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***An Ethological Approach to Measuring Maternal Caretaking During Critical Child Illness***

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## **Abstract**

The aim of this study was to create an instrument to measure maternal caretaking behaviors in Pediatric Critical Care Units (PCCU). Maternal participation in child caretaking during hospitalization deserves attention because it has been related to positive coping, diminished stress, and reduced uncertainty in mothers. Further, maternal caretaking behavior is of interest as an indicator of interruption of maternal role and maternal-child relationships during critical child illness. Ethological methods were used to develop the Maternal Caretaking Observation Schedule for PCCU. Seven mothers of critically ill children were videotaped in PCCU with their child. Analyses were performed on 330 minutes of videotape. Mutually exclusive behavior codes were developed, which were categorized theoretically with attention to validity. Behavior codes were formatted into a time-interval recording instrument with attention to reliability issues. Twenty-four behavior codes within 7 categories were identified. The categories (with behaviors in parentheses) were: Proximity (Close, Contact, Distancing), Monitoring (Gaze, Vigilance, Timing, Inattention), Touch (Grooming, Soothing, Tentative, Kissing), Affect (Smiling, Flat, Frowning, Crying, Nervous), Caregiving (Assist Nurse, Independent), Modifying Environment (Adjusting, Adding, Removing), and Talking (To Child, About Child, Social Talk). The study resulted in a rich taxonomy of maternal caretaking behaviors formatted to measure behavior frequencies within a unique caretaking context.

**Keywords:** Child, Critical Care Nursing, Caretaking, Ethology, Instrument Development, Maternal Behavior, Observation

## **An Ethological Approach to Measuring Maternal Caretaking During Critical Child Illness**

### **Introduction**

Nurses who care for children understand the need to integrate families, particularly mothers, into the care of their hospitalized child.<sup>1</sup> This need is driven by the desire to avoid potential health problems posed by separation and interruption of maternal-child relationships.<sup>2-5</sup> Further, nurse researchers have substantiated that it is important to include

mothers in care of their child when the child is hospitalized in a Pediatric Critical Care Unit (PCCU), not only for the child's sake, but to preserve the maternal role.<sup>6-12</sup> Because of the universality of high technological care, there is widespread international nurse interest in investigating the experiences of parents as participants in their child's care during hospitalization.<sup>11</sup>

Many factors can complicate child caretaking in the high-technological environment of PCCU. The severity and unpredictability of child illness, the child's behavior and appearance, the novelty of the environment, interruption of normal mothering roles, and ambiguity related to shared caretaking of the child with nurses combine to create significant maternal stress and uncertainty.<sup>7,8,11,13-15</sup> Despite these negative aspects, mothers usually desire to be with their child in PCCU and do participate in care.<sup>6,16-19</sup> Mothers' presence offers a sense of familiarity, protection, and support to their vulnerable child.<sup>20-23</sup>

The need for mothers to perform child caretaking behaviors fills biological and societal demands to fulfill a vital function: Child survival.<sup>24</sup> Caretaking behaviors, assumed to be in process whenever a mother is with her child, occupy a major portion of the maternal role and consist of nurturing, protecting, comforting, feeding and providing hygiene.<sup>26</sup> In everyday life, our biological and societal traditions guide mothers in caring for their child. However, it is not clear how such long-evolved roles and behaviors fit with the newness of participation in caretaking of a critically ill child in a high-technological environment, under conditions of threat, stress and uncertainty.

### **Purpose**

The purpose of this study was to create an instrument that records the presence and frequency of maternal caretaking behaviors in PCCU. Identifying maternal behaviors in the PCCU is necessary for understanding what some mothers presently do and what others could do, with guidance, to participate in the care of their critically ill child. Further, such a measure could also be used to assess outcomes of interventions designed to increase maternal role participation in the care of their child in PCCU.

### **Background**

Ethology is the systematic, naturalistic, study of behavior using observation within the target organism's environmental context<sup>27,28</sup> and is originally rooted in evolutionary biology and the philosophy of critical realism.<sup>24,27-29</sup> A strength of

ethological methodology is the process of systematic, inductive behavior identification and development of taxonomies of behavior. According to human ethological theory, behavior is the method by which we relate and sustain relationships with each other.<sup>2,4,30,31</sup> Nurses have been urged to use ethological methods because the work of nurses involves observation, and also because the identification of human behavior within naturalistic and/or health care environments cannot be easily controlled.<sup>32-34</sup>

Within this theoretical framework, the ultimate function and purpose of maternal behavior is to ensure quality child well-being and survival,<sup>2,35,36</sup> which in the present study are fulfillment of maternal role expectations of caretaking behaviors directed toward the care of the critically ill child within a critical care environment.

