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How to engage children in self-administered dietary assessment programmes

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Abstract

Effectively assessing children's dietary intake is essential for understanding the complex relationships among dietary behaviours and obesity. Dietary assessment accuracy decreases when children are unable or unmotivated to complete accurate self-reports. Technology-based assessment instruments for children's self-report of diet can be enhanced in light of developments in media psychology and communication science. To motivate children to complete a dietary assessment, researchers could use animated, customisable agents; embed the assessment process into a video game; or add narratives to encourage self-reporting behaviour. To improve accuracy, the intake environment could be recreated virtually; training sessions could be interspersed to improve portion estimation; and implicit attitudinal measures could be incorporated as a control or to increase validity. Research is needed to evaluate possible methods of enhancing children's self-reporting motivation and accuracy. The main challenge remains how to engage children without biasing their reporting.

Keywords

accuracy; children; communication; dietary assessment; media psychology; motivation; technology-based dietary assessment

Introduction

Motivating children to provide accurate dietary intake information is essential for exploring the impact of childhood dietary intake on child or later adult health and for evaluating effectively health interventions. Recent dietary assessment instruments for children (Baranowski *et al.*, 2002; Jaramillo *et al.*, 2003; Boushey *et al.*, 2009; Ngo *et al.*, 2009) have incorporated media and communication technologies: customisable assessment, animated cartoon characters and interactive questionnaires. Although these instruments incorporated significant procedural and measurement accuracy improvements compared to traditional interviews or paper and pencil methods, two problems remain: the children's lack of motivation and a lack of accuracy in self-reporting their dietary intake (Rockett & Colditz, 1997; Livingstone & Robson, 2000).

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Although technology-assisted dietary data collection has made it convenient for children to report their answers, their compliance usually declines because of the burden of answering detailed questions, which are typically repeated. Boredom and fatigue affect dietary information retrieval especially when using self-administered instruments with children (Farris *et al.*, 1985; Domel *et al.*, 1994a). Major limitations affecting the accuracy of reporting among children, as well as adults, are a reliance on memory and difficulty in estimating portion sizes (Flin *et al.*, 1992). Errors are attributed to multiple factors such as attention, perception, organisation, retention and response (Baranowski & Domel, 1994). Younger children tend to report information less accurately than older children and adults (Domel *et al.*, 1994b).

How to motivate children to accurately report their diet is a critical issue. Relatively little is known about children as respondents (De Leeuw *et al.*, 2004). Theories from media psychology and communication research provide innovative perspectives to address children's motivation and accuracy in dietary assessment.

Motivation

Human behaviour is generally influenced by individual (intrinsic) and external (extrinsic) motivation factors (Heider, 1958). Extrinsic motivation relies on external rewards and punishments, whereas intrinsic motivation is driven by characteristics such as novelty, challenge and aesthetic value (Ryan & Deci, 2000). Entertainment has been conceptualised as an intrinsically rewarding activity sought by people independent of extrinsic rewards (Vorderer *et al.*, 2004). A challenge for entertainment media is to provide an environment that motivates children to accurately complete the dietary assessment task. Three candidate strategies are considered.

Strategy 1: use animated, customisable agents

Animated agents have been a popular feature in interactive educational interfaces (Reeves & Nass, 1996; Atkinson, 2002). The mere presence of a lifelike character could have a strong positive effect on simple task performance (Zajonc, 1965) and facilitate the navigation of an interactive interface (Lester *et al.*, 1997).

Customisation of interactive agents has been an element of parasocial interaction (Klimmt *et al.*, 2006). Increased levels of customisation may expand the feeling of interpersonal communication (Beniger, 1987). Well-scripted and programmed agents may serve as interactive motivators by creating a sense of interpersonal communication and making the assessment more dynamic. Recent development in voice-recognition technology has revolutionised people's interaction with intelligent digital assistants (e.g. Siri on Apple's iOS). Children may participate in a dietary assessment programme by simply telling the assistants what they have had (Roemmele, 2011). On the tangible front, humanoid robots may even have the potential to teach children social interaction (University of Hertfordshire Adaptive Systems Research Group, 2006). These agents could form close relationships with children throughout the dietary assessment process through virtual mediated interpersonal communication, encouraging them to report accurate data and 'make it to the end' of the assessment.

Strategy 2: embed the dietary assessment process into a video game

Entertainment features, such as humour, drama and special effects, effectively drive attention (Bryant *et al.*, 1983). Pleasure is one of the most important and, in evolutionary terms, oldest regulators of human behaviour (Miron, 2006). Pleasurable experiences with media, commonly known as 'enjoyment', are at the heart of media entertainment (Vorderer

et al., 2004). Pleasure is likely the affective factor in complex responses that guides behaviour (Vorderer & Hartmann, 2009). Thus, intrinsic motivation and interest should be heightened if dietary assessment is conducted in the context of a video game.

Control and interactivity are distinct characteristics that differentiate video games from traditional forms of non-interactive media (Grodal, 2000; Tamborini & Skalski, 2006). An instrument that presented dynamic questionnaires with instant feedback based on respondents' particular responses helped to increase respondents' motivation (Schmidt, 1997). Video games have also been used to monitor cognitive decline (Jimison *et al.*, 2007). Both control and interactivity create opportunities to deliver dynamic assessment questionnaires, which could also be divided into smaller blocks and interspersed with pleasant interactive elements to reduce the perceived burden on young respondents. The challenge is to design such interactivity to minimise adverse reaction to the reporting of dietary intake. This might be performed by providing non-evaluative feedback (e.g. 'Yes, I understand.') periodically during dietary report.

