

Validity and Reliability of Behavior and Theory-Based Psychosocial Determinants Measures, Using Audience Response System Technology in Urban Upper-Elementary Schoolchildren

Heewon Lee Gray, PhD, RD¹; Pamela A. Koch, EdD, RD¹; Isobel R. Contento, PhD, CDN¹; Lorraine N. Bandelli, PhD²; Ian (Yi Han) Ang, MA¹; Jennifer Di Noia, PhD³

ABSTRACT

Objective: To examine the validity and reliability of a questionnaire administered with an audience response system (ARS).

Design: Cross-sectional study.

Setting: Two New York City public elementary schools.

Participants: Fourth- and fifth-grade students.

Main Outcome Measures: A Food, Health, and Choices questionnaire (FHC-Q) assessed energy balance-related behaviors (EBRBs) including intake of fruits and vegetables, sugar-sweetened beverages, processed packaged snacks, and fast food; physical activity; recreational screen time; and associated psychosocial determinants (≥ 3 questions/outcome scale). Previously validated reference instruments were used for relative validation. The ARS format was compared with a paper-and-pencil format. All measures were administered in a classroom setting.

Analysis: Pearson correlation coefficients between the reference instruments and the FHC-Q were calculated. Internal consistency reliabilities were evaluated with Cronbach α . Spearman rank correlation, intra-class correlation, and percent agreement were used for test-retest reliability between paper-and-pencil and ARS, and between 2 ARS FHC-Q administrations.

Results: Correlations for EBRBs with reference instruments ranged from 0.38 to 0.61 ($P < .01$). Cronbach α ranged from .77 to .92 for EBRBs and .74 to .90 for psychosocial determinants. Test-retest reliability correlations ranged from 0.36 to 0.87 ($P < .001$). Agreement for knowledge questions ranged from 69.8% to 84.8%.

Conclusions and Implications: The ARS FHC-Q has acceptable validity and reliability for collecting data on EBRBs and associated psychosocial determinants for upper-elementary students.

Key Words: instrument development, validation, reliability, energy balance-related behaviors, childhood obesity (*J Nutr Educ Behav.* 2016; ■:1-16.)

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INTRODUCTION

Energy balance-related behaviors (EBRBs) such as consuming energy-dense snacks and excessive sedentary behavior are important contributors to the current high rates of childhood obesity.^{1,2} These behaviors, which are considered to contribute to childhood obesity, are within the food choice control of children and include consumption of fruit and vegetables, sugar-sweetened beverages, processed packaged snacks, and fast food; as well as physical activity and recreational screen time behaviors.^{1,3} Schools have been an ideal setting for intervention studies targeting

¹Department of Health and Behavior Studies, Teachers College Columbia University, New York, NY

²GENYOUth Foundation, New York, NY

³Department of Sociology, William Paterson University, Wayne, NJ

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Address for correspondence: Heewon Lee Gray, PhD, RD, Laurie M. Tisch Center for Food, Education and Policy of the Program in Nutrition, Department of Health and Behavior Studies, Teachers College Columbia University, 525 W 120th St, New York, NY 10027; Phone: (212) 678-3480; Fax: (212) 678-8259; E-mail: hl2001@tc.columbia.edu

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EBRBs to reduce risk of childhood obesity because students spend a considerable amount of time at school and programs can reach a large number of children in a short time.⁴⁻⁷ In addition to behavior out-comes, theory-based psychosocial determinants are often targeted as potential mediators of behavior change. The assumption is that psychosocial determinants cause or mediate the targeted behavior changes in interventions.⁸⁻¹⁰ Determinants from the Theory of Planned Behavior,¹¹ Social Cognitive Theory,¹² Health Belief Model,^{13,14} and Self-determination Theory^{15,16} have been frequently used in school-based nutrition and/or physical activity interventions.^{10,17} Studies sometimes use psychosocial determinants from multiple theories and develop their own conceptual frameworks.¹⁰ Thus, to evaluate the effectiveness of interventions, valid and reliable measures are required for both EBRBs and their associated psychosocial determinants.^{17,18}

School-based intervention studies targeting EBRBs have commonly used self-report questionnaires to assess diet and physical activity behaviors because questionnaires are inexpensive and easy to administer, and are widely accepted for use in group settings (eg, schools),^{19,20} whereas diaries or recalls are associated with high subject burden and high administrative and data analysis costs.²¹⁻²³ Furthermore, diaries or recalls provide more information than is needed to evaluate a particular set of behaviors in intervention studies such as EBRBs.²⁴⁻²⁶

