

Katherine Bevans, PhD  
Assistant Research Professor  
The Children's Hospital of Philadelphia  
3535 Market Street, Room 1584  
Philadelphia, PA 19104-4399  
[bevans@email.chop.edu](mailto:bevans@email.chop.edu)  
Ph. (267) 426-2967  
Fax (215) 590-0426

## Personal Research Agenda

My research agenda reflects current and future involvement in three interrelated areas: (1) understanding child health trajectories and the impact of health on school performance; (2) the development, dissemination, and testing of health promotion interventions; and (3) methodological advances in the measurement of child health and school performance outcomes.

### ***Understanding child health trajectories and the impact of health on school performance.***

Since 2005, I have served as project manager and co-investigator for Project Healthy Pathways (PHP), an NIH-funded longitudinal study of relations between child health and school performance. This study revealed that 45% of children in grades 4 – 6 exhibit at least one significant health need (e.g., symptoms, poor subjective wellbeing, poor interpersonal connectedness, risk behaviors). Children with a single health need are 4 times more likely to perform below grade level on standardized tests and 5 times more likely to earn poor grades.<sup>1</sup> We also demonstrated that health mitigates the negative effects of social risk (e.g., low family income, poor maternal health) on academic achievement.<sup>2</sup> In future work, we will identify trajectories of health as children transition from elementary to middle school and determine how these longitudinal profiles influence school performance. In addition, we will further our work on identifying biologic, social, and amenable school environmental factors that promote child health and strengthen the effects of positive health on academic achievement.<sup>3</sup>

***School-based health promotion interventions.*** School health programs (SHPs) can reduce the urgently escalating threats to children's health and school success. I am currently principal investigator on a CDC-funded Early Career Development Award. Aims of this project are to improve the measurement of SHP quality, assess the impact of resources on SHP quality, and evaluate the effect of SHP access/quality on child health and school performance. We conducted

comprehensive assessments of physical education (PE), health education (HE) and food service (FS) programs in 34 schools. Using these data, we generated a reliable and valid multimethod measure of PE quality and demonstrated that access to human, curricular, and material resources positively influence the quality of PE.<sup>4</sup> Future work will determine how PE quality impacts child physical activity, wellbeing, and school performance. We will address similar research questions for HE and FS programs. These studies represent the next step toward developing effective school-based health promotion programs. In the future, collaborations between our research group and agencies expert in SHP development and implementation (e.g., Nemours) will support randomized controlled trials of school-based physical activity and healthy eating interventions.

***Methodologic advances in the measurement of child health and school performance.***

Recent advances in modern measurement theory support the valid and efficient measurement of health and performance concepts using item response theory and computerized adaptive testing techniques. Currently, I apply these techniques to several psychometric projects including the assessment of patient satisfaction, the development of a behavioral health screener for use in primary care and emergency settings, and the measurement of children's treatment preferences for the management of pain. My experiences with child health/performance models, program evaluation, advanced measurement, and the management of large multisite research projects will allow me to make unique contributions to our newest research endeavor, the development of a comprehensive and adaptive system for the measurement of child- and parent-reported outcomes. This system will be used in future research on the effectiveness of clinical and educational interventions. It will be modeled after that which has been developed for adult populations (e.g. the NIH PROMIS program), but modified to reflect children's unique competencies and needs.

## References

1. Bevens, K.B., Forrest, C.B., Mills, C., & Riley, A.W. (2007, July). *Caring for the Whole Child: Activating conceptual and practical strategies for promoting the health and academic success of all students*. Workshop presented at the National Assembly of School Based Health Care, Washington, DC.
2. Forrest, C.B., Riley, A.W., Bevens, K.B., & Mills, C. (under review). Relations between child health and school performance. *Pediatrics*.
3. Bevens, K.B., Mills, C., Riley, A.W., & Forrest, C.B. (under review). Multilevel school promoting assets: Child- and school-level predictors of academic success. *Journal of School Health*.
4. Bevens, K.B., Sanchez, B.M., Fitzpatrick, L.A.D., Riley, A.W., & Forrest, C.B. (under review). Relations between physical education resources and student activity. *Journal of Teaching in Physical Education*.

## Research Proposal

### Abstract

The purpose of this multisite collaborative project is to generate and test emotional distress (depression, anxiety, anger) item banks for use with pediatric populations. This project will be conducted collaboratively by child health and development experts, cognitive psychologists, psychometricians, and experts in the development of computerized adaptive tests (CATs). The aims are to (1) validate existing (adult) emotional distress item banks among youth aged 10 to 17; and (2) develop and evaluate supplemental emotional distress items for use in pediatric populations. Calibration of the items to item response theory models will support the development of a CAT for each emotional distress domain. CATs greatly increase the efficiency of assessment by reducing the total number of required survey items without compromising measurement accuracy. Because the measures will be developed for children aged 10 - 17 and linked to currently existing adult surveys, they will support the assessment of change in emotional distress across the lifespan. Thus, the measures could be adopted as screening tools for the identification of children with emotional distress, to track changes in emotional distress for a specific population or student over time, or to test for intervention effectiveness. Future work will focus on adding pediatric-specific health domains to the conceptual model of patient-reported outcomes.

