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Interactive Behaviors of American Indian Mothers and Their Premature Infants

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Abstract

The interactive behaviors of 17 American Indian mothers and their premature infants and selected maternal and infant factors affecting those behaviors were measured using naturalistic observation and the Home Observation for Measurement of the Environment (HOME) Inventory at 3, 6, and 12 months corrected infant age. The frequency of some maternal behaviors changed over the first 12 months. Mothers spent less time holding, looking at, touching, and interacting with their premature infants and more time uninvolved as the infant aged. Maternal education and infant illness severity were associated with mother–infant interactive behaviors and HOME Inventory scores. These findings emphasize the importance of maternal and infant factors affecting the interactions between American Indian premature infants and their mothers.

Keywords

maternal–infant interaction; premature infants; parenting; cultural influences; American Indian

Significant racial and ethnic disparities persist in the rate of premature birth, with ethnic minorities experiencing higher rates than whites: 13.5% of births to American Indians are premature versus 10.8% of births to non-Hispanic whites (Hamilton, Martin, & Ventura, 2010; Martin et al., 2012). American Indian women in North Carolina have premature birth rates of 15.1%, which is higher than that of the national American Indian population (National Center for Health Statistics, 2010).

Infants born prematurely experience higher morbidity and mortality than infants delivered at term (Genzel-Boroviczeny, MacWilliams, Von Poblitzki, & Zoppelli, 2006; MacDorman & Matthews, 2008; Teune et al., 2011) and exhibit more cognitive, language, and attention problems than full-term infants (Cserjesi et al., 2012; de Jong, Verhoeven, & van Baar, 2012; Sansavini et al., 2007; van Baar, van Wassenar, Briet, Dekker, & Kok, 2005). Unfavorable

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developmental outcomes are exacerbated by factors within the social environment, particularly by the quality of mother–child interactions (Duncan & Brooks-Gunn, 2000; Forcada-Guex, Pierrehumbert, Borghini, Moessinger, & Muller-Nix, 2006; Jackson, Brooks-Gunn, Huang, & Glassman, 2000; McGroder, 2000; Smith, Landry, & Swank, 2006).

Despite the high rates of premature births to American Indians and the potential for poor developmental outcomes related to prematurity, literature reporting the quality of interactions between American Indian mothers and their premature infants is scarce. Therefore, the purpose of this longitudinal exploratory study was to examine the interactive behaviors of American Indian mothers and their premature infants, to describe how these interactions change over time, and identify selected maternal and infant factors that affect them.

Most studies of interactions between mothers and their premature infants have been focused primarily on mother–infant interactions among Whites and African Americans (Cho, Holditch-Davis, & Belyea, 2004; Holditch-Davis, Bartlett, & Belyea, 2000), but some comparisons of American Indian to African American maternal behavior have been reported. American Indian mothers were found to look more, gesture more, and provide primary care to their infants more often than African American mothers (Brooks, Holditch-Davis, & Landerman, 2013). More positive affect and gesturing were reported for American Indian infants, and more nonnegative vocalization for African American infants. Higher scores on the Home Observation for Measurement of the Environment (HOME) subscales of provision of appropriate play materials and parental involvement with infants were reported for African American mothers, whereas higher scores on the opportunities for variety in daily living subscale were reported for American Indian mothers (Brooks et al., 2013).

Others have examined the interactive behaviors of American Indian mothers and their full-term infants. According to Seideman et al. (1994), American Indian mothers were less verbal than white mothers but provided more social–emotional and cognitive growth-fostering activities for their full-term infants. In contrast, Alaskan Inuit mothers were found to be less involved, to be less emotionally and verbally responsive, and to provide less cognitive growth-fostering, but were more sensitive to their full-term infants' cues and responsive to infant distress than a comparison group comprised of White, African American, and Hispanic mothers (MacDonald-Clark & Harney-Boffman, 1994). American Indian full-term infants provided clearer cues and were more responsive to their mothers than White full-term infants (Seideman et al., 1994). These studies were generally conducted using the HOME Inventory and tools from the Nursing Child Assessment Satellite Training (NCAST). With both measures, mother and infant behaviors are assessed in standardized situations (Caldwell & Bradley, 1980; Seideman et al., 1994). Thus, American Indian mother–infant interactions were not examined in the variety of activities typical of daily life.