A number of questionnaires have been developed for use with upper-elementary schoolchildren^{20,27-31} and adolescents.^{25,32-34} However, the questionnaires for upper-elementary schoolchildren have various limitations in their assessment of multiple EBRBs and related theory-based psychosocial determinants. For example, 1 focused more on food groups (grains; protein food; dairy products; fruits and vegetables; and fat, oils, and sweets),²⁷ and 1 assessed only fruit and vegetable consumption not including other EBRBs, and their format was similar to a 24-hour recall with write and draw questions.³⁰ Three studies included a limited number of EBRBs (1 with fruit and vegetables consumption and physical activity,²⁹ which included only 2 fruit and vegetable questions that were adapted from

another study²⁷; 1 included soft drinks, fruit juices, breakfast, dieting, and physical activity behaviors²⁰; and 1 included sweetened beverages and fruit and vegetable consumption²⁸) and 1 study assessed only psychosocial determinants.³¹ One relevant instrument measuring EBRBs in this age group was specifically designed to provide comprehensive and detailed descriptive information on populations of children in 6 European countries.^{20,35} This instrument was based on a social ecological model with 150 questions assessing behaviors along with determinants and environmental factors. However, it included only a limited number of dietary behaviors (soft drinks, fruit juices, breakfast, and dieting), without questions on other EBRBs such as fruit and vegetable, processed packaged snack, or fast-food consumption.^{20,35} Given the limited availability of validated instruments for assessing, in a parsimonious fashion, a range of major EBRBs in upper-elementary schoolchildren, there is a need for an instrument to measure multiple EBRBs comprehensively as well as their associated potential psychosocial determinants of change for use in intervention studies.

New technologies such as computerized frequency questionnaires have recently been introduced to assess diet and physical activity behaviors as a way to decrease the research burden of processing paper-based surveys in large studies.³⁶ One such potentially useful technology is an audience response system (ARS), which is an interactive method in which multiple choice questions are put onto PowerPoint (Microsoft, Redmond, WA, 2010) slides and projected. Audience members use handheld clickers to enter their chosen answer for each question. The responses are collected by a wireless receiver device and processed by electronic software.³⁷ The ARS has been used in a variety of settings, most often for educational purposes such as in-class assessments of learning, especially in college and graduate school settings.^{38,39} It has also been used to assess a health education program with low-income urban minority children (aged 9–11 years) and was found to be a feasible tool for survey data collection without additional confounding effects of ARS on schoolchildren's learning.³⁷ Students completing

an ARS-administered survey reported increased attention and participation compared with children who completed the survey in a paper-and-pencil format.³⁴ For study participants, ARS can be a novel and exciting tool that maintains participants' confidentiality in group settings.⁴⁰ For researchers, ARS can be an efficient method to collect data from an audience; it automatically saves the data into a computer database, which could reduce data entry errors and time for data management.

The purpose of the current study was to conduct validity and reliability testing of the Food, Health, and Choices Questionnaire (FHC-Q) administered with ARS technology to assess EBRBs and associated psychosocial determinants in upper-elementary schoolchildren (fourth and fifth grades, aged 9–11 years). Specific objectives of the study were to answer the following research questions: (1) Did a questionnaire measuring EBRBs and psychosocial determinants have valid constructs? (2) Did the target population understand the questions? (3) Did students answer the questions consistently over time (stability)? (3a) Did students answer the questions similarly between the paper-and-pencil format and ARS? (3b) Did students answer questions consistently using ARS over time? (4) Did multiple questions within the same construct generate consistent results as a scale (internal consistency)?

METHODS

Study Design, Participants, and Setting

This study was conducted as part of the formative evaluation of *Food, Health, and Choices* intervention. Convenience samples were recruited for the purpose of instrument validation and reliability tests. An invitation was sent to principals and teachers of 2 New York City public elementary schools in which the principals agreed to participate in the main study for the following school year. Two schools agreed, and fourth-grade and 4 fifth-grade classes from school 1, and 4 fourth-grade classes from school 2 participated in the study (Figure 1). Table 1 presents demographic characteristics. The majority of students were aged ≤ 10 years (88.4%) and were black or Hispanic (95.9%).

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