Pain assessment in children: Theoretical and empirical validity

Valid assessment of pain in children is foundational for both the nursing practice and research domains, yet few validated methods of pain measurement are currently available for young children. This article describes an innovative research approach used in the development of photographic instruments to measure pain intensity in young African-American and Hispanic children. The instruments were designed to enable children to participate actively in their own care and to do so in ways that are congruent with their developmental and cultural heritage. Conceptualization of the instruments, methodological development, and validation processes grounded in Orem's Self-Care Deficit Theory of Nursing are described. The authors discuss the ways in which the gaps between nursing theory, research, and practice are narrowed when development of instruments to measure clinical nursing phenomena are grounded in nursing theory, validated through research and utilized in practice settings.

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THE DESIGN AND provision of care to people experiencing pain has long been at the core of nursing practice and represents a critical area of inquiry in nursing science. Valid assessment of pain is foundational for both the practice and the research domains. When children's pain experiences are assessed, validity is a critical concern for the clinician and scientist. The challenge in developing accurate pain measures for children is that, in addition to issues of psychometrics, attention must be paid to the practicality and versatility of the instruments.[1] The child's age, level of cognition, sociocultural background, and the appeal of the instrument to the child, the researcher, and the clinician are factors that must be addressed in the development and use of pain assessment instruments for children.

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The purpose of this article is to describe an innovative research approach used in the development of instruments to measure pain intensity in young children. The conceptualization of the instrument, methodological development and validation processes, and the relevance of this research for practice will be addressed.

The Self-Care Deficit Theory of Nursing developed by Orem,[2,3] was used to direct the instrument development research. The theoretical constructs of self-care agency and the basic conditioning factors of culture and development were of central concern. Orem defines self-care as deliberate action directed toward the regulation of life, health, and well-being. Self-care agency is conceptualized as the human capability to engage in self-care. Basic conditioning factors are phenomena that are theorized to affect a person's ability to engage in self-care. Thus, action taken by a child to alleviate pain or promote comfort is self-care; the child's abilities to make judgments about pain and to take action are aspects of self-care agency; and the child's developmental level and culture are conditioning factors that influence his or her ability to make those judgments and to take action to alleviate pain. Important goals in nursing are to support the abilities of children to alleviate their pain and promote their comfort, and to do so in a way that is culturally sensitive and developmentally appropriate. Such efforts by nurses assist children to develop images of themselves as respected and responsible self-care agents.[3]

PAIN ASSESSMENT IN CHILDREN

Within the past two decades, there has been an increased development of methods to assess pain in children. Instruments have been developed in the areas of cognitive or self-report measures, behavioral observation, and physiological measures. There is consensus that physiological measures and behavioral observation methods are appropriate for use with neonates, infants, and toddlers.[4] However, self-report measures for assessing pain, while accepted as valid in adults, present a challenge in relation to children because of their immature, yet developing cognitive and verbal abilities. There is controversy regarding the abilities and accuracy of preschool, school-aged, and adolescent children in verbally reporting their experiences with pain.[5-8]

Several methods and instruments have been developed to obtain children's self-reports of pain in a manner that does not rely totally on their verbal abilities.[5,9,10] Such instruments reflect creative efforts by researchers to provide developmentally appropriate approaches that facilitate the child's ability to communicate the nature of the pain he or she is experiencing. Whereas these instruments are attentive to issues of practicality and versatility, few have accrued convincing evidence of the strength of their psychometric properties in general[11] and specifically in use with preschool and young school-aged children.

One instrument for which extensive and systematic validity testing has been completed is the "Oucher" scale,[12] which is a self-report measure of pain intensity. The basic premise underlying the Oucher is that preoperational children would be better able to relate to the face of a real child than to abstract drawings or conceptualizations of pain. Moreover, it is postulated that the rich and complex cues contained in photographs would attract and hold the attention of chil-

dren at this developmental level (Beyer JE, unpublished data, 1990).

The Oucher consists of a photographic scale and a numerical scale, depicted on a laminated white poster board. The photographic scale is used for children between the ages of 3 and 7 and comprises a series of six different photographs of a 4-year-old European American boy. They are arranged in an order designed to convey, through the child's facial expressions, increasing levels of pain. When this scale is used to assess a child's perception of his or her pain experience, the child is asked to point to the picture that best reflects what he or she "hurts like."

