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Enhancing the Construct and Content Validity of Rating Scales for Clinical Research: Using Qualitative Methods to Develop a Rating Scale to Assess Parental Perceptions of Their Role in Promoting Infant Exercise

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Abstract

With a focus on the early stages of developing new assessment tools, we present an example of how researchers can apply qualitative data to the development of conceptual domains and specific items representing those domains for quantitative instruments. Specifically, our previous research examining mothers' perceptions and experiences of engaging in assisted exercise with their infants provided the foundation for the development of the Perceptions of Pediatric Activity Scale (PPAS). We describe the process we used to develop the PPAS as an exemplar for the process of incorporating qualitative data in instrument development. In addition, we address instrument development for diverse populations, and we provide examples illustrating how we extracted concepts using a concept-indicator model to construct the items in the PPAS. We conclude by noting that we are currently in the process of pilot-testing the PPAS to evaluate its utility and reliability.

Keywords

Questionnaire development; qualitative research; item development; interviews

Introduction

In recent years, qualitative research in psychology, sociology, and nursing and health sciences has been exponentially increasing. Madill and Gough (2008) described this growth as “phenomenal,” and it is evidenced in recent special issues on qualitative and mixed methods research in leading social science journals. Psychological and educational assessment approaches have long included both quantitative approaches (i.e., those leading to numerical data such as test scores, numerical ratings on questionnaires) and qualitative approaches (i.e., those leading to non-numerical data such as text from interviews, descriptive observations), although the majority of articles in assessment journals describe quantitative methods or instruments. However, as Yoshikawa, Weisner, Kalil, & Way (2008) noted, “Behaviors or contexts relevant to human development are not inherently qualitative or quantitative, but the methods of representation through which behaviors or contexts are recorded in research are” (p. 345). Researchers select these “methods of representation” likely as a result of many factors including their particular expertise with a certain method (which Yoshikawa et al referred to as “methodocentrism”), belief in the

validity of particular methods for specific purposes, and perceptions regarding how certain methods will affect the likelihood that their research will be published. Rather than basing decisions solely on practical considerations, scientific considerations, such as content validity for a particular population, should guide researchers' decisions. As Yoshikawa et al. stated, "The focus should be on the participants, the contexts in which they live, the theory, and the emerging story that the accumulated evidence tells—not on which method has been used to gather such evidence..." (p. 352). In our research, we have addressed scientific questions for which qualitative and quantitative assessments were necessary to understand clinical research participants, their context, and their perceptions about their role in a new intervention for infants. The purpose of this paper is to present the process we used to collect and apply qualitative data to the development of a quantitative instrument to measure the perceptions and concerns of new mothers as they anticipate beginning an assisted exercise program with their infants. In doing so, we aim to illustrate a process that could be applied to the development of other research tools.

How Can the Rise in Qualitative Research Enhance the Science of Psychological and Educational Assessment?

The development of quantitative instruments can be based on evidence derived from another method, in this case qualitative research (Yoshikawa, Weisner, Kalil, & Way, 2008). For example, interviews can be used to generate qualitative categories or items for rating scales, which will eventually be incorporated into a quantitative instrument. Qualitative data also can be used to discover constructs of relevance to a particular scientific investigation, leading to the inclusion of a new research variable and corresponding measure. Moreover, qualitative research can be used to understand responses on a quantitative tool, leading to improvements in that measure (Yoshikawa et al., 2008). Finally, assessment can be enhanced by the incorporation of a mixed-methods approach, where both qualitative and quantitative approaches are used simultaneously to provide a rich, detailed description of the construct or constructs under investigation. In this manuscript, we discuss two of these examples: 1) how qualitative methods led us to discover a critical construct of relevance in research investigating the impact of infant exercise on health and development, and 2) how we used qualitative data to both inform and construct a quantitative instrument that could be used in our research.