Infant caring among Cherokee Indian mothers has been described in more detail (Nichols, 2004). Cherokee mothers described living bicultural lives and feeling compelled to provide personal and health care based on a blend of the differing perspectives of these cultures. Cherokee mothers also felt that living spiritually and passing the Cherokee heritage on to their infants was important. To provide culturally appropriate care, Cherokee mothers

formed a consortium of family members to help them care for their infants. When restructuring infant behavior, they based their disciplinary approach on the developmental age of the infant. Further, Cherokee mothers were unobtrusive and provided autonomy to promote infant learning (Nichols, 2004).

The quality of American Indian mother–infant interactions may be affected by the severity of illness in premature infants (Chapieski & Evankovich, 1997; Holditch-Davis, Cox, Miles, & Belyea, 2003). Some investigators have reported a direct relationship between illness severity and interactive difficulties (Landry, Smith, Miller-Loncar, & Swank, 1997), perhaps because mothers of premature infants with more medical complications were less sensitive to their infants' cues and distress and less nurturing, both socially and emotionally, than mothers of full-term or premature infants with fewer medical complications (Jarvis, Myers, & Creasey, 1989; Muller-Nix et al., 2004). Premature infants with more severe illnesses also have been found to be less responsive than healthier infants to the interactive behaviors of their mothers (Landry, Chapieski, Richardson, Palmer, & Hall, 1990; Landry et al., 1997; Singer et al., 2003; Zarling, Hirsch, & Landry, 1988).

In contrast, other researchers have found that mothers of chronically ill premature infants provided more positive interactions (i.e., more gestures, touching, involvement, playing, and looking) than mothers of nonchronically ill full-term or premature infants (Holditch-Davis et al., 2003; Holditch-Davis, Schwartz, Black, & Scher, 2007). These findings are probably related to mothers' greater efforts to elicit infant responses, which generally are lower with prematurity (Holditch-Davis et al., 2003; McGrath, Sullivan, & Seifer, 1998). These apparently contradictory findings may be due to different infant ages, comparison groups, and definitions of maternal behaviors and illness severity.

The quality of American Indian mother–infant interactions also may be affected by socioeconomic factors. Researchers have linked the effects of poverty and lower maternal education to less positive mother–infant interactions (Jackson et al., 2000; Roopnarine, Fouts, Lamb, & Lewis-Elligan, 2005; Schiffman, Omar, & McKelvey, 2003; Tesh & Holditch-Davis, 1997). Although a large percentage of low-income Canadian Indian mothers provided poor parenting, their overcrowded, substandard housing with poor sanitation and unsafe water supplies were more significant contributors to their poor parenting than were maternal characteristics (Graham-Cumming, 1967). When compared to middle class mothers, mothers living in poverty were less sensitive to their infants' cues, used less verbal and nonverbal communication when interacting with their infants (Schiffman et al., 2003), provided less help to infants who were nonmobile (Roopnarine et al., 2005), and provided less stimulation to their infants (Bradley, Mundfrom, Whiteside, Casey, & Barrett, 1994). These factors are likely to be important for American Indian mothers of premature infants living in poverty, who report lack of access to health care and challenges in establishing consistent visitation in the neonatal intensive care unit (NICU) (Docherty, Lowry, & Miles, 2007).

Among ethnically diverse mothers, lower maternal education has been associated with more use of negative control and less nurturing touch, looking, talking, and stimulation for learning (Feeley, Gottlieb, & Zelkowitz, 2005; Gordon, Chase-Lansdale, & Brooks-Gunn,

2004; Tesh & Holditch-Davis, 1997; Weiss, Wilson, Hertenstein, & Campos, 2000). Thus, the quality of parenting for American Indian mothers is likely to be negatively affected by low education, low-wage jobs, and poor economic conditions.

The above studies provide some description of mother–infant interactions in American Indian groups (MacDonald-Clark & Boffman, 1995; MacDonald-Clark & Harney-Boffman, 1994; Seideman et al., 1994). However, most were cross-sectional and did not include premature infants. Because mother–infant interactions change with infant age (Holditch-Davis et al., 2007), these interactions need to be studied over time. Further, these investigators did not examine contextual factors affecting interactive behaviors. Given the importance of mother–infant interactions for the outcomes of premature infants (Duncan & Brooks-Gunn, 2000; Forcada-Guex et al., 2006; Jackson et al., 2000; McGroder, 2000; Smith et al., 2006), a fundamental understanding of American Indian mothers' interactions with their premature infants is needed.

