

Influences on Children's Dietary Behavior, and Innovative Attempts to Change It

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Key Messages

- Child fruit and vegetable intake reflects many influences from multiple levels (e.g. internal to the child, family, school, and neighborhood).
- Effective interventions use known behavior change procedures to change the influences on fruit and vegetable intake enough to change the behavior.
- Videogames for Health offer a medium that is attractive to children and shows promising results for dietary behavior change.

Key Words

Children · Fruit · Vegetables · Intake · Video games · Psychosocial · Family · Neighborhood · Intervention

Abstract

Fruit and vegetable (FV) intake may protect against several chronic diseases, and the preferences and habits in relation to FV intake appear to form in early childhood. Child FV intake reflects many influences from multiple levels (e.g. internal to the child, family, school, and neighborhood). We have documented influences at each of these levels, but more definitive research in longitudinal samples remains to be conducted. Even though validated comprehensive models of influences on child FV intake in longitudinal studies are not available to guide intervention design for children of differ-

ent ages, there has been an urgency to initiate chronic disease prevention interventions to mitigate the substantial health consequences. Effective interventions use known behavior change procedures to change the influences on FV intake enough to change the behavior, but few such interventions have demonstrated effectiveness at meaningful levels. Innovative methods need to be explored. Videogames for Health offer a medium that is attractive to children and shows promising results, especially for dietary behavior change. Exciting additional research is needed to clarify possible bidirectional influences between the environmental and individual influences on child intake with possible age-related differences in influence and in the optimal design of video games for dietary change.

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Background

Chronic disease is the most common cause of mortality [1], and diet contributes to or can prevent cardiovascular diseases [2], diabetes [3], stroke [4], several cancers [5], and maybe obesity [6–8]. Fruit and vegetable (FV) intake, in particular, appears to play a strategically important role in the etiology and prevention of several chronic illnesses [9]. There is accumulating evidence [10] including that FV intake tracks through childhood [11, 12], suggesting that the preferences for and habit of FV intake are formed early in life. As a result, we have focused our research on correlates of FV intake among children to

guide our attempts to design and evaluate likely-to-be-effective behavior change interventions for chronic disease prevention. Our recent work has emphasized childhood obesity because of its high prevalence among US youth [13].

Dietary behavior change can be best understood by imposing the mediating/moderating variable model (MMVM) on the change process (fig. 1). Our outcome or dependent variable of primary concern is FV intake. The mediators of interest are variables suggested by alternative theories [14] as determinants of FV intake and could include personal, family, neighborhood or biological variables, among others. The interventions or primary independent variables incorporate various proposed behavior change procedures [15]. Moderator variables [e.g. gender and socioeconomic status (SES)] influence the relationships between other variables. Moderators are nuisance variables which dilute program effectiveness, but are important to identify either to add intervention procedures to promote change in the nonresponsive group(s), or to exclude people with that characteristic from the intervention to minimize expenses for ineffective outcomes [16]. Assumptions of the MMVM are that changes in the mediating variables cause change in behavior (FV intake); the intervention procedures have been adequately (preferably thoroughly) implemented, and they can change the mediators enough to expect change in the behaviors. For simplicity, this conceptual MMVM presents only 1 intervention procedure, 1 mediator, 1 moderator, and 1 dependent variable. Useful MMVMs, alternatively, may have multiples of any or all. A further complication of this analysis is the possibility that these relationships may vary (and many likely do) by age of the child [17]. It is likely best to analyze FV separately, since the influences appear to vary, but we did not know that when we started this research.

Our research can be organized into segments corresponding to the MMVM. This article briefly reviews the influences on FV intake, which provide the foundation for intervention (table 1), and summarizes our findings evaluating a highly innovative approach to changing dietary behaviors: serious video games, which offer a method that appears promising for obtaining dietary change.

Mediating Variables: Influences on Behavior

Child FV intake is low (about 2 servings/day) and varies substantially by meal and from day to day, especially from weekdays to weekends [18]. Girls tend to eat more

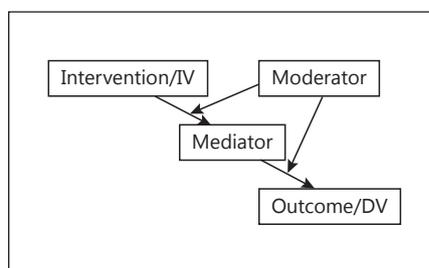


Fig. 1. Mediating/moderating variable model. IV = Independent variable; DV = dependent variable.