Mixed-methods assessment and the use of qualitative research findings to develop quantitative instruments are not new topics, but only a few articles have actually described the process of constructing quantitative instruments using qualitative data (Gilgun, 2004), such as a recent article in this journal that addressed the process of using qualitative data to generate categories for future quantitative assessment (Chatterjee, 2011). There are numerous articles on instrument development that do not address the use of qualitative research as part of this process. Worthington and Whittaker (2006), in their content analysis of the process of scale development, found several problematic areas, including questions regarding criteria for including or excluding items in scales that raise concerns about content validity. In this article, building on the prior work of Gilgun (2004), we aim to address important gaps in the current literature on construct and content validity. We present the process of analyzing qualitative data to develop a quantitative instrument with a focus on three specific issues that affect construct and content validity: (1) development of comprehensive and appropriate content for diverse individuals, specifically Latinas; (2) development of content that reflects the depth and variations in meaning of a construct; and (3) development of items that contain words or terms that reflect the populations being studied.

Qualitative Methods and the Development of Rating Scales

In the course of scientific investigation, researchers frequently determine that existing quantitative instruments do not address the construct(s) adequately for their research, leading them to develop a new measure for their study (or modify an existing one). For example, they may determine that there is no existing measure for their construct or that existing measures are not comprehensive enough or appropriate for their populations. The decision to develop a new instrument should not be taken lightly, as the process of constructing, piloting, evaluating, and revising it requires time, resources, and psychometric expertise. Given the potential for measures with weak reliability coefficients to attenuate research findings and increase the likelihood of Type II errors (e. g., Lakes & Hoyt, 2009), researchers should carefully construct their measure and conduct rigorous evaluations of its psychometric qualities, including reliability, validity, intended use, generalizability, including application to various groups of people. Failure to address these adequately could undermine the entire research study. Although it is important to consider multiple psychometric issues in instrument development, we have limited the scope of this manuscript to the discussion of construct and content validity.

When developing an instrument to measure respondents' perceptions or beliefs, the issue of construct validation must be addressed systematically. Hoyt, Warbasse, and Chu (2006) described the complexity, though necessity, of attaining construct validity in order to create useful instruments that truly reflect what we seek to measure. Their detailed description of validity theory clarifies key aspects of validity, emphasizing that asking whether a measure is valid is not enough; we must ask whether we are using measures in a valid way (i.e. in a way in which the measures reflect what we are, indeed, trying to measure). Gilgun (2004) clearly explained the use of Lazarsfeld's (1958) and Lazarsfeld's and Theilsens' (1958) classic theory of concept-indicator model, which was then used by Glaser and Strauss (1967) in their development of grounded theory. In essence, through qualitative research, we are able to cite specific indicators (through the raw data) that reflect important concepts discovered through the process of qualitative research. These indicators, as representations of the concepts or construct, can be transformed into items that reflect specific content that comprise a quantitative questionnaire, which is the process we employed in development of our instrument.

In psychological and nursing sciences, self-report questionnaires are a common form of measurement, particularly when the construct under investigation requires an understanding of the respondent's perceptions or beliefs. For these types of constructs (e.g., individual's perceptions of self-efficacy, cultural beliefs, religious beliefs, etc.), the respondent's perspective is essential. Suppose a researcher wishes to investigate individuals' perceptions of a topic or issue for which there is no prior published measure: where should the researcher start? Clark and Watson (1995) described a model for scale development with recommended steps for researchers to take after making the decision to construct a scale. The first step was to "develop a precise and detailed conception of the target construct and its theoretical context" (p. 310). To do this, a thorough literature review is needed to ensure that the measure is theoretically-derived; in other words, developers should consider the relevant science and construct the instrument's content and format accordingly. For many topics, a review of the literature will yield dozens (if not hundreds) of published articles that can inform the process of developing the instrument. However, for some novel and rarely studied topics (such as *how do parents view their role in impacting the physical activity of their newborn babies?*), the literature search may yield little of relevance.

When there is little if any published theory from which to derive instrument content, researchers may first need to use qualitative methods to form an initial description of, or theory about, the research topic. The information-rich nature of qualitative methods allows

researchers to form a comprehensive summary of the research topic in question. A summary can then be developed from codes that are generated from the data over the course of the analysis (Sandelowski, 2000). In this paper, we present an illustrative study to demonstrate how we transformed such qualitative research data into a self-report questionnaire to accomplish the first step in Clark & Watson's (1995) model: Conceptualizing the construct and its context. First, we describe the qualitative research we conducted that informed the development of the new questionnaire. Next, we describe the process of analyzing qualitative data to help inform the construction of items or content for the questionnaire. In doing so, we aim to demonstrate a process for developing assessment instruments to study novel topics in child, or pediatric, research.