Motivators for child caretaking are rooted in attachment theory, and include fear and anxiety related to loss, separation, and child survival,<sup>2,36,37</sup> as well as emotional caring, empathy and responsibility.<sup>35</sup> Another well established motivator from the nursing literature is the attainment of the maternal role, or the process of becoming a mother, which includes mastering caregiving behaviors.<sup>26,38-43</sup> Mercer's program of research indicates that child related variables such as health status, appearance, responsiveness, and separation affect maternal role attainment.<sup>39-44</sup> All of these child caretaking motivators vary according to circumstances and maternal and child characteristics.<sup>2,4,26,35,38-44</sup> Nurses have also investigated maternal role alterations in the PCCU setting,<sup>6,15,18,45,46</sup> and a common theme across these studies was the disruption of the maternal role, with resultant stress and/or uncertainty, which in turn, can undermine caretaking behaviors.

Within the present study, maternal role enactment (in the form of caretaking behaviors) in the PCCU is assumed to be adaptive behavior directed at sustaining the maternal-child relationship and assisting the child to survive the critical illness experience. Therefore, mothers are expected to perform caretaking behaviors that can be identified, defined, and categorized. From previous studies, the following behaviors were expected in the present study: Seeking proximity, touching, gazing, signs of emotional warmth, and simple caregiving behaviors such as feeding and providing hygiene.<sup>25</sup> However, due to maternal uncertainty and stress, the PCCU medical environment and critical condition of the child, other behaviors related to medical care or procedures were expected to occur.

Many highly productive programs of nursing research have reinforced the value of observational methodology.<sup>47-54 55-62</sup> A few nursing observational studies of parent behavior in the PCCU have identified child caretaking behaviors through the framework of parent coping. Lewandowski<sup>63</sup> used participant-observation methodology to study behavioral coping of

parents of cardiac surgery children. Parents were found to exhibit the following coping behaviors: touching and stroking, proximity to the bed and child, focusing on the child or equipment or events around them, and involvement in child's care. Similarly, LaMontagne et al.<sup>64</sup> used observation to examine parental coping, activities, and stress in the PCCU. The use of problem-focused coping was positively associated with higher parental involvement in child-care activities and with three activities in particular: instrumental acts, consultation with health care providers, and emotionally supportive acts. Participating parents reported a significant reduction in anxiety between 24-48 hours after admission, and at 72 hours after admission.

One study<sup>65</sup> systematically focused on maternal behavior through the framework of role theory. The behaviors of 12 mothers in PCCU were identified using observation and grounded theory methods. Behaviors were defined at a broad, or macro level of role behavior identification. The following maternal role behaviors were identified: Vigilant Parent, Nurturer-Comforter, Medical Parent, Caregiver, Entertainer and Protector. Vigilant and Nurturer-Comforter Roles predominated in the PCCU. The child's condition and presence of another person were both found to influence the roles that mothers assumed.

Previous observational studies of mothers in PCCU have conceptualized behavior as role functioning,<sup>63</sup> and as coping.<sup>63,64</sup> In the present study, maternal behavior was conceptualized as child caretaking, which has a broader meaning than caregiving. Caretaking is defined as the physical signs and actions mothers exhibit when in proximity of the child; behaviors which have research-based linkages to sustaining the maternal-child relationship. Caregiving has a narrower meaning, and is defined as specific physical actions performed to meet basic physiological child needs. Child caretaking in the present study was operationalized at a relatively micro behavioral level (touch, talk, and proximity), instead of a macro behavioral level (e.g. Parent roles such as Vigilant Parent,<sup>65</sup> or Coping behaviors<sup>63-64</sup>), due to the aims of the study. Further, micro level behaviors can be more objectively extracted from video records, and more precise descriptive definitions can be created, which improves inter- and intra- rater reliability.<sup>66,67</sup> By beginning with theoretically meaningful micro level behaviors, the researcher can work towards a more macro level if desired, whereas the reverse process is less feasible.<sup>66,67</sup>