FV than boys; lower-SES children tend to eat fewer FV, and many variables have been shown to influence child FV intake [19]. Influences can be grouped into individual, family, neighborhood, and biological influence categories.

Individual Influences

A child's beliefs, or perceptions of others, can influence how they behave. Self-efficacy, or the confidence one may have to eat FV under diverse, and sometimes adverse, circumstances (as specified by Social Cognitive Theory) was positively related to FV intake among 5th-grade students [20]. Perceived social norms, or one's perceptions of peers or parents eating FV or expecting oneself to do so (as specified by the Theory of Planned Behavior) were also related [20]. In a comprehensive social cognitive theory model, FV preferences (i.e. whether the child liked FV) and outcome expectancies (i.e. the belief in whether good or bad consequences would occur from eating FV, also called 'attitude' in the Theory of Planned Behavior) predicted FV intake [21]. A literature review on mediators of dietary behavior change [22], however, revealed that only self-efficacy and outcome expectancies were consistently associated with dietary change, and outcome expectancy was the only individual-level variable shown to be a mediator (i.e. was both influenced by the intervention and causal of behavior change). More research is needed on individual determinants of FV intake, especially possible differences by age group and in longitudinal designs.

Family Influences

We conducted one of the earliest family-based interventions to enhance family members' diet and physical activity practices [23]. It did not work. We reviewed the literature on family-based interventions for dietary change and found most of them were not working or not

Table 1. Correlates of FV intake used to select behavior change procedures in serious video games

Levels of influence	Influencing (mediating) variables	Related game intervention procedures
Individual	Self-efficacy	Characters showing how to perform the tasks Repeated exposure to a change task with encouraging feedback
	Outcome expectancies	Characters making statements about the good things that will happen from doing the behavior Characters experience these changes in the story
	Values/reasons	Providing motivational statements for doing the behavior based on the player's selected values and reasons
Family	Home FV availability	Encouraging parents to purchase more of the child's favorite FV by having the child practice asking their parents for them
	Effective FV parenting practices	Simulate an interaction with a target-aged child; allow the parent to select effective or ineffective FV parenting practices, and provide feedback in the form of the child eating or not eating the FV in response to the selected parenting practice
Neighborhood	Proximity to fast food restaurants	Enhance the parent's skills to make more, less expensive recipes preferred by the child at home

working well [24]. A clearer picture is needed of how families influence children's FV intake to establish a stronger foundation for FV change interventions.

We were the first to show that food in the home environment, i.e. home FV availability (FV in the home) and accessibility (FV in a form and location that children could easily access), were related to child FV intake [25]. These findings have been repeated many times [26], and changing the home food environment has become a standard component of food parenting practices inventories [27]. With home FV availability firmly established as an influence on child FV intake, we initiated research to identify the factors that influenced home FV availability and assumed FV shopping would be an important factor. In a grocery store intercept survey, we learned that families varied in the frequency of grocery shopping with some families shopping only once a month with few smaller trips in between, while others shopped every few days as needed to replenish fresh home FV supplies [28]. African American families tended to shop less frequently and Asian families more frequently [28]. Clearly, families shopping only once a month were not purchasing a large quantity of fresh FV items. FV shopping practices, social support for purchasing FV [29],

parent outcome expectancies for purchasing FV [30], and FV pantry management practices [31] were correlated with home FV availability. When combined in the same predictive model and controlling for possible demographic confounders, only social support for purchasing FV predicted home FV availability [32]. Establishing perceived support for purchasing FV for consumption at home, thus, appears to be an important intervention target, but we have not yet taken this next step.

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We initiated qualitative research with children and parents from 3 ethnic groups to explore family influences on FV intakes [33]. Diverse positive and negative influences were identified [33]; child-reported home FV availability, parent modeling of FV intake, and parenting control were positively correlated with FV intake, while peer normative beliefs were negatively correlated with child FV intake [34], and parent-reported negative parenting practices and barriers were negatively correlated with child FV intake, but a number of parent-reported parenting practices were not [35]. To our surprise, few ethnic group differences were detected in the child- or parent-reported parenting practices [36].

