portion of vegetables for your after-school snack</li> <li>• Eat one more portion of vegetables for lunch/school lunch</li> <li>• Eat one more portion of vegetables for dinner on a school day</li> <li>• Eat one more portion of vegetables at fast food places</li> </ul>                                                                                                                                                                                                                     |
| Water               | <ul style="list-style-type: none"> <li>• Drink one more glass of water with your after-school snack</li> <li>• Drink one more glass of water with your dinner on a school day</li> <li>• Drink one more glass of water whenever you're thirsty</li> <li>• Drink one more glass of water when eating out at places like fast food restaurants, cafeterias, or buffets</li> <li>• Drink one more glass of water with your lunch/school lunch</li> <li>• Drink one more glass of water after being physically active</li> </ul>                           |
| Physical inactivity |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| Television          | <ul style="list-style-type: none"> <li>• Watch TV for 30 less minutes</li> <li>• Watch TV for 60 less minutes</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                               |
| Computer/video/DVD  | <ul style="list-style-type: none"> <li>• Play video- or computer games for 30 less minutes</li> <li>• Spend 30 less minutes on the computer (not games)</li> <li>• Play video- or computer games for 60 less minutes</li> <li>• Spend 60 less minutes on the computer (not games)</li> </ul>                                                                                                                                                                                                                                                           |
| Other               | <ul style="list-style-type: none"> <li>• Talk on the telephone for 30 less minutes</li> <li>• Spend 30 less minutes shopping</li> <li>• Spend 30 less minutes hanging out with friends</li> <li>• Talk on the telephone for 60 less minutes</li> <li>• Spend 60 less minutes shopping</li> <li>• Spend 60 less minutes hanging out with friends</li> </ul>                                                                                                                                                                                             |

**Goals.** The most frequently selected diet goal referred to after-school snacks (Table 7). Children had to specify the FV they would like to eat more. Most children chose the more common fruit such as apples, bananas, and grapes. Few children chose the more exotic fruits such as mangos, nectarines, and tangerines. The more common vegetables (carrots, corn, or broccoli) were selected most often, and no children selected vegetables like peppers (green, red, orange, or yellow) or pinto beans.

TABLE 4. POSSIBLE OPTIONS FOR BARRIERS TO ATTAIN DIET AND PHYSICAL (IN)ACTIVITY GOALS

| Goal        | Option                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
|-------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Diet        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| Fruit/juice | <ul style="list-style-type: none"> <li>• Fruit or juice is not always available at home.</li> <li>• You do not have time to eat fruit or juice.</li> <li>• Do not like the way most fruit taste</li> <li>• Fruit cost too much.</li> <li>• Friends make fun of you when you eat fruit.</li> <li>• Fruit does not fill you up.</li> <li>• Hard to find fruit on fast food menus</li> <li>• Takes too long to make a fruit snack</li> <li>• Fruit is messy to eat.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| Vegetables  | <ul style="list-style-type: none"> <li>• Vegetables do not fill you up.</li> <li>• Friends make fun of you when you eat vegetables.</li> <li>• Cooked vegetables are too mushy.</li> <li>• Takes too long to make a vegetable snack.</li> <li>• Hard to find vegetables on fast food menus</li> <li>• Fresh vegetables cost too much.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| Water       | <ul style="list-style-type: none"> <li>• You do not usually drink water when you are thirsty</li> <li>• You would rather drink sweetened drinks instead of water.</li> <li>• Do not always have bottled water at home</li> <li>• Friends make fun of you when you drink water.</li> <li>• You do not like to drink from water fountains.</li> <li>• Do not like the way water tastes</li> <li>• Bottled water costs too much.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| PA/PI       | <ul style="list-style-type: none"> <li>• You feel too tired to do anything else.</li> <li>• You do not have anything else to do.</li> <li>• Bad weather keeps you inside.</li> <li>• You have to stay inside the house when you get home from school.</li> <li>• You enjoy watching movies, DVDs, and music videos.</li> <li>• Sometimes you just want to hang out with friends.</li> <li>• You do not like to sweat.</li> <li>• You enjoy talking on the phone.</li> <li>• Sometimes you just want to do nothing.</li> <li>• Your friends call you and want to talk.</li> <li>• You enjoy e-mail and instant messaging.</li> <li>• Watching TV helps you relax.</li> <li>• You have to stay inside the house on weekends.</li> <li>• You feel left out when friends talk about their favorite programs.</li> <li>• You enjoy playing video-/computer games.</li> <li>• You enjoy hanging out with friends.</li> <li>• You enjoy shopping.</li> </ul> |