## Research Proposal

**TITLE: Pediatric patient-reported measurement system for emotional distress**

**BACKGROUND:** In 2004, the NIH-funded Patient-Reported Outcomes Measurement Information System (PROMIS) was established to: (1) develop large item banks to measure patient-reported outcomes (PROs), (2) create computerized adaptive tests (CATs) that permit efficient and psychometrically robust assessment of PROs, and (3) create a publicly available and modifiable system that allows clinical researchers to access a common repository of survey items and CATs.<sup>1</sup> To date, PROMIS has developed item banks for several generic adult PROs including three components of emotional distress (ED): depression (e.g., withdrew from others), anxiety (e.g., racing or pounding heart), and anger (e.g., stayed angry for hours).<sup>1,2</sup> The NIH is currently seeking applications to support further development and psychometric validation of PROs in diverse populations.

**THE CURRENT PROPOSAL:** The purpose of this multisite collaborative project is to **generate and test pediatric versions of: (1) the existing ED (depression, anxiety, and anger) item banks; and (2) ED item banks with supplemental items that fill the gaps in the current ED domains when they are applied to children.**

**IMPLICATIONS FOR SCHOOL PSYCHOLOGY:** Upon completion of this project, we will have developed psychometrically sound and efficient tools for the measurement of depression, anxiety, and anger in pediatric populations. These tools have two significant advantages over those currently available. First, calibration of items to IRT models supports the development of CATs, which greatly increase the efficiency of assessment by reducing the total number of required survey items without compromising measurement accuracy. Second, because the measures will be developed for children aged 10 - 17 and linked to currently existing adult

surveys, they will support the assessment of change in ED across the lifespan. Thus, the measures could be adopted as screening tools for the identification of children with ED, to track changes in ED for a specific population or student over time, or to test intervention effectiveness.

**Aim 1: Conduct a validation study of the existing ED item banks among youth aged 10 to 17.**

The purpose of this aim is to identify ED items from the adult measure that are also appropriate for use with children. The 57 ED items developed with adults will be administered to 2,500 children. The appropriateness of items will be determined through statistical analyses in two phases. First, we will conduct factor analyses to determine whether data meet the assumptions of item response theory (IRT) and to select items for calibration. Second, we will fit IRT models to assess item difficulty, discrimination, and the effectiveness of response options. Items will be retained in the pediatric ED item banks if they contribute to unitary depression, anxiety, and anger dimensions and adequately discriminate between various levels of these constructs. Subcomponents of this aim include: (1a) statistical equating of child and adult version of the ED measures; and (1b) testing for differential item functioning between various clinical populations and demographic groups to ensure that items are unbiased.

**Aim 2: Develop and evaluate supplemental ED items for use with youth aged 10 to 17.** The purpose of this aim is to expand the item pool to include ED symptoms that are often experienced by children (e.g., somatic complaints). Supplemental items will be developed in 4 stages: (1) extant items will be identified by systematic search for currently available scales, (2) expert item review and revision will be conducted by trained professionals; (3) focus groups will be conducted with children, parents, and child development experts (e.g., teachers, psychologist, pediatricians) to confirm coverage of the ED domains; and (4) cognitive interviews will be conducted with children to examine individual items. Items successfully screened through this

process will be administered to 2,500 children who did not participate in early phases of the project. The appropriateness of items will be determined through statistical analyses identical to those used in Aim 1. Subcomponents of this aim include: (2a) cognitive testing to assess children's understanding of ED concepts; and (2b) testing of multiple survey administration modalities such as paper/pencil and computer-based, with or without audio.

***Future aims:*** The unique health needs of children are not adequately reflected in the current PRO framework. In the future, we will refine the PRO conceptual framework by adding pediatric-specific health constructs (e.g., school engagement). Item banks will be developed and tested for these constructs. This process will be guided by conceptual models of child health/functioning and input from children, parents, and child development experts. A key criterion for inclusion in the pediatric PRO framework is that the construct is clinically meaningful and useful.

**RESEARCH SITES AND PERSONNEL:** This project requires multidisciplinary collaboration from experts on child health/functioning (e.g., mental health, social development), a cognitive psychologist (to ensure that developmentally-appropriate items are generated), psychometricians (to guide analyses), programmers (to develop CATs), and a data collection team (to recruit participants and administer measures). Children, parents, and applied education and medical professional are also considered key members of the team. To maximize utility of the measures, children will be recruited from data collection sites that are diverse with respect to the population they serve and location.

**BUDGET:** The estimated direct cost of this 2-year project is \$271,870. Support for key personnel (PI, psychometrician, content experts, project coordinator, and RAs) totals \$214,070. The total cost for additional expenses (programming, computers, travel, supplies) is \$57,800.

## References

1. *Patient-reported outcomes measurement information system: Dynamic tools to measure health outcomes from the patient perspective*. Retrieved November 13, 2008, from <http://www.nihpromis.org>.
2. Ader, D. (2007). Developing the Patient-Reported Outcomes Measurement Information System (PROMIS). *Medical Care*, 45, S1-2.