Method

Identification of an Assessment Need

Preterm infants are at risk for obesity, decreased bone mineral density and other adverse health outcomes (e. g., Casey, 2008; Eliakim & Nemet, 2005; Stephens & Vohr, 2009; Yliharsila, Kajantie, Osmond, Forsen, Barker, & Eriksson, 2007). Preliminary research has indicated that exercise interventions implemented in infancy can increase bone mineral density and weight (Vignochi, Miura, & Canan, 2008). The goal of our interdisciplinary research team has been to determine if exercise interventions early in life can provide substantial benefit to preterm infants. We are conducting a five-year study to determine the effects of gentle assisted exercise on muscle growth, bone mineralization and spontaneous physical activity in healthy growing preterm infants. Based on existing health promotion and pediatric literature, we believed that prior to enrolling parents in a caregiver-assisted home-based physical activity program for infants, it was crucial that we understood caregiver perceptions of their potential role in promoting infant physical activity or exercise as well as identify potential barriers to implementing the infant exercise intervention in the home. For example, prior research has noted that parental beliefs regarding the benefits of children's physical activity have important implications for health education targeting the reduction of obesity (Akhtar-Danesh, Dehghan, Morrison, & Fonseka, 2011). Moreover, parent's perceptions of, and perceived support for, physical activity have been directly linked to children's quantity of physical activity (e. g., Dowda, Dishman, Pfeiffer, & Pate, 2007) and have been described as potential barriers to the promotion of physical activity in children (e. g., Gallagher, 2010). Prior research in the adult literature has also identified important factors affecting adherence to physical activity or exercise regimens, which include the perceived benefits and value of physical activity (e. g., Pentecost & Taket, 2011; Tierney et al., 2011), support or encouragement (e. g., Pentecost & Taket, 2011; Tierney et al., 2011), motivation (e. g., Butterworth, 2008), and perceived physical fragility or risks of physical activity (Rhodes, Martin, Taunton, Rhodes, Donnelly, & Elliot, 1999).

Therefore, as part of our research to evaluate the feasibility of a home-based physical activity (or exercise) intervention for infants, we conducted a study to identify parental perceptions of and support for physical activity. We also sought to identify potential barriers to physical activity and exercise in preterm infants so that we could improve the intervention. As a first step, we reviewed published studies of instruments that have been used to understand parental perceptions of and support for children's exercise. Most prior studies focused on parental influence on physical activity in school-age or older children. These studies addressed the relationship between parental activity levels and child activity levels (Zecevic, Tremblay, Lovsin, & Michel, 2010); the child's participation in organized sports, sedentary activities, and feeding behaviors (Shea, Man, Dwyer, Heeney, Goy, & Simpson, 2010); psychosocial influences on children's physical activity (Alderman, Benham-deal, & Jenkins, 2010; Saunders et al., 1997); and parental beliefs and attitudes about feeding and obesity (Birch, Fisher, Grim-Thomas, Markey, & Sawyer, 2001). Our

review yielded no instruments designed to assess caregiver attitudes towards the current or future physical activity levels of infants, leading us to conclude that a new assessment would be required.

Gathering Qualitative Data to Discover and Describe Relevant Constructs

Given the paucity of research in this area, we began with open-ended, semi-structured interviews with mothers to yield a qualitative description of perceptions of and support for infant physical activity. After securing approval from the Institutional Review Board (IRB), we screened neonatal intensive care unit (NICU) medical records to identify eligible participants. In two separate studies (Gravem et al., 2009; Gravem et al., 2011), we conducted a total of 23 semi-structured, 45-minute interviews with caregivers (ages 19 to 47; see Table 1) of preterm infants to assess diverse maternal perceptions of physical activity in infants and potential barriers to completing a home exercise intervention. As Table 1 illustrates, one strength of this study was our inclusion of a diverse group of participants, which allowed us to study relevant constructs in both English- and Spanish-speaking groups. Such diversity in the earliest stages of instrument development enhances construct and content validity and measurement equivalence for diverse groups of individuals.