The purpose of this study was to describe interactive behaviors between American Indian mothers and their premature infants during videotaped interactions at 3, 6, and 12 months corrected age; describe how these interactions changed over 12 months; and explore how interactive behaviors were affected by infant illness severity and maternal education. Bronfenbrenner's (1989) ecological systems framework was used to guide this study. Examining mother–infant interactions from an ecological approach emphasizes the study of their interactions within the physical and social settings in which infants and their mothers are mutually involved (Rogoff, 2003). In this conceptual framework, mother–infant interactions occur within an ecological hierarchy of nested environmental structures in which the child develops, referred to as the microsystem, mesosystem, exosystem, and macrosystem. This study was focused on examining interactive behaviors and environmental factors occurring within the microsystem, including maternal (socioeconomic status) and infant (illness severity) characteristics.

Methods

In this longitudinal exploratory study, the interactive behaviors of American Indian mothers and their premature infants were examined at 3, 6, and 12 months corrected age. The time points were chosen because at 3 months after term (what would have been the 40-week pregnancy due date), the mother and child have made the initial transition to home and are settled in their daily routine. Six months after term is a relatively stable time to assess the mother–infant relationship, as infants are becoming more active and involved in social interactions with their mothers. Twelve months after term is an important time to observe the mother–infant relationship, as the infant's developing motor and language abilities affect the relationship.

Sample

Mother–infant interactions were examined in a sample of 17 American Indian biological mothers and their premature infants (i.e., infants born before 37 weeks gestational age). Mothers who self-identified as Lumbee Indian were eligible for the study. The Lumbee Tribe of North Carolina is the largest American Indian tribe east of the Mississippi River.

Although groups of Lumbee Indians can be found living in cities along the east coast, most reside in rural southeastern North Carolina.

Infants were excluded if they had congenital problems, were symptomatic from substance exposure, were hospitalized longer than 1 month postterm, or were no longer in custody of the biological mother. Infants also were excluded if follow-up for 12 months was unlikely or if the maternal age was less than 15 years. Mothers and their infants were recruited from either a NICU or a pediatric clinic in southeastern North Carolina. The demographic and birth characteristics of the sample are shown in Table 1.

Measures

Naturalistic observation—Infants and their mothers were videotaped for 45 minutes in a home setting at 3, 6, and 12 months corrected age. Home visits were scheduled at a time when the infant was awake and not due for a meal. Mothers were informed that the goal was to videotape mother–infant behaviors in the home as if they were interacting in the absence of the researcher. Videotaping of the infants continued during times when the mother left the room. These videotape recording procedures have been used successfully in earlier studies by Holditch-Davis with African American families and other minorities, including small numbers of American Indians (Cho et al., 2004; Holditch-Davis et al., 2000; Holditch-Davis, Tesh, Burchinal, & Miles, 1999).

Videotape recordings were scored using the Holditch-Davis observational schema designed to measure varying aspects of mother and infant behavior that occur during interaction (Holditch-Davis et al., 2000, 2001, 2007). The scoring system is reliable across coders, with percentages of agreement above 85% and kappa coefficients above .70 (Holditch-Davis et al., 2000, 2007). This scoring system accommodates infant behaviors from birth to 12 months and allows infants with delayed development to be scored as easily as infants with normal development. Definitions of the maternal and infant behaviors are shown in Table 2. These behaviors were chosen because they had been scored for minority mothers in previous studies (Cho et al., 2004; Holditch-Davis et al., 2007), allowing for racial and ethnic comparisons of interactive behaviors. Each 10-second interval of the videotapes was coded for the presence or absence of the identified behaviors. The scored videotape data were entered into a computer program for analysis. Inter-rater reliability was verified every 2 months by having each pair of coders score the same videotapes. Kappa coefficients of inter-coder reliability for these variables ranged from .73 to .91.

HOME inventory—The HOME Inventory (Birth to 3 Years version: Caldwell & Bradley, 1980) was used to examine social–emotional and stimulation characteristics of the mother and the home environment that are known to positively contribute to the developmental outcomes of infants from birth to 3 years of age. The HOME Inventory was completed at each contact (3, 6, and 12 months corrected age). The scale is 45 binary items grouped into six sub-scales to assess specific features of the home environment: (a) emotional and verbal responsivity of the primary caregiver; (b) avoidance of restriction and punishment; (c) organization of the physical and temporal environment; (d) provision of appropriate play materials; (e) parental involvement with the child; and (f) opportunities for variety in daily

stimulation. Subscale and total scores reflect the number of “yes” responses recorded (range 0 to 45 for the total HOME Inventory score). Although no cut-off points have been established, total scores falling in the lowest quartile of the score range (below 32) indicate a possible risk for delayed development (Totsika & Sylva, 2004). Information required to score the HOME Inventory was collected through a combination of observation in the home and information obtained from the mother. Scoring the HOME Inventory generally takes 15 minutes when using the videotaping situation for the observation portion of the tool.