Using 36 FV parenting practice items generated by parents of preschoolers, a cluster analysis revealed three

types of parents: indiscriminate (they used all the practices), non-directive, and low-involved food parenting [37]. Food non-directive parents more frequently used increased home FV availability and teachable moments, but less firm discipline than the others, and were more likely to have preschoolers who ate more FV [37]. These 36 FV parenting practices were rated by child health and nutrition professionals in 6 countries into effective and ineffective parenting practices, and a three-dimensional structure (i.e. structure, responsiveness, and control) was confirmed [38]. This three-dimensional FV parenting practices structure was re-verified for effective and ineffective parenting practices, separately [39]. We hosted an international conference on food and other obesity-related parenting practices to identify steps forward in moving this research toward intervention, including more comprehensive assessment of food parenting practices in longitudinal studies [40].

To better understand when or why parents might use the effective or ineffective parenting practices, we created a model of goal-directed vegetable parenting practices (MGDVPP), which combines emotional and motivational variables with variables in the Theory of Planned Behavior [41], and have identified reasons that connect a mother's values with using effective vegetable parenting practices [42]. We expect that as the model of MGDVPP is validated, we will target the strong relationships therein to motivate parents to use effective, and not use ineffective, vegetable parenting practices.

Neighborhood Variables

There has been substantial interest in whether proximity to stores that offer healthier food enables residents to eat healthier. Our early study in this line of research showed that Boy Scouts who lived closer to restaurants that offered more FV tended to eat more FV, but those restaurants also tended to be located in higher-SES areas [43], a potential confounder. Using a different data set, Boy Scouts who lived near fast food restaurants tended to consume more high-fat vegetables, but also more fruit and juice; those who lived further from convenience stores tended to eat more FV, and vegetable preferences (whether children liked vegetables) accounted for 26% of the relationship (i.e. mediated) between low-fat vegetable consumption and distance to the nearest convenience

store [44]. It was not clear whether families with children who preferred FV chose to live in locations further from convenience stores, or living near convenience stores influenced child choices, or both (bidirectional relationships). More research is needed on how the proximity and quality of the neighborhood food environment moderates relationships between individual and family variables and FV intake.

Biological Variables

Most of the relationships detected to this point tended to be weak. We reasoned that perhaps combining biological with behavioral approaches would enable us to better understand FV intake and obesity. The chemical propylthiouracil (abbreviated as PROP) is found in brassica or cruciferous vegetables; it accounts for any bitter taste when eating them, and the ability to taste the bitterness from PROP is genetically determined [45]. Some research had shown that individuals who could taste PROP were less likely to eat these vegetables, and more likely to be obese. We mounted the largest study of this relationship to date ($n = 1,587$), but found that PROP taste sensitivity was not related to child adiposity [46] nor to vegetable intake [47]. More creative research is needed that integrates biological with behavioral influences on food intake and health problems [48].

Summary

We have made substantial contributions to a rapidly growing literature on influences on child FV intake. The relationships appear to be complex. Much work remains to better understand the influences and establish causal relationships in longitudinal research in order to facilitate well-designed likely-to-be-effective interventions.

Innovative Interventions

Although we may not thoroughly understand the influences on child FV intake, there has been an urgency to mount and test interventions to mitigate the ravages of chronic disease. Cross-sectional studies have shown relationships between knowledge and behavior [49], and it was once thought that enhancing a child's knowledge about a behavior would result in change (kind of a self-

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interested response to new information), but little support exists for this proposition [50]. We participated in a substantial number of evaluation studies to test the effects of interventions which incorporated what we had been learning about influences on children's dietary intake, and more recently obesity. We have designed, implemented and evaluated dietary change interventions directly with individual children [51], children and families [23, 52], children in schools [53–56], and children in social organizations [57]. Despite several interventions being long in duration (up to 3 years) and several being well funded, many had little or no effects [56]. The reasons for not being effective are likely many [58], but not clear [59]. As a result, we have sought innovative ways to promote change using media that appealed especially to children, which we expected would enhance effectiveness. Our first such effort was a video game called Squire's Quest! [60]. Squire's Quest! employed a story designed to

engage or immerse children in the game, and the story line advocated for dietary change: the Kingdom of Five-a-lot was under siege by the Slimes (snakes) and Mogs (moles) who were attacking the FV crop, the primary source of energy for the knights; the player agreed to be a knight in training (a squire) and needed to eat more FV to enhance their good energy. The King's chef who knew how to prepare FV was kidnapped and replaced by a mole chef, who did not prepare any FV. Behavior change procedures (e.g. goal setting and review, problem solving, and FV recipe preparation) were incorporated into the story and game play. In a brief 5 weeks (2 sessions per week, about 20 min/session), the targeted lower-income 4th-grade children increased their FV consumption by 1.0 serving/day, which is the largest documented change even when compared to studies delivered over several years [61].