Interviews included questions addressing perceptions of mothers' roles in promoting their babies' health, perceptions of infant physical activity, and perceived risks and benefits of physical activity in infants. The researcher also described the infant caregiver-assisted exercise program and asked caregivers how they would respond if asked to implement the intervention with their babies and what, if any, barriers might affect their ability to implement the intervention at home. Interviews were conducted in English or Spanish, audio recorded, transcribed verbatim, and translated by a professional translator, if needed. Three researchers reviewed the transcripts and identified key concepts and themes. The data were categorized, using constant comparative analysis (Strauss & Corbin, 1998) and qualitative description (Sandelowski, 2000). Classic grounded theory methods (Glaser & Strauss, 1967) guided our work as well, through the use and application of the concept-indicator model to the process of constructing items for our quantitative instrument.

The results indicated that caregivers perceived physical activity and the home-based intervention as beneficial, while simultaneously fearing that physical activity could harm their infants, due to their infants' perceived fragility. This was an important discovery as it indicated the potential for the perceived fragility of infants and corresponding parental fears regarding encouraging physical activity as potential barriers to implementing the home-based intervention (Gravem et al., 2009). Thus, this important data led to our decision to include an assessment of maternal perceptions of and support for physical activity in our main studies. As noted previously, we had found no published measures appropriate for this investigation (primarily because none of the existing instruments addressed infant physical activity), so we began the process of transforming our qualitative data into a quantitative tool that could be administered to a larger cohort of mothers in our main study.

Results

Development of a Questionnaire to Assess Parental Perceptions of Infant Exercise

We developed an instrument based on the central paradox discovered in our previous research (Gravem et al., 2009): while mothers believed that assisted exercise was beneficial to their infants, at the same time they were fearful of doing these exercises due to the perceived fragility of their infants. An understanding of the complexity of mothers' paradoxical views of assisted exercise with their infants could be used to improve

intervention guidelines by urging health care providers to encourage mothers to adhere to an exercise regimen, while also being aware of and empathic to their concerns and fears. Because not all mothers have the same perceptions or the same degree of fears, and because these perceptions may differ between mothers of premature infants and mothers of full-term infants, we realized that it would be important to be able to assess individual mothers, leading us to the development of an instrument to do just that. In addition, because our sample consisted of both Latinas and non-Hispanic Whites, we were cognizant of the importance of capturing the nuances and multi-dimensions of the core construct/central paradox.

As noted in the prior section, we studied caregiver perceptions with the goal of identifying valid constructs that could be further measured, studied, and applied to the improvement of the experimental intervention. Our research yielded four important conceptual categories or constructs (see Table 2): (1) caregivers' perceptions of their roles in promoting their infant's health; (2) perceived benefits of infant physical activity or exercise; (3) anticipated barriers to implementing the intervention, and (4) caregivers' fears related to the perceived fragility of their infants. Our next step was to develop valid content by creating individual questionnaire items derived from the qualitative data generated in our research. The words of the research participants ("raw data" in the interview transcripts) guided our construction of questionnaire items (see Table 2). We modeled the format of items on the format of an already validated instrument, the Exercise Benefits/Barriers Scale (EBBS; Sechrist, Walker, & Pender, 1987). This format included a 4-point Likert scale (Strongly Agree, Agree, Disagree, Strongly Disagree) for each item. It is important to note, however, that because of the uniqueness of the constructs on which our instrument is based and our instrument's focus on caregiver perceptions of infant activity, our instrument is not an adaptation of the EBBS, but is an entirely new instrument – based on new constructs and different content – that requires pilot testing of its validity and reliability.

The process of developing items for our questionnaire involved examining closely the core paradoxical concept of mothers wanting to do the exercises with their infants despite verbalizing fears regarding the fragility of their infants by reexamining the words and phrases that supported the analysis. We looked broadly across all interviews in order to be sure to include the range of responses among the participants, and the variety of perceptions within this core concept. In other words, we recognized the individual variability among responses, perceptions, and experiences, and we aimed to capture this variability in a reliable and valid instrument. Therefore, we examined very specifically the variety of examples in the data. We generated individual items for the instrument that reflected the individual examples provided by the research participants. Thus, we looked broadly in order to capture the variety and we looked specifically in order to capture the nuances and details that guided our development of the items. The quantitative items that we constructed were based on the conceptual constructs generated from the qualitative data, thus grounding these items in a theoretically sound way. This is important in order to develop construct and content validity in the instrument, as emphasized by Clark and Watson (1995).