PA/PI, physical activity/physical inactivity.

**Barriers and solutions.** The most often reported barrier for fruit intake was that fruit does not fill you up ( $n=58$ ). The limited availabilities of fruit and juice ( $n=39$ ), vegetables ( $n=38$ ), and bottled water at home ( $n=35$ ) were also often chosen as barriers. Solutions chosen were to eat larger portions of fruit ( $n=43$ ), ask a parent/guardian to have vegetables available at home ( $n=27$ ), ask them to buy bottled water ( $n=20$ ), or to go to the grocery store with a parent/guardian and buy fruit or 100% juice ( $n=15$ ). Specific solutions for water were also to remind yourself to drink water when you



TABLE 5. CHILDREN'S CHARACTERISTICS

| Characteristic              | Number (%) |
|-----------------------------|------------|
| Age (years)                 |            |
| 10                          | 43 (41.7)  |
| 11                          | 34 (33.0)  |
| 12                          | 26 (25.2)  |
| Sex                         |            |
| Girl                        | 45 (43.7)  |
| Boy                         | 58 (56.3)  |
| Ethnicity                   |            |
| White                       | 37 (35.9)  |
| African-American            | 28 (27.2)  |
| Hispanic                    | 28 (27.2)  |
| Other                       | 10 (9.7)   |
| Highest household education |            |
| Some college or less        | 31 (30.1)  |
| College degree or more      | 72 (69.9)  |

are thirsty ( $n=20$ ) and to bring a water bottle to school ( $n=19$ ).

#### PA/PI

**Values and "reason" statements.** Similar to diet, the most frequently reported values linked to PI goals were getting good grades and being healthy and fit. The values "being in control of yourself," "being independent," "having friends," and "being respected at home" were not selected at all. The most selected PA/PI reason statement was "keeps you healthy so you miss less school" (Table 8).

**Goals.** The most common goal choices were decreasing time spent in watching television, playing videogames, working on the computer (not games), and talking on the telephone (Table 9). Few children chose to limit their time spent shopping or hanging out with friends. Most children preferred the goals that only limited their time by 30 minutes instead of 60 minutes.

**Barriers and solutions.** For reducing inactivity, the most commonly mentioned barriers were "feeling too tired to do anything else" ( $n=89$ ) and "having nothing else to do" ( $n=63$ ). Other frequently selected barriers were "bad weather keeps you inside" ( $n=48$ ), "your friends call you and want to talk" ( $n=34$ ), "watching TV helps you relax" ( $n=26$ ), "you have to stay inside the house when you get home from school" ( $n=24$ ), "you do not like to sweat" ( $n=21$ ), "you

TABLE 6. MOST FREQUENTLY CHOSEN DIET "REASON" STATEMENTS (TOP 5)

| Diet "reason" statements                                | n   |
|---------------------------------------------------------|-----|
| Keeps you healthy so you pay better attention at school | 100 |
| Keeps you healthy so you miss less school               | 50  |
| Helps you be a healthy weight                           | 46  |
| Keeps you physically active longer                      | 38  |
| Helps you feel better                                   | 18  |

Children could choose more than one option across sessions during the game.