## **Methods**

### *Design*

A descriptive design using qualitative ethological methods was utilized to identify maternal caretaking behaviors and create a quantitative instrument to record the frequency and types of maternal caretaking behaviors observed in PCCU. Ethological methodology used in this study consisted of 5 steps: Behaviors were (1) captured on videotape, (2) identified, (3) operationally defined, (4) organized into meaningful categories and (5) formatted into a time-interval behavioral instrument.<sup>32</sup>

### *Participants*

*Samplings and subjects.* Mothers were included in the convenience sample based on the following criteria, (a) mother must speak and read English (in order to understand the explanations and to respond to survey questions), (b) child had been home and in the care of the mother prior to the hospitalization (so that a pattern of non-hospitalized parenting had been established), (c) child had been admitted to PCCU no more than 3 times previously (to avoid maternal sensitization to the environment), (d) child was aged 1-month through 5-years (in order to standardize, to some degree, the character and type of mothering activities), (e) child must be expected to survive by staff (to avoid over-burdening mothers and to prevent confusing grieving behavior with caretaking behavior), (f) no child in restrictive isolation situations (this might alter/restrict the behaviors of those in the room), (g) no child abuse or suspected abuse (to avoid legal liabilities), and (h) child had been in this PCCU at least 24 hours ( to provide for some degree of stability, as well as acclimation of the mother to PCCU).

Mothers were recruited until a full repertoire of behavior was obtained. No new behaviors were added after the first 5 subjects. Two more mothers' video records were obtained and analyzed, to ensure that no new behaviors emerged. No new behaviors were observed with the 2 additional video records.

All but one (Mexican-American) of the participants were European American, and family incomes ranged from \$10,000 to about \$49,000 USD/year, with a mean income of \$20-29,000 USD/year. Maternal mean age was 24-29 years, and 86% of the sample was married. The 7 children ranged in age from 3 months to 2 years, with a mean age of 10 months. Two children were 6 months or younger, and five were 1 year or younger. Five children were in PCCU due to cardiac problems, one due to liver failure, and one due to cancer. Children had been in PCCU an average of 4 days, with a range of 2-8 days. All of the children were sedated and on ventilator support. For 3 of the children, this was the first PCCU hospitalization, for 3 children, this was the second or third PCCU hospitalization. One child had been in the PCCU four other times, but two of the prior PCCU experiences were for less than 3 hours each (brief post-op experiences), and so

was retained in the study. There were 2 girls and 5 boys. Four mothers had no other children; the other 3 mothers had one other child each.

### *Setting*

The PCCU was in a 14-bed regional referral center for critically ill children aged newborn through 18 years situated in a large university hospital. Children were admitted for a variety of medical and surgical conditions. The rooms were semi-private; the end of a single room connected by a glass door to the end of another single room. There was a bed or crib, with life support equipment that abutted a head wall, in each of these rooms. Rooms had one window covered by mini-blinds. All rooms had a sink, toilet, and a computer on a rolling desk with a high-seated rolling chair for the nurse. Mothers were able to move about the room freely when they were with their child in PCCU. There were no specific visiting hours; mothers and fathers were free to visit at any time.

### *Procedure*

Data collection procedures were based on a lengthy period of on site preliminary observations of mothers, the children, nurses and doctors in the PCCU. These observations helped establish staff and patient activity patterns, identified best sites for observing/videotaping, and an understanding of PCCU care routines. Additionally, meetings with the PCCU head nurse, clinical nurse specialist, and the PCCU nurses' education and research committee were held to plan the process of data collection. Using the participant criteria, the PCCU clinical nurse specialist identified all eligible participants from the census sheets, and asked if they were willing to speak to an investigator about the study. If the mother agreed, the clinical nurse specialist notified the investigator. The investigator met the mother in the PCCU at a mutually agreeable time and explained the study requirements. Mothers were told that the investigator wanted to videotape her while she was with her child in the PCCU. The consent form was given to the mother to read and sign. All mothers approached by the CNS and subsequently, the investigator, agreed to participate in the study.

In order to create an accurate taxonomy of behavior, repeated viewing and corroboration by others is necessary. For these reasons, the decision was made to videotape behaviors.

### *Recruitment*

*Data Collection.* Video records were collected at a convenient time for the mother, which was usually the day after obtaining consent. Video recordings were obtained while mothers were with their children in PCCU, with the assumption that if the mother was in the room with the child, then she was engaged to some degree in child caretaking.