We developed items – using research participants' words – for all four of the important conceptual categories or constructs (see Table 2) generated through our research: 1) caregivers' perceptions of their roles in promoting their infant's health; 2) perceived benefits of infant physical activity or exercise; 3) perceived barriers to encouraging or promoting infant physical activity, and 4) caregivers' fears related to the perceived fragility of their infants. The resulting questionnaire contains four subscales (one addressing each of the constructs described above), with a total of 48 items. The subscale assessing caregivers' perceptions of their role in promoting their infants' health contained five items, such as "My attitudes about exercise will strongly impact my child's attitude towards exercise over the

course of his/her life.” The subscale for perceived benefits was the longest scale, with 27 items; this was due to the wide range and multiple dimensions of perceived benefits described by our participants, which included physical benefits (“Physical activity in infancy will make my baby’s bones stronger”), emotional benefits (“Physical activity decreases feelings of stress and tension for my infant”), cognitive benefits (“Physical activity increases my infant’s mental alertness”), and social benefits (“Encouraging my infant to be active will let me have contact with my infant”). Perceived benefits were described as immediate (“My infant feels proud when doing physical activities”), short-term (“Exercising helps my infant sleep better at night”), and long-term (“My infant will live longer if I encourage him/her to be active”). Perceived risks or fears were included in a 12-item subscale; items were described either as a perceived risk (“It is dangerous for my baby to be physically active”) or a fear (“I am scared that physical activity will be harmful for my baby”). Although these fears and perceived risks could also be considered barriers, we separated other barriers to form a separate 4-item subscale assessing barriers such as time (“Encouraging infants to do physical activities takes too much time”) and lack of support (“My family members do not encourage me to do physical activity with my infant”).

Table 2 presents a few exemplar items that include the raw data from the transcripts, how the data reflects our qualitative analysis, and then how this analysis led to the construction of the particular item. Our purpose in presenting these exemplars is to demonstrate the process of applying qualitative data analysis to the development of a quantitative instrument that measure the concepts generated in the original qualitative analysis. Table 2 is, in fact, a heuristic for explaining the logic behind our instrument development.

As evidenced in Table 2, we generated four conceptual categories that were dimensions of the core finding from our qualitative research. This core finding was that mothers experience paradoxical feelings related to assisted exercise with their infants; while they understand the important benefits, they simultaneously harbor fears due to the perceived fragility of their infants and describe their fears and other factors as barriers to promoting physical activity with their infants. Not all mothers experience this paradox in the same way or to the same degree and, therefore, if we could measure each mother’s experiences, we could tailor our intervention to each mother.

Table 2 is self-explanatory so we will not provide a detailed textual discussion of it in this manuscript. The main purpose of including the table is to present a visual representation of how we moved from four conceptual categories or constructs to the development of individual items for the quantitative instrument. We provide direct quotes from research participants that reflect these constructs for the purpose of showing how the actual items were constructed, guided by the words of the research participants. In summary, this process illustrates the development of comprehensive and appropriate content for diverse individuals; the development of content that reflects the depth and variations in meaning of a construct; and the development of items that contain words or terms that reflect the populations being studied.

In summary, Table 2 provides a snapshot of some of the qualitative data, including how data were categorized and conceptualized and how these qualitative data led to the construction of quantitative items that comprised the quantitative instrument that we are now pilot testing. We purposely developed more items than we anticipate we will eventually include, so that as we test and refine our instrument, we will be able to select the most useful items and discard those with weak psychometric value (Clark & Watson, 1995). A pilot study is currently underway to evaluate the reliability of the questionnaire. We will use mixed methods as we undertake this study. In keeping with Gilgun’s (2004) caveat that testing and refining clinical instruments is incomplete by omitting qualitative evaluation, we plan to

integrate qualitative methods in our instrument evaluation. We will interview research participants to evaluate how effectively the items in the instrument captured their perceptions and concerns.