The HOME Inventory has been used as a predictor of development in numerous populations, including American Indians (Bradley et al., 1989; MacDonald-Clark & Boffman, 1995; Tesh & Holditch-Davis, 1997; Williams et al., 2003). Further, previous studies have validated the use of the HOME Inventory with premature infants (Bradley, Mundfrom, et al., 1994). Test–retest reliability for the total scale when administered at 6 and 12 months is .76 to .77, respectively (Caldwell & Bradley, 1980; Holditch-Davis et al., 2000; Tesh & Holditch-Davis, 1997). Inter-observer agreement on the HOME Inventory was as high as 90% in previous studies (Holditch-Davis et al., 2000; Tesh & Holditch-Davis, 1997). Internal consistency in this study was .76 at 3 months, .74 at 6 months, and .77 at 12 months.

Socioeconomic variables—The socioeconomic variable (completed years of maternal education) was collected from demographic information recorded at enrollment and at subsequent contacts (3, 6, and 12 months corrected age).

Infant illness severity—Infant illness severity (Neurobiologic Risk Score; NBRs, Brazy, Goldstein, Oehler, Gustafson, & Thompson, 1993; Thompson et al., 1997) was determined using data collected from the infant’s medical record at enrollment. Data on the occurrence, severity, and duration of seven potential neurological insults (i.e., mechanical ventilation, acidosis, seizures, intraventricular hemorrhage, periventricular leukomalacia, infection, and hypoglycemia) were recorded and scored as 0, 1, 2, or 4. Items were summed to provide a total score ranging from 0 to 28. Higher scores indicate more severe neurological insults. Inter-rater reliability for the NBRs was reported to be 97% and correlations between the NBRs and the Bayley Mental and Psychomotor Index at 6 and 24 months corrected age were reported as .37 and .65, respectively (Brazy et al., 1993).

Procedures

Before data collection, a Lumbee Parent Advisory Committee of three Lumbee parents of premature infants assured the cultural appropriateness of the HOME Inventory and data collection procedures.

The case managers at the hospitals determined infant eligibility weekly. If a mother and her premature infant met all eligibility criteria, the case manager provided the mother with a study brochure and obtained verbal consent for follow-up by the researcher. Whenever possible, enrollment was performed in person during a mother’s visit to the hospital. When enrollment at the hospital was not possible (because of infrequent visitation or limited time before transfer back to a less-acute care hospital), the researcher arranged a home visit, with the mother’s agreement.

At the pediatric clinics, the healthcare provider identified eligible participants at the time of the infant's visit. Following the visit, the healthcare provider mailed a letter and study brochure to the mothers to obtain verbal consent for follow-up by the researcher. Enrollment was performed in person during a home visit or during a scheduled visit to the clinic.

When enrolled, mothers signed a consent form approved by the Institutional Review Board of each participating institution. Data were collected on each study participant by the researcher at enrollment and during home visits (at 3, 6, and 12 months corrected age). The home visits were made at times most convenient for the mothers. Mothers were compensated (\$10) at enrollment and at each home visit. Infants were given a small gift worth about \$10 at each home visit. At the end of the study, the mothers were given a copy of the three videotaped interaction sessions.

Analyses

The SAS statistical analysis software (Version 9.2) was used to analyze data using correlations and general linear mixed models (henceforth referred to as mixed models). Statistical models referred to as mixed models (Verbeke & Molenberghs, 1997) or multilevel models (Goldstein, 1995) were used to examine the relationship of maternal and infant interactions (naturalistic observation and HOME Inventory) to infant illness severity and socioeconomic status longitudinally. Unlike the standard repeated measures analysis of variance, mixed models allow for error structures other than compound symmetry and mistime measurements, and make better use of available information when missing data are present (Verbeke & Molenberghs, 1997). In addition, by weighting for differential reliability, mixed models provide more precise estimates of the individual growth trajectories (Singer & Willett, 2003). The mixed model allows for individual repeated measures on the observed behaviors and HOME Inventory to be parameterized as an individual growth trajectory plus an error term.