The video data collection periods were: (a) two 15-minute periods on day 1, then (b) two 15-minute periods the next day. Three mothers were videotaped for one day only (two 15 minute periods). In two of these cases the children were discharged from PCCU on the second day, thus were ineligible for more data collection. In the third case the child significantly worsened overnight. Since the child's survival was in question, the mother was not videotaped on the second day. In total, 330 minutes of videotaped data were used to identify maternal behaviors.

The investigator dressed in a lab coat with nametag (required by the PCCU), and did not interact with others in the room during taping. A lightweight commercial grade Panasonic VHS camera with low-light capabilities on a tripod and superior grade Fuji videotape film were used to collect behavioral data. Prior to beginning videotaping, nurses in the room were consulted for their permission, the external glass doors to the hallway were pulled almost shut, and a "Do Not Disturb – Research in Progress for 20 Minutes" sign was placed on the door. The camera and investigator were positioned about 6 feet from the bottom of the child's bed. At times it was necessary to pan the camera, or to zoom in or out to maintain the desired frame composition.

### *Validity*

The primary validity concern was to ensure that true maternal caretaking behavior was being captured on video records. To address that concern, several procedural processes were employed. Video recording on holidays and birthdays were avoided, as behavior may be different on special days such as Mother's Day or the child's birthday. As there was no feasible way to hide the video camera, video recording was done from a corner of the room, as unobtrusively as possible. During the preliminary in vivo observations of the PCCU, it was noted that many parents and grandparents were video recording or asking the nurses to video record them and their child, indicating some de-sensitivity to being video recorded. The investigators debated the effect that visible video recording may have upon the mothers, and realized that was a necessary limitation to the study, however steps to verify "usual" behavior was made, namely verification of that mother's usual visiting behavior with the PCCU nurse, and by screening of video recordings with a pediatric nurse clinical specialist with 10 years of PCCU experience, who was not on the research team. After each videotaping session, the child's nurse was asked if the mother's behavior during videotaping was usual and representative of behavior when she was with the

child during previous visits. In one case the nurse replied that the mother was overly vocal and highly theatrical, which was not the mother's usual visiting behavior, so that mother's video records were not used in the analysis. One more mother was recruited to replace this lost subject, resulting in the sample size of seven described above. Another validity process was to compare observed behaviors to maternal behavior literature. Further, two members of the research team who are experts in measurement and/or maternal-child observational methodology reviewed the procedures, video records and behaviors for corroboration. The inductive process of arriving at behavior codes further supported the validity of the content of the instrument. Because of the validity risk of missing behaviors by only observing 10 seconds of every 30 second period, participants were observed at different times of day (15 minutes, twice a day, for 2 days) to broaden the possible behaviors that were captured.

### *Reliability*

Reliability in this study included the accuracy of measurement during the process of behavioral data collection, as well as during instrument formatting and design. Also, very specific participant inclusion criteria helped reduce measurement error. To address data reliability, the data collection process was systematically performed in a uniform manner for each participant. The same audio and video equipment was used for all sessions, and the same type of videotape was used. Each participant's data were recorded on separate tapes, labeled with their subject number. A 24-inch color monitor and a Hitachi video cassette player (VHS) was used to review each tape repeatedly.

When constructing an observational instrument, formatting and design are important for reliability. An observational instrument that is simple yet sufficient is the goal. Formatting issues are addressed in the Results section, in the description of the instrument and rationale for decisions about establishing time intervals for observing and recording data.

### *Ethical Considerations*

Institutional Review Board permission to perform the study was granted by the hospital and university where the study was conducted. In determining the final data collection scheme, the investigator weighed the potential benefits of the study against the invasiveness of the study and the possible effects on subjects and their families. The unique health care environment warranted special human subject and data collection considerations. In addition to the Human Subjects requirements that were abided by (informed consent, confidentiality, and freedom to withdraw) further guidelines were instituted to address the sensitivity of the situation and environment, and the potential invasiveness of the video method

for recording behavior. Guidelines were: (a) Data collection would not interfere with or delay care, (b) Filming would be arranged at a time when child care tasks involving the nurse were minimal, (c) Data collection would not take more than 30 minutes per data collection period with no more than two a day, (d) Any nurse who may be affected would be consulted prior to any data collection periods, (e) Change of shift times would be avoided when possible, (f) Any staff persons appearing on the videotape would be asked for their permission to videotape, and if they refused, taping would be suspended until care was given and they were clear of the video camera, then video recording would restart.