TABLE 7. TOP 5 OF SELECTED DIET GOAL CHOICES IN "ESCAPE FROM DIAB"

| Diet goal choices                                                         | n  |
|---------------------------------------------------------------------------|----|
| Fruit and juice                                                           |    |
| Eat one more portion of fruit for your after-school snack                 | 60 |
| Eat one more portion of fruit or 100% juice for breakfast on a school day | 46 |
| Vegetables                                                                |    |
| Eat one more portion of vegetables for your after-school snack            | 39 |
| Eat one more portion of vegetables for lunch/school lunch                 | 19 |
| Water                                                                     |    |
| Drink one more glass of water with your after-school snack                | 74 |
| Drink one more glass of water with your dinner on a school day            | 17 |

Children could choose more than one option across sessions during the game.

enjoy watching movies, DVDs, and music videos" ( $n=20$ ), and "you enjoy playing video-/computer games" ( $n=19$ ).

Solutions the children chose were "to be physically active for 10 minutes at a time to get used to it" ( $n=61$ ), "find physical activities you can do inside, like dancing or exercise videotape" ( $n=30$ ), "join friends doing their favorite physical activities" ( $n=29$ ), "to do nothing for a minute and then be physically active" ( $n=20$ ), or "be physical active and then play games as a reward" ( $n=15$ ). The following solutions were not chosen at all: "Physical activity helps you relax—do it while watching TV (e.g., dancing, walking in place, or exercising)," "Do physical activity while you watch TV program (e.g., dancing, walking in place, or exercising on a bike)," or "Exercise with an aerobics videotape."

#### Discussion

This study was designed to enable others to more efficiently design similar interventions for preventing overweight in children by reporting what values and corresponding reasons were important for children, which health goals they preferred to set, which barriers they perceived, and what they thought were good solutions for these barriers. The fact that children playing the game increased their intake of FV<sup>19</sup> enhances the credibility of the procedures detailed here.

TABLE 8. MOST FREQUENTLY CHOSEN PHYSICAL ACTIVITY/PHYSICAL INACTIVITY "REASON" STATEMENTS (TOP 5)

| PA/PI "reason" statements                 | n  |
|-------------------------------------------|----|
| Keeps you healthy so you miss less school | 75 |
| Gives you good energy to do more homework | 66 |
| Helps you be a healthy weight             | 57 |
| Helps you feel better                     | 35 |
| Keeps your skin looking healthy           | 26 |
| Shows you make good decisions             | 15 |

Children could choose more than one option across sessions during the game.

PA, physical activity; PI, physical inactivity.

TABLE 9. TOP 5 OF SELECTED PHYSICAL ACTIVITY/PHYSICAL INACTIVITY GOAL CHOICES IN "ESCAPE FROM DIAB"

| PA goal choices                                   | n  |
|---------------------------------------------------|----|
| Watch TV for 30 less minutes                      | 75 |
| Play video- or computer games for 30 less minutes | 62 |
| Talk on the telephone for 30 less minutes         | 57 |
| Spend 30 less minutes on the computer (not games) | 52 |
| Watch TV for 60 less minutes                      | 42 |

Children could choose more than one option across sessions during the game.

PA, physical activity.

### Diet

Regarding diet, getting good grades and being healthy and fit were reported as important values for children. The most frequently selected reason statements also emphasized performance at school and fitness. Other studies have also shown that school performance is important for children and that they were tied to healthy eating and PA.<sup>40</sup> Although the study sample was not large enough, future evaluations of such games should assess differences in outcomes by selected values or with values as a moderating variable.

The goals were mostly targeted in school food and after-school settings: School meals, after-school snacks, and on schooldays. Substantially fewer were on non-school days or eating out in restaurants or fast food places. Children may have emphasized school over non-school selections because they likely have more control over selections and consumption at school and for snacks. Future health games or other interventions may require goal selections made outside of school to test whether change is increased by thus expanding the focus of the goals.