Conclusion

Yoshikawa, Weisner, Kalil, and Way (2008) argued that the study of behavior and belief systems requires both qualitative and quantitative approaches, noting that quantitative data can describe the prevalence of behaviors or beliefs, and qualitative data can describe “meanings, functions, goals, and intentions” (p. 346). They noted that incongruent beliefs or behaviors are especially interesting and described how combining qualitative and quantitative data can explain this incongruence. In our research, we noted that although mothers believed that infant exercise was beneficial, the perceived fragility of their infants led to a simultaneous (and seemingly incongruent) belief that the exercise or physical activity could be harmful for their infant. This paradox was discovered using qualitative methods, and we would have been unlikely to discover it using only quantitative methods.

The process of developing qualitative constructs that reflect the phenomenon being studied, followed by developing quantitative items that represent those constructs and content is an example of one of the ways that qualitative and quantitative data are integral parts of a comprehensive research program. We build on the work of Gilgun (2004) in our application of Lazarsfeld’s (1958) and Lazarsfeld’s and Thielsens’ (1958) concept-indicator model, which underlies Glaser and Strauss’s classic grounded theory method (1967). Our qualitative research produced constructs, supported by evidence in the form of direct quotes from research participants, which represent concrete examples of concepts that were generated from the qualitative data. The qualitative data allowed us to capture the depth and breadth of caregiver perceptions of physical activity in premature infants, which led to the development of the specific content for a quantitative instrument. Our items reflect the multidimensional aspects, particularly in regard to the meaning to our diverse population, of the concepts measured in the items.

The next step in the development of this instrument is to pilot test it with a group of caregivers. We are currently in the process of doing just that and, based on results of this research, we will modify the instrument as needed. We will then be poised to employ this instrument in future studies of mothers’ perceptions of infant exercise or physical activity. In conclusion, the process we described highlights the need for mixed methods research conducted by multiple investigators with diverse areas of methodological expertise. As Haverkamp, Morrow, and Ponteretto (2005) noted, mixed methods research can lead to greater communication between qualitative and quantitative researchers and will prevent bifurcation and allow greater transformation in science.

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Table 1

Participant Demographics

	Study 1 (n=13)	Study 2 (n=10)
Mean age of caregiver in years	29.4	24.3
Marital status		
Single	25%	20%
Significant other	8.3%	40%
Married	67%	40%
Educational attainment		
Some high school	8.3%	30%
High school diploma	25%	50%
Some college/vocational training	42%	0%
College diploma	25%	20%
Language of interview		
English	80%	80%
Spanish	20%	20%

Table 2

Conceptual Categories, Raw Data, and Corresponding Questionnaire Items

Core Finding: Mothers described a paradox—while they were interested in promoting health through assisted exercise and perceived infant exercise as beneficial, they worried about perceived fragility of their infants.		
Conceptual Categories	Sample Participant Quotation	Exemplar questionnaire Item
Caregivers' perceptions of their roles in promoting their infants' health	<i>"Knowing you gotta start them early, gotta get them outdoors...if you get the parents involved in that and make it part of their lives, then the kids will make it part of theirs."</i>	My attitudes about exercise will strongly impact my child's attitude toward exercise over the course of his/her life.
Perceived benefits of infant physical activity	<i>"Interacting with them...to get them used to showing how they feel."</i>	Encouraging my infant to be active will let me have contact with my infant.
	<i>"I'd move her little knees...I feel that helps them more... they start to hold themselves up on their own sooner."</i>	My infant's muscle tone is improved with physical activity.
Perceived barriers to or facilitators of promoting physical activity in their infants	<i>"When my mom came to see her the other day...she was like doing these things with her legs, like moving them back and forth, moving her arms. She says it helps them to exercise. I'm thinking they might have done that with my nephew..."</i>	My family members encourage me to do physical activity with my infant.
Caregivers' fears of performing infant exercise	<i>"You don't want to move your kids...you wanna keep them still...she just pulled out her line yesterday."</i>	It is dangerous for my baby to be physically active.
	<i>"She has only been held by me, my husband is too scared. We really don't let a lot of people hold them now."</i>	