### **Equipment and Technical Considerations**

#### *Data Analysis*

The first strategy was to develop a taxonomy of behavior called an ethogram. The ethogram consists of behavioral codes, which are mutually independent operational definitions of behaviors. The process used for developing the ethogram for this study was developed by Tomlinson et al.,<sup>61, 68</sup> and had been used in a previous study.<sup>62</sup> One of the investigators viewed video records in the sequence they were acquired. As the video records were reviewed, lists of behaviors were generated and given preliminary labels, definitions, and categories. Concurrent comparisons between observed behavior and those reported in the literature continued throughout video record review. The video records were reviewed multiple times until the listings were complete, and were continued until no new behaviors were observed.

The list of behaviors and randomly selected segments of video records were analyzed by an expert in maternal behavior and in ethological methodology. Main, recurring behaviors related to maternal caretaking behavior, definitions, and categories were identified in repeated observations of the data until agreement among the investigators was obtained on observed caretaking behaviors, categories of behavior, suitable behavior code names, and behavior code definitions. Behaviors that could be linked conceptually were categorized for the purpose of improving observer reliability.

### **Results**

#### *Ethogram*

An ethogram consisting of 7 categories and 24 mutually exclusive behavior codes was created. The term “mutually exclusive” applies only to the definitions of the behavior codes themselves, as combinations of necessarily dependent

behavior codes may occur within an observation period and be recorded on the ethogram (i.e., Close Proximity, Touch and Independent Caregiving).

Three behaviors reflected the mother's degree of physical closeness and were categorized as Proximity: (a) *Close*-very close to the child, head and part of the body trunk are over the bed/ child, or embracing or holding the child. (b) *Contact*-Body or hand only is in contact with the child or bed, head only may be near bed, but position is upright, and (c) *Distant*-No contact with the child or bed.

Four behaviors represented the directional focus of the mothers' eyes and were categorized as Monitoring: (a) *Gaze*-eyes are directed at the child, (b) *Vigilance*-eyes are directed at monitors, equipment, scanning the room or observing nurses or doctors, , (c) *Timing*-Eyes are directed towards clock or watch, and (d) *Inattention*- Eyes are not on child/health care environment or watch; may be reading to herself, checking phone, watching television, or looking at visitors.

Four types of touching behaviors were categorized as Touch, defined as mother makes contact with child using her hands, face or lips: (a) *Grooming*-touches child to influence child appearance. May remove lint, pick at tape, comb or adjust hair with fingers or brush, (b) *Soothing*-touches child gently by holding body part, or stroking with long, repetitive or massaging motions, or cupping head or other body parts with the hand, (c) *Tentative*-hesitant, brief or light contact using only tips of or backs of hands/fingers, (d) *Kissing*-the mother's lips touch the child.

Five emotive maternal behaviors were categorized as Affect: (a) *Smiling*-the mother's mouth edges are upturned, eyebrows relaxed or raised, may be laughing, (b) *Flat*-no noticeable affect, the mouth was straight, the eyes not expressive, (c) *Frowning*-mouth edges were downturned, and/or eyebrows may be down or furrowed, (d) *Crying*-tears on cheeks, or wiping tears from eyes, may be in presence of frowning or sounds of weeping, and (e) *Nervous*-repeatedly touched hands together, hand-wringing, ring twirling, feet jiggling, or nail biting,

Two behaviors were categorized as Caregiving, which is when the mother acts to provide basic physiological care for her child (feeding, warmth, movement, elimination or safety). May include responding to monitors, performing procedures, adjusting tubes or wires, feeding by any method, range of motion, repositioning limbs, cleaning, diaper changes, adjusting blankets, covering or uncovering child: *Assisting Nurse with Caregiving*-mother performs caregiving with nurse participation or supervision. *Independent Caregiving*- physical care of the child initiated by the mother and performed alone, without nurse. Specific procedural behaviors observed included suctioning the child, removing moisture out of

ventilator tubing, milking urine down catheters into the bags, moving electrode wires, feeding by tube, performing range of motion, and repositioning limbs. Caregiving behaviors could fall into either behavior code, depending on the degree of maternal independence.