Evidence provided through several studies demonstrates the psychometric properties of the instrument. Strong evidence for the content validity of the photographic scale was provided in a study in which children between the ages of 3 and 7 were asked to sequence the Oucher photographs.[13] Level of agreement among the total sample (n=78) was high (Kendall's coefficient = 0.73, $p<0.01$), which indicated that children were able to identify and order differing levels of pain as depicted in the Oucher photographs. Clinical trials conducted with children between the ages of 3 and 7 also provide good support for construct, convergent, and discriminant validity.[14-16]

This cluster of studies provides evidence to support the use of the Oucher in clinical practice and research. In addition, initial and convincing data have been provided regarding the abilities of preschool and young school-aged children to utilize self-report measures of pain in a meaningful way.[13-16] While the use of self-report methods has been developed and established for school-aged children, the appropriateness of the use of these measures with preschool children previously had not been determined.

As is the case with most pain measurement instruments, the Oucher has not been tested with children from culturally diverse populations. As the scale consists of photographs of a European American boy, the issue of its use with nonwhite children has been questioned by clinicians and researchers. The issue of the cultural relevance and sensitivity of an otherwise promising instrument was the impetus for the series of studies described herein, in which two alternate versions of the Oucher, for African-American and Hispanic children, were developed.

The initial research study planned by these investigators was directed toward determining the content validity of the Oucher in relation to African-American and Hispanic children. However, discussions with African-American and Hispanic nurses and with nurses who care for African-American and Hispanic children revealed that, merely validating instruments with these children was not sufficient for them to justify the use of the Oucher with nonwhite children. These nurses indicated that, establishing acceptable psychometric properties would not address issues related to cultural relevance or sensitivity. It was at this point that a decision was made to develop alternative versions of the Oucher for Hispanic and African-American children.

CONCEPTUALIZATION OF THE INSTRUMENT

The utilization of nursing theory to guide the discovery and development of empirical referents for concepts of relevance to clinical

nursing practice, such as measures of pain intensity, has implications for both practice and research. If nursing theory is to be relevant in the practice arena, then mechanisms to validate and integrate theoretical formulations and statements must be used in nursing practice settings.[17] The development of instruments to measure clinical phenomena that are grounded in nursing theory represents a means of promoting and facilitating the utility of nursing theory within the practice arena. Further, the use of these instruments in research facilitates the design of theory-testing research. When such instruments are validated through research and used in practice settings, the gaps between nursing theory, research, and practice are narrowed.

Orem's Self-Care Deficit Theory of Nursing directed the development and testing of the alternate versions of the Oucher. As noted previously, self-care agency is the human capability for engaging in self-care; it is viewed as a complex structure consisting of three types of abilities:

1. foundational capabilities and dispositions, that is, abilities essential to the performance of any type of deliberate action, such as sensation, perception, memory, and orientation;
2. enabling capabilities for self-care, that is, capabilities specific to the performance of self-care, such as energy for self-care and self-care knowledge; and
3. capabilities for self-care operations entailed in making judgments and performing actions directed toward self-care.[18,19]

When a child is experiencing pain, nurses must assess the adequacy of self-care agency in the design of nursing care to prevent or alleviate pain. Areas for assessment include the child's ability to perceive and communicate about pain (foundational capabilities and dispositions), the ability to minimize or relieve pain, as through control of body position (enabling capabilities for self-care), and the ability to make judgments about specific actions to engage in to minimize pain (capabilities for self-care operations).

In the care of Hispanic and African-American children, the adequacy of self-care agency must be assessed within the context of developmental abilities as well as from the perspective of the children's cultural group.

Additional areas for assessment of pain in young Hispanic and African-American children, such as developmental level and sociocultural orientation, are derived from Orem's theory. First, in relation to development, Orem postulated that the presence or level of development of self-care agency is related to the state of physical, cognitive, and psychosocial development of the individual. Second, Orem[20] indicated that culture guides an individual's judgments of what should be (goals), what should be done (conduct and practices), and what should ideally be done (preferred action). Thus, in the care of Hispanic and African American children, the adequacy of self-care agency must be assessed within the context of developmental abilities as well as from the perspective of the children's cultural group.

The purpose of this research was to develop instruments that would assist young Hispanic and African-American children in

communicating their perception of pain. From a theoretical perspective, this instrument represents a means of assessing and activating an aspect of the child's foundational capabilities and dispositions within self-care agency. Further, this scale was designed as an instrument that could be used to determine, in both research and practice settings, how the basic conditioning factors of culture and developmental state affect the value of self-care agency in relation to a young child's perception of pain. Beyond the issue of assessment, however, the use of this scale in research and practice arenas presents opportunities for children to engage in activities that will assist in their development as self-care agents.

In the original content validity studies[13] for the Oucher, efforts were directed toward developing procedures by which validity could be determined for preschool children. In the studies described herein, the investigators also developed a way for children aged 3 to 7 to participate meaningfully throughout the entire process of developing new, alternate instruments. Further, direction for these studies was sought and obtained from African-American and Hispanic children, adults, nurses, and other health care professionals to ensure that cultural factors were attended to in the design of the instruments.