Children preferred common FVs for their goals to more exotic types. Given the generally low levels of FV consumption among U.S. children,<sup>10</sup> substantial increases could be made with the common varieties. Increasing consumption of more exotic varieties would likely require intense engagement of characters in the game in making those choices. This probably should be attempted in a future game and the effect observed.

The most common barrier was lack of getting a feeling of fullness from eating fruit, but barriers were also often related to lack of availability of the items at home. Lack of satiety from eating fruit has also been indicated as an important factor in other studies as described in a review.<sup>41</sup> Several qualitative studies revealed that children expressed concern for the satiety value of FVs, compared with foods like chips and chocolate.<sup>41</sup> Further research is warranted to find solutions. Lack of availability also emerged from the review of Krølner et al.<sup>41</sup> as an important factor influencing FV consumption. In the current study an often-mentioned solution for lack of availability was to ask parents to make the desired food options more available at home. Child-asking behavior has been related to increased availability at home<sup>34</sup> and offers an important solution. Perhaps such games should more clearly focus on simulation training of the child to effectively ask.

### PA/PI

Regarding PA and PI, important values and reasons were not missing school, obtaining energy to do homework, and being a healthy weight. Children preferred the goal to limit

their screen time, computer time, or talking on the telephone, rather than limiting their time hanging out with friends. Also, they preferred a lower dose of self-denial by limiting their time by 30 minutes instead of 60 minutes, as might be expected. Perhaps shorter-duration denial could be offered earlier in game play and larger-denial duration later once skills developed to obtain the lower cost changes. Many children saw barriers to decreasing the time spent in sedentary acts because they felt too tired to do something else or because they had nothing else to do. Often-mentioned solutions for these barriers were to do short bouts of PA to get used to it or to find PAs done inside.

Active videogames have been shown to induce light to vigorous PA,<sup>42–45</sup> and they may provide an outlet for children wanting something to do but not able or willing to go outside. Moreover, active games give children the opportunity to engage in an activity they like<sup>46–48</sup> in their own home while getting some exercise. An aspect that children like about active games is the suitability to play with friends.<sup>48</sup> Thus, active games enable children to be active but not limit their time hanging out with friends. Furthermore, active videogame play is often intermittent. Thus, active games seem appropriate for getting used to PA (an often-mentioned solution in the current study). The study into the effects of Diab showed that playing Diab in combination with Nano resulted in an increase in FV intake but not in PA.<sup>19</sup> Future interventions could combine serious game play like Diab, with active games such as those for the Nintendo® (Redmond, WA) Wii™, PlayStation® (Sony, New York, NY) Move, or Xbox® (Microsoft, Redmond) Kinect and by targeting value and reason statements to which children feel related, thereby promoting motivation for behavior change.

Most studies use questionnaires or interviews to evaluate children's opinions, which could be burdensome and boring for the participants. A strong element of the present study is that videogame play was a process evaluation tool. As videogames are very appealing to children, videogames have excellent capability to serve as a fun and efficient process evaluation tool. Although they may have managed to minimize social desirability bias by incorporating the questions within the game as opposed to an in-person interview, research is needed to assess whether these were socially desirable responses, were influenced by providing *a priori* options in the game, or were a self-selected biased sample and how to minimize such responses or sample biases in research on future games. Data stored in videogames can provide a rich information source for optimizing videogame components to maximize behavioral change. A limitation of the study is that reported findings are descriptive and cannot be generalized. The specified procedures operationalize our understanding of how best to use this. Future research will need to determine if they were need or optimally designed. The lists of goals, barriers, values, and reasons were listed in fixed order, which may have biased selection toward those earlier in the list. The sample of the current study was limited mostly to white children with parents with a college degree or higher. Quantitative studies are necessary to further evaluate the findings in representative samples.

In summary, the findings of the current study provide important input to enable others to design similar interventions or make further enhancements and thereby improve interventions for diet and PA behaviors in children.

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## Author Disclosure Statement

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