Our next such effort, the Fun, Food and Fitness Project (FFFP), combined a 4-week summer day camp with an 8-week internet program [62]. Summer day camps are valuable intervention modalities because children will engage in many diverse learning behaviors as long as the activities are perceived to be fun. Targeted at 8-year-old African American girls, the internet program had child and parent versions. The story line for the girls involved four 8-year-old African American girls who just complet-

ed a 4-week summer day camp and were experimenting with how to best use what they had learned in summer day camp in their home lives. Thus, the characters modeled the desired behavior changes and problem solving, i.e. how to overcome the barriers to behavior change. The websites also employed the common behavior change procedures of goal setting and review. The parent website enabled the parents to monitor their child's web activities and offered a variety of behavior change support activities, e.g. FV recipe preparation and parenting goal setting. Although implemented as a pilot study with only 39 girls, a marginally significant treatment-control group difference

was detected in body mass index in favor of the intervention group, and diet changes were detected in the expected directions [62]. The child internet program, implemented subsequently as a stand-alone intervention, resulted in statistically significant dietary changes [63]. The parent internet program, modified in response to par-

ent review and subsequently implemented as a stand-alone intervention, also detected parent behavior change [64].

A Boy Scout 5-a-Day Badge program, based on our earlier Boy Scout intervention [55], combined brief in-troop activities with an internet program [65]. The troop activities involved FV recipe preparation and taste testing (procedures shown to influence intake [66]), while the internet program incorporated a story line about Boy Scouts trying to make dietary changes to earn a badge, facing and overcoming barriers, and also including the goal setting and review behavior change procedures. An evaluation involving 42 Boy Scout troops revealed increased fruit consumption in the treatment compared to the control groups at the end of the 9-week program, but not 6 months later [65].

Our biggest effort in this area was the creation of 2 video games (Escape from Diab and Nanoswarm: Invasion from Inner Space) with 9 episodes each (at 45–60 min/episode) designed to be played sequentially over about 2 months. A comprehensive theoretical model of mediating variables and behavior change procedures was generated to specify how we believe these videogames functioned to influence behavior [67]. Extensive formative research was conducted to generate the story line and artwork to be maximally interesting to the targeted 10- to 12-year-old

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children [68] and to generate intervention activities [69]. The Diab story (a third-person action adventure) involved a renegade troop of teenagers in the Kingdom of Diab who were resisting the autocratic pressures from King Etes to eat junk food and be inactive (to make his subjects more malleable). A youth soccer star from our world (D.J.) fell through a time warp into Diab and took the renegade troop under his wing; D.J. provided guidance on a healthier lifestyle, so the troop could escape from Diab. The troop modeled the lifestyle behaviors and had to over-

There is emerging literature that FV parenting practices influence preschool child FV intake.

come barriers to doing them. Children set specific goals to change their diet behaviors; children attaining most of their lifestyle change goals saw the troop overcome Etes, while children not attaining their goals were dragged back to Diab. The Nano story (a first-person action adventure) involved a similar engaging plot, characters modeling desired behaviors and overcoming barriers to performing the behaviors, and a dichotomous ending contingent on player goal attainment. A pilot evaluation revealed that the treatment group increased their FV intake by 0.67 servings per day [70]. Children who became more immersed in the Diab story line were more likely to change [71]. Many of the specific intervention procedures have been presented in detail [72].

Since FV preferences and intake may be established at the earliest ages [11], we do not know how to design effective behavior change games for preschoolers. There is emerging literature that FV parenting practices influence preschool child FV intake [37, 38], and parents of preschoolers commonly complain that they do not know how to get their child to eat FV [33]. We initiated a project to use videogames to train parents in effective vegetable parenting practices [73]. We have completed 1 episode which simulates an interaction with a preschool child named Kiddio [74]. To enable the parent to interact with a child similar to their own, we abbreviated a lengthy questionnaire that assesses child temperament [75] and then simulated Kiddio's reactions to the player's offer of a vegetable based on the player's report of their child's temperament. We generated Self-Determination Theory-specific personal values and corresponding reasons statements that link values to making dietary changes [42] and provided motivational statements to the player encouraging use of

goal setting of parenting practices predicated on the parent-selected reasons statements. We found that the usual game feedback procedures (e.g. dynamic data summary bars) were not attended to by the players, and middle-income players preferred brief feedback statements that clearly identified a problem, while lower-income players preferred to have these problem statements buffered by a positive statement [76]. An α test of the 1 episode found that players enjoyed the game and made valuable suggestions for improvement [73]. We requested funding to develop 25 episodes which would simulate interactions with Kiddio in 5 different locations (e.g. at grandparent's home or at fast food restaurants), with each location presenting different and more difficult challenges.