The age of the infant in weeks beyond term (40 weeks postmenstrual age) was used in analyses to control for differences in infant age at each contact. The random effects component was comprised of the mother–infant dyad-specific intercepts across age. Covariates for behavioral and HOME outcomes included infant illness severity (NBRS) and socioeconomic status (maternal education).

Results

Influences on Mother–Infant Interactive Behaviors

The results of the mixed models analyses for the mother and premature infant behaviors are presented in Table 3. Five maternal behaviors (mother hold, mother look, mother touch, interaction, and uninvolved) were affected by infant age. Over time, mothers spent less time holding, looking at, touching, and interacting with their premature infants and spent more time uninvolved with their premature infants.

Infant illness severity (NBRS) and maternal education affected some mother–infant interactions. Mothers spent more time touching infants with higher illness severity than those with lower illness severity. Premature infants with higher illness severity spent more

time vocalizing to their mothers than premature infants with lower illness severity. Mothers with more education spent more time talking to their infants than mothers with less education. Premature infants of mothers with more education spent more time vocalizing to their mothers than premature infants of mothers with lower education.

Influences on HOME Inventory

The results of the mixed model analyses for the HOME Inventory are shown in Table 4. Although the means of several of the HOME variables appeared to increase over time as infants aged, there were no significant changes in either the subscales or total scores. However, the covariates did affect the HOME Inventory. Mothers of premature infants with higher illness severity provided fewer opportunities for variety in daily stimulation than did mothers of infants with lower illness severity. Mothers with more years of education scored higher on the subscales of provision of play materials, maternal involvement, and opportunities for variety in daily stimulation than did mothers with lower education.

Discussion

To the best of our knowledge, we are the first to describe the interactive behaviors of American Indian mothers and their premature infants. In addition to a change in maternal behaviors over time, maternal and infant characteristics were associated with both the interactive behaviors and HOME Inventory scores over the first year.

Consistent with studies of healthy full-term infants and medically fragile infants, mothers in our study spent less time holding, looking, touching, involved, and interacting with their premature infants with increasing infant age (Bornstein & Tamis-LeMonda, 1990; Holditch-Davis et al., 1999; Minde, Perrotta, & Marton, 1985). These findings are probably due to mothers' responses to changes in the infant's social skills with increasing infant age. Similar to mothers of full-term infants, mothers of premature infants may be more likely to be involved in distal interactions (e.g., talking and gesturing) than proximal interactions (e.g., holding and touching) over time due to the infant's increasing alertness and vocalization (Belsky, Gilstrap, & Rovine, 1984; Bornstein & Tamis-LeMonda, 1990; Minde et al., 1985).

Despite changes in maternal behaviors over time, none of the infant behaviors or scores on the HOME Inventory changed significantly over the first 12 months of corrected age. This may be a result of low power due to our small sample size, a reflection of the relatively small number of premature infants born in the small population of Lumbee mothers in each year. While insufficient power may have affected our ability to detect significant change, approximately 33% of the tests had *p*-values of less than .10, which indicates that increasing the power would not have had a major effect on the results.

Based on our findings, there is a need for additional research on the effects of infant and maternal characteristics, such as illness severity and maternal education, on the interactions between American Indian mothers and their premature infants over time. Infant illness severity was related to the interactive behaviors of Lumbee mothers and their premature infants. We found that the mothers of infants with high illness severity spent more time touching their infants, and infants with higher illness severity spent more time vocalizing to

their mothers. Although some investigators have reported less positive interactions between mothers and infants with more medical complications (Jarvis et al., 1989), our findings are consistent with others that mothers of chronically ill premature infants provided more positive interactions (i.e., more gestures, touching, involvement, playing, and looking) than mothers of nonchronically ill full-term infants, possibly in an effort to engage infants who are immature and typically lack responsiveness (Holditch-Davis et al., 2003, 2007).

Despite their positive interactions with sicker infants, Lumbee mothers provided fewer opportunities for variety in daily stimulation to infants with higher illness severity than to those with lower illness severity. It is possible that mothers with sicker infants felt more compelled to limit public outings and incorporate fewer social meetings with others to reduce their infants' potential exposure to infections. Others have reported that mothers provided less organization of the environment to premature infants with higher illness severity than to those with lower illness severity (Cho et al., 2004). Based on these findings, infant illness severity may exert both positive and negative effects on the quality of interactions between American Indian mothers and their premature infants. Thus, there is a need to support mothers' positive interactions with their high-risk premature infants and to seek more evidence on how to help mothers create social opportunities while protecting their infants' health.