Three behaviors were categorized as Modifying the Environment, where mothers changed the child's surroundings for aesthetic effect. Does not include adjusting tubes, wires, or blankets. Does include toys, pictures, music, lights, blinds, doors or curtains: *Adjusting*-adjusting what is already in the child's environment, repositioning, lifting toys, or pictures, fixing lighting, or blinds. *Adding*- Introducing new objects into the child's immediate surroundings. Turned on lights, started music, place a toy in the bed. *Removed*-removed from the room, or immediate surrounding of child. Turn off lights, turn off music, remove toys from bed or room. This category did not include adjusting wires, tubes or blankets (unless removed from the room); these were coded as Caregiving behaviors.

Three verbal behaviors were categorized as Talking, when the mother speaks to the child or others: *Talking To Child*-mother speaks or reads to the child. *Talking About the Child*-mother speaks to others in room, or on phone about the child. *Social Talk*-mother speaks to others in the room or on the phone about non-child, non-PCCU treatment related subjects. Social talk topics include the nurse's or the mother's family, vacation, the weather, current events, hometowns, pets, or who was coming to visit in the PCCU.

### *Instrument Development*

Ethogram behavior codes were formatted by categories into The Maternal Caretaking Observation Schedule: Pediatric Critical Care Unit (MCOS: PCCU), a paper and pencil time-interval measure, suitable for recording maternal caretaking behavior either in real time observation, or from videotapes. See [Figure 1: MCOS: PCCU](#). Benefits of real time pencil and paper measurement usually include less expense and preparation time, when compared to video or handheld device recording. The instrument is formatted as a one page document to facilitate ease of use.

Time interval sampling is a strategy used to obtain representative behavioral data, while overcoming the challenges imposed by the number and complexity of behavior codes and complexity of the setting. A specific time period is provided for observation, followed by a specific amount of time for recording the behaviors. Therefore, observers will observe and record only portions of the behavior (termed modified frequencies) out of all behaviors that actually occurred.<sup>67</sup>

Time interval determination (the amount of time one observes, then records on the MCOS: PCCU) was established by determining the amount of time it would take a well-trained observer to view and then record the 24 behaviors reliably, as well as maximizing observation time versus recording time in order to capture as many maternal behaviors as possible. Through repeated practice, the best combination was determined to be a 30 second measurement unit consisting of 10 seconds of observation followed by 20 seconds of recording. For every minute of observation, 2 squares on the MCOS: PCCU are used. Each 30-second time interval on the MCOS: PCCU (numbered 1, 2, 3 or 4) equals 10 seconds of observed behavior.

### *Instrument Instructions*

The user memorizes the behavior codes and definitions, and familiarizes him or herself with the instrument's format. The user should create an audio prompt to be listened to with head phones during observation that prompts them to "Look" (10 seconds), and "Record" (20 seconds). This assures uniformity in the timing of observation and recording. Several practice sessions, using another rater to establish satisfactory intra- or inter-rater reliability, should be conducted prior to data collection.

During observation sessions, the user records behaviors by placing a mark in boxes corresponding to the proper time interval (vertical axis) and behavior code(s) (horizontal axis). MCOS: PCCU behaviors are grouped by categories, with selected lines made heavier than others and some columns consistently wider than others to provide quick visual landmarks. During the 10-second observation period, the user records all behaviors observed. In other words, the mother may be Close, Kissing, Soothing, and Crying within 1 observation unit. The user does not put more than 1 mark within any 1 behavior code for each observation unit. If the mother leaves the room during the observation period, observation is suspended and a note is made on the MCOS: PCCU. Observation resumes when she returns. If she does not return, those time units are left blank, and should be treated as missing data (see below). More sheets are used to record times longer than 15 minutes.

### *Instrument Scoring*

After observation sessions, each behavior code will have an associated modified behavioral frequency (*mf*), which represents the number of times behavior was marked as occurring. However, if the total observation times are not equal across subjects, or if there is missing data, then the scorer must convert modified behavioral frequencies to relative

behavioral frequencies (*rf*). A relative behavioral frequency is the number of behavioral occurrences observed, divided by the total number of observation intervals possible. It is the norm to use relative behavioral frequencies in analysis, unless observational times are equal across all subjects.<sup>66,67</sup>

Scoring can be performed in several ways, depending on the need of the investigator. MCOS: PCCU results may be expressed as a total relative frequency of all of the maternal caretaking behaviors, or as category relative frequencies, or as relative frequencies of individual behaviors. Frequencies may also be used in analyses with other relevant variables within a study (for instance, the relationship of the age of the mother to relative frequency of maternal caretaking behaviors in PCCU).