Strategy 3: add narratives to the dietary assessment programme

A narrative or story with a beginning, a middle and an end provides information about plot and characters, all of whom possess distinctive characteristics (Lyotard, 1984). Narratives are pervasive across different kinds of media and can serve as powerful tools for health communication (Baranowski *et al.*, 2008). Stories that 'transport' a reader or viewer into the narrative world induce story-consistent beliefs and thoughts (Green & Brock, 2000).

Narratives could provide intriguing incentives for children who in the role of characters (Bielenberg & Carpenter-Smith, 1997) feel obliged to finish the story. Embedding narratives with immersive qualities into dietary assessment could create intrinsic motivation to complete a dietary assessment (Pillay, 2002). (For example, children could act as detectives solving mysteries by collecting evidence in different stages of the narrative development.) When an involving narrative is dissected into different episodes and interspersed with a dietary assessment, children should be more willing to complete the assessment because they want to see what will happen next. Narrative transportation theory could also be applicable to video games when stories are effectively embedded in the games (Lu *et al.*, 2012).

Accuracy

Research on children's self-reported dietary assessment has attributed extensive error to the child's cognitive processes (Baranowski & Domel, 1994; Baranowski *et al.*, 2002). Although the next-day recall rate of 6–9-year-old children is similar to that of adults (Flin *et al.*, 1992), their ability to use their available working memory capacity is less (Case *et al.*, 1982). Besides developmental limitations (Domel *et al.*, 1994b), children's dietary reporting varies as a function of their relative weight and body composition (Fisher *et al.*, 2000) and their susceptibility to social desirability bias (Borgers *et al.*, 2000).

Strategy 1: recreate virtual dietary intake environment

To help children recollect what they have eaten at an earlier time, interactive media could recreate the dining environment as 'retrieval cues,' thus facilitating children's recall of the eating occasion (Tulving & Osler, 1968). The phenomenon of reinstating the environment in which an action has been performed to bring back the memory of that action has been found in literary works (e.g. Wilkie Collins' *The Moonstone*; Collins, 1868). In empirical psychological studies (Godden & Baddeley, 1975), this is called 'context dependency': environmental cues (e.g. dining environment) could help children locate the relevant

memory of the food consumed during the dietary assessment process. Interactive media could incorporate the appearance of alternative dining environments (e.g. home dining room, kitchen table, in front of the television in the living room, school cafeteria) into the dietary assessment interface, either as a background image or as a virtual space. How similar the virtual environment needs to be to the child's original one should be the subject of future research. Perhaps salient aspects of the environment can be tailored to the child's experience (e.g. the size of the television in the living room) by having the child select the items and types present.

Strategy 2: intersperse training sessions to improve portion estimation

Although several dietary assessment programmes have started to incorporate graphics showing different portion sizes (Baranowski *et al.*, 2002, 2010; Foster *et al.*, 2008), children may still have difficulty choosing the portion size that best approximates their dietary intake. One-session portion-size estimation training significantly improved children's ability to estimate portion size for several food items (Weber *et al.*, 1999), although multiple training sessions were necessary for other items. By dividing a narrative video game into multiple sessions, minigames could be inserted before each of the estimation tasks as training sessions, which could take different forms by emphasising different elements of the food and portion estimation.

Strategy 3: incorporate implicit attitudinal measures as a control to increase incremental validity

People can intentionally exaggerate or downplay their intake of various food items to satisfy what they perceive others to consider socially desirable (Matlin & Stang, 1978). Besides reporting that is biased by social desirability concerns, affective response to food items could be another factor affecting reporting accuracy. Explicit attitudes (EAs), comprising attitudes that are consciously held and can be reported when asked (Fazio & Olson, 2003), are usually deliberative and easily recognised (e.g. answers to survey questions). EAs are subject to social desirability bias (Forrestal, 2011) and developmental limitations (Borgers *et al.*, 2000).

Measures of implicit attitudes (IAs) provide an alternative to EA measures based on the automatic evaluation of a food item, often without conscious awareness (Fazio & Olson, 2003; Greenwald & Nosek, 2008). IA measures tap evaluative associations that are beyond conscious control, relying on response latencies (i.e. the time it takes participants to react to a particular object) to draw conclusions about the strength of association between a target and an evaluative dimension (Greenwald *et al.*, 1998). Implicit attitudes towards foods could be incorporated into dietary assessment as a control for the influence of social desirability bias on children's reporting or for higher incremental validity.

Conclusions

Technology-based dietary assessment programmes provide opportunities to improve the motivation and accuracy of children's reporting of dietary intake. Many motivation and accuracy strategies could be combined. For example, a video game with an involving storyline could include multiple accuracy training sessions via a virtual environment. However, important questions remain to be answered. What is a reasonable balance between motivation and accuracy so that children's emotional responses do not impair their memory, or bias their reporting? What kinds of game elements should be inserted at different points in an assessment to foster proper narrative development? Which characteristics about a child's dining environment are crucial to facilitating dietary recall? What strategy (if any) could be

used to keep children focused on the dietary assessment task (main goal) and to discourage them from pushing buttons erratically, just to see what happens?

In the future, a typical technology-based dietary assessment among children may go like this: children are given some technological device tailored to their developmental characteristics. An animated agent acting as a character in an involving story guides the child throughout the assessment process. Children complete the assessment without feeling bored or tired. Numerous mini-interactive games embedded in the assessment constantly ensure that children input the most accurate information. The children are continuously motivated until the end.

That day may not be as far away as people might think. It is likely to happen in the next decade.

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