Socioeconomic status also was associated with interactive behaviors between Lumbee mothers and their premature infants. The finding that Lumbee mothers with more education spent more time than mothers with less education talking to their infants is similar to prior reports that mothers with higher socioeconomic status had more episodes and higher durations of talk with their 3-year-old premature infants than mothers with lower socioeconomic status (Cho, Holditch-Davis, & Belyea, 2007). Other investigators also have reported that among ethnically diverse mothers, lower maternal education was associated with less talking and stimulation for learning (Feeley et al., 2005; Gordon et al., 2004; Weiss et al., 2000). Further, mothers with lower socioeconomic status have been found to use a more limited vocabulary and shorter utterances than mothers with higher socioeconomic status in talking to their children (Hoff & Tian, 2005). These findings suggest that regardless of ethnicity, lower maternal education may influence talking and stimulation behaviors of the mother and thus compromise language development.

Premature infants of American Indian mothers with more education spent more time vocalizing and less time touching their mothers than infants of mothers with lower education. The increased vocalizing behavior of these infants may be due in part to the mother's increased talking to their infants. These findings add to evidence that higher maternal education is linked to more positive mother-infant interactions (Jackson et al., 2000; Roopnarine et al., 2005; Schiffman et al., 2003).

Our findings that less-educated mothers scored lower than mothers with higher education on the HOME subscales of provision of opportunities for variety in daily stimulation are consistent with others (Cho et al., 2004). Other researchers have reported similar findings for mothers living in poverty (Bradley, Corwyn, McAdoo, & Garcia Coll, 2001; Watson, Kirby, Kelleher, & Bradley, 1996). These findings suggest that some aspects of the physical (i.e.,

stimulating environment with appropriate play materials) and social environments (i.e., mother–infant interaction) of premature infants may be negatively affected in American Indian mothers with lower maternal education levels, like mothers of other ethnicities with low socioeconomic status, because of the related effects of poverty. In a disenfranchised group with one of the highest poverty rates in the country, Lumbee premature infants are at higher risk of suboptimal developmental outcomes. Research is needed on the relationship between interactive behaviors and developmental outcomes of premature American Indian infants.

Overall, Lumbee mothers' mean total scores on the HOME Inventory approached the lowest quarter of the score range (below 32), indicating added risk from the social–emotional and stimulation characteristics of the mother and home environment. Although this cut-off point is arbitrary and data are outdated, in other studies, scores on the HOME Inventory were lower for American Indian families than for white families (Bradley, Mundfrom, et al., 1994; Bradley et al., 1994; Seideman et al., 1994) and indicate aspects of the home environments of these premature infants that may negatively affect their development (Caldwell & Bradley, 1980; Totsika & Sylva, 2004). However, because HOME scores have received little study in American Indian groups, other aspects of the American Indian culture might compensate for the scores, such as the involvement of extended family in caring for premature infants (Nichols, 2004).

The generalizability of this study may be limited by several factors. First, although the interactions of 17 Lumbee mothers and their premature infants were examined at three time points, the small sample size may have resulted in inadequate power to detect changes in mother and infant behaviors over time. While the longitudinal design was a strength, larger and more heterogeneous samples of American Indian mothers and their premature infants belonging to different tribes followed over a longer period of time will enhance generalizability. Second, there is a potential for bias in the videotaping data collection method. Mothers' behaviors may be influenced by their awareness of the videotaping procedures. However, videotaping over an extended, yet reasonable, period of time (45 minutes) minimizes the chances of atypical behavior due to the presence of the researcher. Third, the HOME Inventory is based on American middle class cultural values and may not be suitable for adequate measurement of home environments of populations with varying cultural backgrounds (Gaffney, Kodadek, Meuse, & Jones, 2001). Studying American Indian mother–infant interactions using an ethnographic approach would reveal a richer description of behaviors. Last, the sample included in this study was medically and economically homogenous. Recruitment of premature infants with a larger range of gestational ages and more complicated medical conditions might result in different findings.