### *Pilot Study*

After the development of the MCOS: PCCU, a pilot study was conducted over a 4-week period in the same PCCU, using the same inclusion criteria and procedures, except that data were collected *in vivo* by two observers simultaneously. Three mothers were observed for a total of 180 minutes in order to provide information about feasibility of use, the sufficiency of behavior codes, and reliability and validity. The pilot sample consisted of 1 European-American mother, 1 Chinese-American mother, and 1 mother who identified herself as half Native American (Ojibwa) and half European-American. The children were 6 months, 3 years, and 5 years. The 6 month and 3 year old children were sedated and on ventilators. The 5 year old was lightly sedated, but was not on a ventilator. As a result of the pilot study, no changes were made to the instrument, no new behaviors were identified, and all behaviors had at least one occurrence across the 180 minutes. Inter-rater reliability was calculated for the first (0.86) and third subject (0.90). Intra-rater reliability was rechecked during this period for both observers, using video recordings of two 20-minute vignettes recorded prior to the pilot study (.90 and .94). Subsequently, the MCOS: PCCU was deemed acceptable to use with a larger sample of mothers in PCCU with more maternal and child age, ethnicity, and disease process diversity.

## **Discussion**

The ethological methodology used to produce the MCOS: PCCU resulted in a rich taxonomy of maternal caretaking behaviors within a unique caretaking context. The similarities of the behavior codes in the MCOS: PCCU to classic maternal behavior descriptions described by Bowlby,<sup>2</sup> Klaus and Kennel,<sup>69</sup> Rubin,<sup>4</sup> Schaffer,<sup>25</sup> and Tomlinson<sup>61</sup> provided positive validity indicators. Most of the 24 behavior codes and their 7 categories were not only similar to classic maternal

behaviors, but also with maternal behaviors in PCCU.<sup>63-65</sup> However, a few unique behaviors were identified, such as Timing, the differentiation of the types of talking behaviors, the independence and interdependence between mother and nurse around caregiving behavior, and the specificity of the affective behaviors.

Sampling limitations should be considered when interpreting the results of this study. The MCOS: PCCU was developed on a sample of predominately European American, middle class mothers with 1 or 2 children. Additionally, all of the children were sedated and on ventilators and were 1 year old or younger, perhaps restricting the use of the MCOS: PCCU in older children of lower acuity with mothers of ethnicities other than European American. Further use of the instrument in larger samples is needed, and piloting should be done before use in the sample of interest. While the MCOS: PCCU is a new instrument, the behaviors were successfully vetted through the expert consultants, matched literature reports, and performed successfully in the pilot study.

There are limitations when using time-interval sampling. Rarely occurring behavior may not be accounted for accurately. Further, interval-sampling results may not correspond to “true” frequencies, but was a necessary trade-off, given the number of behavior codes and the PCCU context. An investigator who reduces the numbers of behavior codes after a pilot study can enhance validity by increasing the observation time and decreasing the recording time.

Using video recording as a means of data collection may have created or suppressed behaviors that usually occur, even in a time where video and camera recordings are used freely. However, no new behaviors were identified during the pilot study, which was done *in vivo*. Additionally, the times selected for video and *in vivo* observations were relatively quieter times, at the convenience of the mother and nurse, which may have impacted validity, as behaviors may emerge during a chaotic time that did not emerge during the quieter times. The nurse-reported control for the mother “behaving as usual when she visited her child” was not the most ideal method of control, but it was the most logical and expeditious one available in that setting, and was suggested by the PCCU nurses themselves. The judgment of the pediatric nursing expert added a reinforcing layer of validity estimation to the study.

Another limitation to consider is that the MCOS: PCCU is designed to capture maternal caretaking behaviors, however it does not account directly for the behaviors of nurses, the child, or others in the environment. Therefore it must be understood that important parts of the PCCU context are not accounted for, unless field notes are kept regarding the environmental context.

Understanding more about maternal behavior relative to child caretaking contributes to nursing knowledge at both the clinical and empirical levels. At the clinical level, knowledge of maternal behavior in PCCU is significant because nurses use behavioral cues when assessing and evaluating child and family health status, and in guiding and evaluating nursing interventions. Further, maternal participation in care is a clinical nursing intervention that has captured nurse interest. At the empirical level, observational investigation of maternal behavior in PCCU is important not only to identify what behaviors are evidenced in the PCCU, but also to establish situational- specific patterns of behavior, and to explore relationships between other variables and behavior.

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