Conclusion

While much has been learned about influences on children's FV intake, we have only just scratched the surface about multi-level influences and interactions among these levels. Potentially exciting avenues for future research are bidirectional relationships among individual, family, and neighborhood influences (e.g. what affects where families choose to live, and how does residential location impact FV purchases and intake). More valid and reliable measures are needed of the dietary behaviors

Potentially exciting avenues for future research are bidirectional relationships among individual, family, and neighborhood influences (e.g. what affects where families choose to live, and how does residential location impact FV purchases and intake).

[77] and the related psychosocial [78], family [40], and neighborhood [79] influences.

While we do not know the definitive influences or mediating variables to target, there is urgency to mount FV intake change interventions to minimize the incidence and prevalence of several chronic diseases. We have initiated the design and evaluation of innovative procedures that incorporate much of what we have learned about influences and have high appeal to our target child audience, i.e. videogames [80]. We are in the earliest stages of understanding how to design such games for maximum effect on

dietary behavior. For example, what types of stories, characters, and plot lines are of maximal interest to children of different ages? Is in-story character modeling of behaviors and overcoming challenges an effective change technique? Is goal setting a child-friendly change procedure? What is 'fun' and how can it be used/enhanced to optimally promote dietary behavior change [81]? Answering such questions should enable us to design programs that are more effective in promoting child and adult health.

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References

- 1 Kochanek KD, Xu J, Murphy SL, et al: Deaths: final data for 2009. *Natl Vital Stat Rep* 2011;60:1-117.
- 2 Estruch R, Ros E, Salas-Salvado J, et al: Primary prevention of cardiovascular disease with a Mediterranean diet. *N Engl J Med* 2013;368:1279-1290.
- 3 Knowler WC, Barrett-Connor E, Fowler SE, et al: Reduction in the incidence of type 2 diabetes with lifestyle intervention or metformin. *N Engl J Med* 2002;346:393-403.
- 4 Chowdhury R, Stevens S, Gorman D, et al: Association between fish consumption, long chain omega 3 fatty acids, and risk of cerebrovascular disease: systematic review and meta-analysis. *BMJ* 2012;345:e6698.
- 5 Masko EM, Allott EH, Freedland SJ: The relationship between nutrition and prostate cancer: is more always better? *Eur Urol* 2013; 63:810-820.
- 6 Newby PK: Are dietary intakes and eating behaviors related to childhood obesity? A comprehensive review of the evidence. *J Law Med Ethics* 2007;35:35-60.
- 7 Newby PK: Plant foods and plant-based diets: protective against childhood obesity? *Am J Clin Nutr* 2009;89:1572S-1587S.
- 8 Ledoux T, Hingle M, Baranowski T: Relationship of fruit and vegetable intake with adiposity: a systematic review. *Obes Rev* 2011;12:e143-e150.
- 9 Boeing H, Bechthold A, Bub A, et al: Critical review: vegetables and fruit in the prevention of chronic diseases. *Eur J Nutr* 2012;51:637-663.
- 10 Schwartz C, Scholtens PA, Lalanne A, et al: Development of healthy eating habits early in life. Review of recent evidence and select-ed guidelines. *Appetite* 2011;57:796-807.
- 11 Resnicow K, Smith M, Baranowski T, et al: 2-year tracking of children's fruit and vegetable intake. *J Am Diet Assoc* 1998;98:785-789.
- 12 Kelder SH, Perry CL, Klepp KI, et al: Longitudinal tracking of adolescent smoking, physical activity, and food choice behaviors. *Am J Public Health* 1994;84:1121-1126.
- 13 Ogden CL, Carroll MD, Kit BK, et al: Prevalence of obesity and trends in body mass index among US children and adolescents, 1999-2010. *JAMA* 2012;307:483-490.
- 14 Baranowski T, Cullen KW, Nicklas T, et al: Are current health behavioral change models helpful in guiding prevention of weight gain efforts? *Obes Res* 2003;11(suppl):S23-S43.
- 15 Michie S, Ashford S, Sniehotta FF, et al: A refined taxonomy of behaviour change techniques to help people change their physical activity and healthy eating behaviours: the CALO-RE taxonomy. *Psychol Health* 2011; 26:1479-1498.
- 16 Baranowski T: Understanding the behavioral linkages needed for designing effective interventions to increase fruit and vegetable intake in diverse populations. *J Am Diet Assoc* 2011;111:1472-1475.
- 17 Jago R, Baranowski T, Baranowski JC, et al: BMI from 3-6 y of age is predicted by TV viewing and physical activity, not diet. *Int J Obes (Lond)* 2005;29:557-564.
- 18 Baranowski T, Smith M, Hearn MD, et al: Patterns in children's fruit and vegetable consumption by meal and day of the week. *J Am Coll Nutr* 1997;16:216-223.
- 19 Rasmussen M, Krolner R, Klepp KI, et al: Determinants of fruit and vegetable consumption among children and adolescents: a review of the literature. Part I: quantitative studies. *Int J Behav Nutr Phys Act* 2006;3:1-19.
- 20 Thompson VJ, Bachman CM, Baranowski T, et al: Self-efficacy and norm measures for lunch fruit and vegetable consumption are reliable and valid among fifth grade students. *J Nutr Educ Behav* 2007;39:2-7.
- 21 Resnicow K, Hearn MD, Smith M, et al: Social-cognitive predictors of fruit and vegetable intake in children. *Health Psych* 1997;16: 272-276.
- 22 Cerin E, Barnett A, Baranowski T: Testing theories of dietary behavior change in youth using the mediating variable model with intervention programs. *J Nutr Educ Behav* 2009;41:309-318.
- 23 Baranowski T, Henske J, Simons-Morton B, et al: Dietary change for cardiovascular disease prevention among Black-American families. *Health Educ Res* 1990;5:433-443.
- 24 Hingle MD, O'Connor TM, Dave JM, et al: Parental involvement in interventions to improve child dietary intake: a systematic review. *Prev Med* 2010;51:103-111.
- 25 Hearn MD, Baranowski T, Baranowski J, et al: Environmental influences on dietary behavior among children: availability and accessibility of fruits and vegetables enable consumption. *J Health Educ* 1998;29:26-32.
- 26 Jago R, Baranowski T, Baranowski JC: Fruit and vegetable availability: a micro environmental mediating variable? *Public Health Nutr* 2007;10:681-689.
- 27 Hughes SO, O'Connor TM, Power TG: Parenting and children's eating patterns: examining control in a broader context. *Int J Child Adolesc Health* 2008;1:323-330.
- 28 Yoo S, Baranowski T, Missaghian M, et al: Food-purchasing patterns for home: a grocery store-intercept survey. *Public Health Nutr* 2006;9:384-393.