METHODOLOGICAL DEVELOPMENT AND VALIDATION PROCESSES

Instrument development

The development and validation processes involved identification of children to be photographed, selection of representative photographs for each scale, and determination of photograph order by level of pain intensity. First, children were selected to be photographed whose characteristics matched the target population for the instrument. From prior research,[21] it was deduced that children would be better able to identify with pain in a child of similar developmental level and cultural heritage. Thus, children were selected from those in a pediatric hospital who were experiencing pain, were 3 to 7 years of age, and were of Hispanic or African-American heritage.

Extremely close attention was paid to protecting the rights of children during the time of selection and each time that children were photographed. Parental consent was obtained, and time and care were taken to explain the study in developmentally appropriate language to the children and to obtain their informed assent. One Hispanic child and three African-American children were photographed. Photographs were taken at various points during hospitalization, at times when the children were experiencing and not experiencing pain. As the final instruments were envisioned to be alternate or parallel forms of the Oucher, six photographs would be needed for each scale. Approximately 40 to 60 photographs of facial expressions of each child were taken to ensure that a full range of expressions of pain intensity were obtained.

Validation processes

In conceptualizing instrument validation processes, the investigators viewed 3- to 7-year-old Hispanic and African-American children as the appropriate content experts to select the six photographs for each scale. It was reasoned that children from the same

developmental and cultural background would be able to make the most valid judgments about the pain intensity levels reflected in the photographs. It was believed that these young children could sort a set of a maximum of 18 photographs; thus, preliminary sorting of the full sets of 40 to 60 photographs was done by separate panels of Hispanic and African-American adults. Agreement levels of 80% to 100% were reached by the adults on 15 photographs depicting clear, unquestionable pain and on 3 photographs depicting neutral or no pain expressions for the Hispanic boy and one African-American boy. The panel of African-American adults also made the selection of which of the three photograph sets of African-American children most clearly reflected pain and thus should be used for the scale.

Procedures were incorporated into the study to assist in determining the child's developmental capability to understand the nature of the photographic sorting and to increase confidence in the validity of the child's sorting. Interviews were conducted with the children to determine their ability to understand the concept of pain or hurt. Children also were directed to perform a simple seriation task with six geometric shapes. This task consisted of putting six equilateral triangles of varying sizes in an order from smallest to biggest. Results of this task were used as a predictor of children's abilities to make meaningful judgments about the serial order of the pain intensity in the photographs. It was postulated that if children were unable to perform the seriation task, they could not meaningfully perform the photographic sorting.

African-American and Hispanic children then selected from the 18 photographs the 6 that would make up each scale. Twenty-five children from each cultural group were presented with the 18 photographs of the child representing their cultural group. They were asked to select and place into a pile the 3 that showed "no hurt at all." They were asked to select and place into a second pile the 3 that showed the "most hurt of all." This was repeated four more times for the remaining photographs; thus, they sorted the 18 photographs into six piles that represented their judgments about the varying levels of pain intensity reflected in the photographs. Upon completion of the task, they were given the opportunity to review their choices and make changes. They also were asked to discuss during the sorting process the bases for their judgments.

Six photographs were selected for the final scale, ranging from "no hurt at all" to the "biggest hurt you could ever have." Selections were made by examining the level of agreement for scale position for each of the 18 photographs. Only the data from the child judges who successfully completed the geometric seriation task were included in the final analysis. Descriptive data from the children about the bases of their judgments also were reviewed to further validate the selection and order of the 6 photographs.

Content validity was examined further by asking a second sample of content experts of African-American and Hispanic children to select the order of the six photographs for each scale. Hispanic (n=112) and African-American (n=143) children aged 3 to 7 were asked to place the six photographs in order by degree of pain intensity. Using the procedure described by Beyer and Aradine,[13] they were asked to select and place at the bottom of a "sticky board" the picture that showed "no hurt at all" and then to place at the top of

the board the picture that showed the "biggest hurt you could ever have." They were asked to select and place below the top picture the photograph that remained that showed the biggest hurt. This was repeated until all six photographs had been placed in order, thus creating a scale of pain intensity. As was described in the first instrument development phase, children also were interviewed regarding their understanding of pain or hurt and were directed to complete the seriation task with the six geometric shapes.

The level of within-group agreement on order of the Hispanic photographs using Kendall's coefficient of concordance was 0.65, p=0.0000; the level of agreement for the African-American photographs was 0.67, p=0.0000. The values indicate support for the content validity of the instruments.

To determine the validity of these scales for children as young as 3 years old, data obtained from the simple seriation task with geometric shapes completed by all children were analyzed. Kendall's coefficients reported above were computed only from data on the 95 Hispanic and 121 African-American children who correctly sequenced the six triangles. Kendall's coefficients computed from data on the 17 Hispanic children and 22 African-American children who failed to sequence the triangles correctly were only 0.16 and 0.22, respectively. The obvious discrepancy in agreement levels suggests that the photographic scales probably are not valid for children who are unable to complete correctly the simple geometric seriation task.