These findings can inform clinicians' awareness of contextual factors affecting the quality of interactions between American Indian mothers and their premature infants. During the infant's hospitalization, health professionals can gather data related to the medical course of the infant and the mother's socioeconomic situation to determine resources to offer to mothers and their infants following discharge to improve the quality of mother–infant interactions or aspects of the home environment. Mothers, particularly those with low education, should be provided with information on ways they can provide a stimulating

environment to their infants and the importance of being physically and emotionally involved with their infants. These small but important changes in maternal behavior and the home environment may reduce the risk for the poor developmental outcomes associated with prematurity and lower maternal education and lead ultimately to improvements in the developmental outcomes for premature American Indian infants (Shah, Muzik, & Rosenblum, 2011).

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Table 1

Demographic Characteristics of the 17 American Indian Premature Infants and Their Mothers

	<i>M</i>	<i>SD</i>	Frequency	Percent
Gender				
Boys			12	70.6
Girls			5	29.4
Birthweight (g)	1766.3	693.4		
Gestational age (weeks)	32.0	3.8		
Mechanical ventilation (days)	7.0	15.2		
NBRBS ^a	1.8	3.0		
Intraventricular hemorrhage				
Yes			2	11.8
No			15	88.2
Maternal age (years)	26.4	7.6		
Maternal education (years)	13.4	2.6		
Number of previous births	2.2	1.6		
Public assistance ^b				
Yes			13	76.5
No			4	23.5

^aNeurobiologic Risk Score (Brazy, Goldstein, Oehler, Gustafson, & Thompson, 1993).^bReceived public assistance during the study period.

Table 2

Definitions of Mother and Infant Behaviors Used to Code the Videotapes of Mother–Infant Interactions

Mother Behaviors	Infant Behaviors	Definitions
Hold		Holds or carries the infant
Not caregiver		Someone other than the mother is the major caregiver for the infant
Look	Look	Looks at the mother or infant
Vis-à-vis with mother		Mother and infant have eye-to-eye contact
Talk		Speaks words to infant
Positive	Positive	Directs positive affect to mother or infant (smile, praise, or affectionate touching)
Gesture	Gesture	Gestures or makes a facial expression, such as smiling or showing a toy
Touch	Touch	Touches the mother or infant, such as pats or caresses
Play with infant		Initiates or takes part in infant's play activity or games
Interaction		Interacts or plays with the infant (hold, talk, teach, smile, touch)
Passive observation		Looks at the infant but does not interact
Uninvolved		Does not interact with or look at the infant
	Vocalize	The infant makes one or more sounds, not words
	Negative	Expresses negative affect to the mother, such as crying or frowning
	Object play	The infant plays with objects (toys, stuffed animal, etc.)

Table 3

Influence of Infant Age, Illness Severity, and Maternal Education on Mother–Infant Interactive Behaviors in Mixed Model Analyses ($n = 17$ pairs)