- 29 Baranowski T, Missaghian M, Broadfoot A, et al: Fruit and vegetable shopping practices and social support scales: a validation. *J Nutr Educ Behav* 2006;38:340–351.
- 30 Baranowski T, Watson K, Missaghian M, et al: Parent outcome expectancies for purchasing fruit and vegetables: a validation. *Public Health Nutr* 2007;10:280–291.
- 31 Baranowski T, Missaghian M, Watson K, et al: Home fruit, juice, and vegetable pantry management and availability scales: a validation. *Appetite* 2008;50:266–277.
- 32 Baranowski T, Watson K, Missaghian M, et al: Social support is a primary influence on home fruit, 100% juice, and vegetable availability. *J Am Diet Assoc* 2008;108:1231–1235.
- 33 Cullen KW, Baranowski T, Rittenberry L, et al: Social-environmental influences on children's diets: results from focus groups with African-, Euro- and Mexican-American children and their parents. *Health Educ Res* 2000;15:581–590.
- 34 Cullen KW, Baranowski T, Rittenberry L, et al: Child-reported family and peer influences on fruit, juice and vegetable consumption: reliability and validity of measures. *Health Educ Res* 2001;16:187–200.
- 35 Cullen KW, Baranowski T, Rittenberry L, et al: Socioenvironmental influences on children's fruit, juice, and vegetable consumption reported by parents: reliability and validity of measures. *Public Health Nutr* 2000;3:345–356.
- 36 Cullen KW, Baranowski T, Owens E, et al: Ethnic differences in social correlates of diet. *Health Educ Res* 2002;17:7–18.
- 37 O'Connor TM, Hughes SO, Watson KB, et al: Parenting practices are associated with fruit and vegetable consumption in pre-school children. *Public Health Nutr* 2010;13:91–101.
- 38 O'Connor T, Watson K, Hughes S, et al: Health professionals' and dietetics practitioners' perceived effectiveness of fruit and vegetable parenting practices across six countries. *J Am Diet Assoc* 2010;110:1065–1071.
- 39 Baranowski T, Chen TA, O'Connor T, et al: Dimensions of vegetable parenting practices among preschoolers. *Appetite* 2012, submitted.
- 40 Baranowski T, O'Connor T, Hughes S, et al: Houston... We have a problem! Measuring parenting: overview of a conference. *Child Obes* 2013, submitted.
- 41 Hingle M, Beltran A, O'Connor T, et al: A model of goal directed vegetable parenting practices. *Appetite* 2012;58:444–449.
- 42 Beltran A, Hingle M, Knesek J, et al: Identifying and clarifying values and reasons statements that promote effective food parenting using intensive interviews. *J Nutr Educ Behav* 2011;43:531–535.
- 43 Edmonds J, Baranowski T, Baranowski J, et al: Ecological and socioeconomic correlates of fruit, juice, and vegetable consumption among African-American boys. *Prev Med* 2001;32:476–481.
- 44 Jago R, Baranowski T, Baranowski JC, et al: Distance to food stores and adolescent male fruit and vegetable consumption: mediation effects. *Int J Behav Nutr Phys Act* 2007;4:35.
- 45 Genick UK, Kutalik Z, Ledda M, et al: Sensitivity of genome-wide-association signals to phenotyping strategy: the PROP-TAS2R38 taste association as a benchmark. *PLoS One* 2011;6:e27745.
- 46 Baranowski JC, Baranowski T, Beltran A, et al: 6-n-Propylthiouracil sensitivity and obesity status among ethnically diverse children. *Public Health Nutr* 2010;13:1587–1592.
- 47 Baranowski T, Baranowski JC, Watson KB, et al: 6-n-Propylthiouracil taster status not related to reported cruciferous vegetable intake among ethnically diverse children. *Nutr Res* 2011;31:594–600.
- 48 Tanofsky-Kraff M, Han JC, Anandalingam K, et al: The FTO gene rs9939609 obesity-risk allele and loss of control over eating. *Am J Clin Nutr* 2009;90:1483–1488.
- 49 Osler M, Hansen ET: Dietary knowledge and behaviour among schoolchildren in Copenhagen, Denmark. *Scand J Soc Med* 1993;21:135–140.
- 50 Contento I, Balch GI, Bronner YL, et al: The effectiveness of nutrition education and implications for nutrition education policy, programs, and research: a review of research. *J Nutr Educ* 1995;27:277–418.