The development and validation phases of this instrument development research yielded two culturally sensitive, self-report photographic pain intensity scales for young children. Significant agreement, at moderate levels, provides evidence for the content validity of these scales. There was also evidence that the simple seriation task is useful in determining the child's ability to sequence the photographs of the scale.

RELEVANCE FOR PRACTICE

The relevance of this instrument development research for practice and further research is evident in a number of ways. First, development of a means for children to participate in assessing their pain has implications for effective relief of their pain. In this study, children as young as 3 years demonstrated ability to communicate meanings of hurt, to perform a seriation task with geometric figures, and to order in a meaningful way photographs that depicted different pain intensities. This provides evidence that the self-care agency of children is developed sufficiently to enable them to participate in the identification of pain. It is clear from this research that young children can make and communicate judgments about pain. The integration of the geometric seriation task in the practice setting would be useful in determining the adequacy of the child's self-care agency in the assessment and communication of his or her pain.

In addition, experience during this research process suggests that it is both possible and important to develop valid instruments to assess young children's health-re-

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lated experiences. Instruments can and should be developed to enhance children's abilities to communicate their experiences to family members, nurses, and other health care providers. This research also demonstrated that children can and thus should be active participants in research processes designed to develop valid assessment instruments for children. As in the practice setting, the integration of methods of assessing children's abilities to participate during phases of the research process, such as the geometric seriation task developed for this study, becomes critical.

The second aspect of relevance is that the two alternate forms of the Oucher and the processes involved in the scale development represent significant contributions in the assessment and care of young Hispanic and African-American children. The development of culturally appropriate instruments for use in practice and research with minority children is overdue.

The alternate versions of the Oucher for Hispanic and African-American children represent the first known effort to develop for minority children a pain instrument that is culturally based. By the use of a culturally based measure of assessing pain in Hispanic and African-American children, the value of culture in conditioning self-care agency and other constructs within the theory, such as self-care and therapeutic self-care demand, can be explored in both practice settings and research. Further, the existence of a culturally based measure will facilitate practice and research efforts in delineating the role of culture in the experience of pain in children.

It is noteworthy to mention that several members of the Hispanic and African-American communities who participated in this research felt affirmed by the attention given to their respective cultural group. This was clearly expressed, for example, by an African-American nurse who exclaimed when she saw the scale for the first time, "Finally, someone believes black people hurt too!"

It is anticipated that culturally sensitive scales can serve to develop and strengthen communication among nurses, children, and families of different cultural groups. The initial attention to instrument development for minority children was focused on African-American and Hispanic children, both because of the prevalence of these groups in the population and because they represent primary groups for whom the authors were providing care and about whom they were conducting research. The potential importance of additional scale forms, such as one depicting pain expressions of an Asian child, is clear.

While careful attention was paid in this research to the basic conditioning factors of culture and development, the authors acknowledge that gender was less fully addressed. The issue of gender is very relevant for practice and research. Agreement levels by gender were analyzed during instrument development, with no evidence of significant differences. However, just as the importance of having culturally sensitive scales has been presented, a persuasive case could be made for having scale forms for girls as well as boys. The authors did obtain photographs of both girls and boys for scale development but did not have sufficiently clear pain expressions in the photo sets of the girls to enable construction of additional scale forms at that time. Development of such gender-sensitive scales in the future seems warranted to enhance girls' abilities to identify with the scale photographs—thus

strengthening the validity of the measures—and to acknowledge the child's gender.

A final point about the practice relevance of the instrument development research described herein needs to be made. At the present time, good evidence has been obtained for the content validity of the new photographic pain scales. Clinical trials similar to those used to establish support for construct, convergent, and discriminant validity for the original Oucher scale must be completed before the African-American and Hispanic scales can be used with confidence in practice or subsequent research.

In summary, this instrument development research focused on a clinical phenomenon and, at the same time, was grounded in nursing theory. Both the research process and the resulting pain measurement instruments described here reflect attention to, and the relevance of, the theoretical constructs of self-care agency, and the basic conditioning factors of development and culture. Children were active participants in the methodological development and validation of these instruments. Their cultural heritage and developmental level were critical to their contributions during each phase of the process. Moreover, the instruments that resulted have clear relevance for the practice discipline. They were designed to enable children to participate actively in their own care and to do so in ways that are congruent with their developmental level and cultural heritage. Providing opportunities for and supporting efforts by children to participate in decisions about their pain promotes the development of self-care agency. When a child participates in making judgments about his or her pain experience, self-care agency is activated, culture and development are operational, and self-care is made possible.

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