	Corrected Age						Parameter Estimate (SE)			
	3 Months		6 Months		12 Months		Intercept	Corrected Age	NBRSA	Maternal Education
	M	SD	M	SD	M	SD				
Mother hold	51.8	28.1	22.2	19.4	16.3	17.4	59.71 (20.67)**	−0.44 (0.20)**	0.73 (1.24)	−1.90 (1.46)
Mother not caregiver	2.6	8.5	2.4	8.2	5.9	8.5	10.49 (6.76)	−0.02 (0.06)	−0.29 (0.40)	−0.45 (0.48)
Mother look	70.3	22.6	65.8	20.5	61.8	23.0	50.34 (19.02)**	−0.55 (0.13)***	2.07 (1.17)*	1.33 (1.36)
Vis-à-vis with mother	17.3	7.3	16.9	10.8	20.9	15.5	3.74 (11.03)	−0.04 (0.08)	0.59 (0.68)	1.03 (0.79)
Mother talk	42.3	24.6	40.2	26.9	46.9	26.6	−21.29 (26.70)	−0.08 (0.10)	2.27 (1.67)	4.50 (1.93)**
Mother positive	15.7	11.4	13.8	8.4	9.9	7.8	−1.88 (9.55)	−0.09 (0.06)	0.29 (0.59)	1.14 (0.69)
Mother gesture	27.3	17.5	35.1	17.0	33.3	19.8	9.37 (19.58)	−0.15 (0.10)	0.31 (1.22)	1.70 (1.41)
Mother touch	36.5	17.1	26.2	15.8	17.9	12.1	26.52 (12.31)**	−0.27 (0.12)**	1.73 (0.74)**	−0.04 (0.87)
Play with infant	20.6	12.5	24.0	13.8	20.4	12.5	10.60 (13.90)	−0.14 (0.07)*	0.33 (0.86)	0.86 (1.00)
Interaction	85.4	23.1	68.4	18.3	65.4	25.1	63.29 (16.38)***	−0.59 (0.16)***	1.41 (0.98)	1.04 (1.16)
Passive observation	3.1	3.9	9.1	7.4	8.3	8.9	11.01 (5.96)*	−0.04 (0.06)	−0.09 (0.36)	−0.27 (0.42)
Uninvolved	11.5	22.6	22.5	16.6	26.3	23.5	25.69 (14.21)*	0.63 (0.14)***	−1.32 (0.85)	−0.76 (1.00)
Infant look	21.4	9.5	21.8	10.9	27.1	16.2	4.28 (11.72)	−0.05 (0.09)	0.27 (0.72)	1.41 (0.84)
Infant vocalize	28.2	7.7	24.9	12.6	30.4	8.9	2.23 (6.96)	0.13 (0.07)*	0.91 (0.42)**	1.68 (0.49)***
Infant positive	5.1	4.4	7.5	4.1	8.6	6.7	5.55 (4.28)	0.05 (0.04)	−0.13 (0.26)	0.09 (0.30)
Infant negative	13.2	6.6	6.0	6.0	9.2	6.5	1.13 (5.48)	−0.00 (0.05)	−0.17 (0.33)	0.65 (0.39)
Infant gesture	19.4	7.2	18.4	6.2	24.2	10.6	14.00 (7.17)*	0.03 (0.06)	−0.40 (0.43)	0.52 (0.51)
Infant touch	23.6	12.8	17.0	12.7	20.0	13.6	25.19 (9.54)**	−0.15 (0.09)*	1.65 (0.57)	−0.45 (0.68)
Infant play with object	7.4	7.6	34.0	11.4	38.0	18.0	34.67 (15.24)**	−0.07 (0.14)	−0.25 (0.91)	−0.54 (1.08)

Note. All variables are measured as a percentage of the total observation with maternal contact (minus periods of questionable technique). Exceptions include Plays with Objects, which is measured as a percentage of the portion of the observation available for independent play and Negative Vocalization, which is measured as a percentage of the total time the mother and child are together.

^aNeurobiologic Risk Score (Brazyl, Goldstein, Oehler, Gustafson, & Thompson, 1993).

* $p < .10$.

$p < .05$
**
 $p < .10$
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Table 4
Influence of Infant Age, Illness Severity, and Maternal Education on HOME Inventory Scores in Mixed Models Analysis ($n = 17$ pairs)

	Corrected Age						Parameter Estimate (SE)			
	3 Months		6 Months		12 Months		Intercept (SE)	Corrected Age	NBRSA	Maternal Education
	M	SD	M	SD	M	SD				
Maternal responsiveness	8.5	2.1	9.4	1.5	9.7	1.3	5.85 (2.06)**	-0.01 (0.01)	-0.05 (0.13)	0.25 (0.15)*
Acceptance of infant	6.2	0.6	6.1	1.0	5.1	1.6	7.23 (1.00)***	0.00 (0.01)	-0.03 (0.06)	-0.10 (0.07)
Organization of the environment	4.9	1.1	5.4	1.0	5.8	0.4	5.38 (0.81)***	0.00 (0.01)	-0.03 (0.05)	0.00 (0.06)
Provision of play materials	3.2	1.7	5.5	1.6	5.8	1.6	1.46 (1.75)	-0.02 (0.01)	0.01 (0.11)	0.26 (0.13)**
Maternal involvement	4.3	1.8	4.3	1.5	3.8	1.6	0.63 (1.67)	-0.01 (0.01)*	-0.09 (0.10)	0.28 (0.12)**
Variety in daily stimulation	3.1	1.1	3.8	0.8	3.8	1.2	2.11 (0.83)**	-0.01 (0.01)	-0.14 (0.05)***	0.13 (0.06)**
Total score	30.2	5.7	34.5	4.5	33.9	5.6	22.73 (5.74)***	-0.05 (0.03)*	-0.33 (0.36)	0.82 (0.41)*

^aNeurobiologic Risk Score (Brazyl, Goldstein, Oehler, Gustafson, & Thompson, 1993).

* $p < .10$.

** $p < .05$.

*** $p < .01$.