- 51 Resnicow K, Yaroch AL, Davis A, et al: GO GIRLS!: results from a nutrition and physical activity program for low-income overweight African American adolescent females. *Health Educ Behav* 2000;27:616–631.
- 52 Nader PR, Baranowski T, Vanderpool NA, et al: The Family Health Project: cardiovascular risk reduction education for children and parents. *J Dev Behav Pediatr* 1983;4:3–10.
- 53 Simons-Morton BG, Parcel GS, Baranowski T, et al: Promoting physical activity and a healthful diet among children: results of a school-based intervention study. *Am J Public Health* 1991;81:986–991.
- 54 Resnicow K, Davis M, Smith M, et al: Results of the TeachWell worksite wellness program. *Am J Public Health* 1998;88:250–257.
- 55 Baranowski T, Davis M, Resnicow K, et al: Gimme 5 fruit, juice and vegetables for fun and health: outcome evaluation. *Health Educ Behav* 2000;27:96–111.
- 56 Foster GD, Linder B, Baranowski T, et al: A school-based intervention for diabetes risk reduction. *N Engl J Med* 2010;363:443–453.
- 57 Baranowski T, Baranowski J, Cullen KW, et al: 5 a day achievement badge for African-American Boy Scouts: pilot outcome results. *Prev Med* 2002;34:353–363.
- 58 Baranowski T, Cerin E, Baranowski J: Steps in the design, development and formative evaluation of obesity prevention-related behavior change trials. *Int J Behav Nutr Phys Act* 2009;6:6.
- 59 Marcus MD, Hirst K, Kaufman F, et al: Lessons learned from the HEALTHY primary prevention trial of risk factors for type 2 diabetes in middle school youth. *Curr Diab Rep* 2013;13:63–71.
- 60 Baranowski T, Baranowski J, Cullen KW, et al: Squire's Quest! Dietary outcome evaluation of a multimedia game. *Am J Prev Med* 2003;24:52–61.
- 61 Thompson CA, Ravia J: A systematic review of behavioral interventions to promote intake of fruit and vegetables. *J Am Diet Assoc* 2011;111:1523–1535.
- 62 Baranowski T, Baranowski JC, Cullen KW, et al: The Fun, Food, and Fitness Project (FFFP): the Baylor GEMS pilot study. *Ethnic Dis* 2003;13:S30–S39.
- 63 Thompson D, Baranowski T, Cullen K, et al: Food, Fun, and Fitness internet program for girls: pilot evaluation of an e-Health youth obesity prevention program examining predictors of obesity. *Prev Med* 2008;47:494–497.
- 64 Cullen KW, Thompson D: Feasibility of an 8-week African American web-based pilot program promoting healthy eating behaviors: Family Eats. *Am J Health Behav* 2008;32:40–51.
- 65 Thompson D, Baranowski T, Baranowski J, et al: Boy Scout 5-a-Day Badge: outcome results of a troop and internet intervention. *Prev Med* 2009;49:518–526.
- 66 Anzman-Frasca S, Savage JS, Marini ME, et al: Repeated exposure and associative conditioning promote preschool children's liking of vegetables. *Appetite* 2012;58:543–553.
- 67 Baranowski T, Baranowski J, Thompson D, et al: Behavioral science in video games for children's diet and physical activity change: key research needs. *J Diabetes Sci Technol* 2011;5:229–233.
- 68 Thompson V, Thompson D, Baranowski T: Understanding 'serious video game' storyline and genre preferences related to game immersion among low-income ethnically diverse urban and rural adolescents; in Evans CM (ed): *Internet Issues: Blogging, the Digital Divide and Digital Libraries*. Hauppauge, NY, Nova Science Publishers, Inc., 2010, pp 177–188.
- 69 Thompson D, Baranowski T, Buday R, et al: Serious video games for health: how behavioral science guided the development of a serious video game. *Simul Gaming* 2010;41:587–606.
- 70 Baranowski T, Baranowski J, Thompson D, et al: Video game play, child diet, and physical activity behavior change: a randomized clinical trial. *Am J Prev Med* 2011;40:33–38.
- 71 Lu AS, Thompson D, Baranowski J, et al: Story immersion in a health video game for child obesity prevention. *Games for Health Journal* 2012;1:37–44.
- 72 Simons M, Baranowski J, Thompson D, et al: Child goal setting of dietary and physical activity in a serious video game. *Games for Health Journal* 2013, in press.

- 73 Beltran A, O'Connor T, Hughes S, et al: Alpha test of a video game to increase children's vegetable consumption. *Games for Health Journal* 2012;1:219–222.
- 74 Baranowski T, O'Connor T, Hughes S, et al: Smart phone video game simulation of parent-child interaction: learning skills for effective vegetable parenting; in Arnab S, Dunwell I, Debattista K (eds): *Serious Games for Healthcare: Applications and Implications*. Hershey, PA, IGI Global, 2012, pp 248–265.
- 75 Sleddens EF, Hughes SO, O'Connor TM, et al: The Children's Behavior Questionnaire very short scale: psychometric properties and development of a one-item temperament scale. *Psychol Rep* 2012;110:197–217.
- 76 Baranowski T, Beltran A, Chen T, et al: Structure of corrective feedback for selection of ineffective vegetable parenting practices for use in a simulation videogame. *Games for Health Journal* 2013;2:29–33.
- 77 Baranowski T, Islam N, Baranowski J, et al: Comparison of a web-based versus traditional dietary recall among children. *J Acad Nutr Diet* 2012;112:527–532.
- 78 Baranowski T, Watson KB, Bachman C, et al: Self efficacy for fruit, vegetable and water intakes: expanded and abbreviated scales from item response modeling analyses. *Int J Behav Nutr Phys Act* 2010;7:25.
- 79 Gustafson A, Hankins S, Jilcott S: Measures of the consumer food store environment: a systematic review of the evidence 2000–2011. *J Community Health* 2012;37:897–911.
- 80 Baranowski T, Buday R, Thompson DI, et al: Playing for real: video games and stories for health-related behavior change. *Am J Prev Med* 2008;34:74–82.
- 81 Mellecker RR, Lyons EJ, Baranowski T: Disentangling fun and enjoyment in exergames using an expanded design, play, experience framework. *Games for Health Journal* 2013, submitted.