

# *Integrating Qualitative and Quantitative Methods to Model Infant Feeding Behavior among Navajo Mothers*

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Anthropologists have long discussed the value and limitations of various methods of describing and understanding behavior. This article demonstrates that utilizing both quantitative and qualitative methods can improve our understanding of complex behaviors. Ethnographic interviews were used to create a decision tree model of the choice of breastfeeding or formula feeding for Navajo women. This preliminary model was tested with reference to the initial feeding decisions of 250 post-partum women. Errors in the model and statistical analysis of correlates of feeding behavior were used to improve the decision model, which was subsequently tested on a new sample of 52 mothers. The final model accurately predicted the initial infant feeding behavior of 96% of women in the new sample. This combination of techniques proved useful in developing a breastfeeding promotion program which targeted specific groups for education and addressed local concerns and perceptions.

**Key words:** decision models, infant feeding, methods, Native Americans; US

For decades, anthropologists have discussed the value and limitations of qualitative and quantitative methods of describing and understanding behavior. The "new ethnography" of the early 1960s was an attempt to make anthropological approaches more "scientific" by developing explicit, formal models which would permit verification. This approach was, in turn, criticized as being "trivial" and emphasizing coherence at the expense of diversity and change. Other approaches have stressed quantification and statistical analysis to assist in objectifying anthropological research, thereby giving readers

a sense of how many behaviors were observed and whether the pattern described applied to all or only a portion of subjects. However, unlike ethnoscientific methods, approaching behavior with a predetermined set of categories does not permit the observer to get at the meaning of behavior and the "definitions, beliefs, values and ideology of actors" (Pelto 1970:82-83).

One qualitative technique anthropologists often use to study the meaning behind actions is decision modeling. Early "normative" approaches, developed to explore agricultural decision making, posited complex mathematical models to predict the "best choice" that a rational, fully informed individual would make in a given circumstance (Cohen 1967). Anthropologists criticized these approaches because the models assume that people rationally assess their options and seek to maximize their situation; moreover, the models rarely predict actual choices people make in natural settings.

Anthropological decision analyses have focused instead on the development of formal models which predict the choices people will make under real world conditions. By proposing a formal model which can be tested, explicit hypotheses are formulated regarding the criteria used to make decisions in particular circumstances, as well as the sequence in which criteria become relevant for groups of individuals. Formal decision modeling allows the researcher to "specify the interrelationships between factors, the relative importance of each factor, and the conditions under which some factors assume precedence. Thus [the researcher moves] beyond partial and surface accounts of variability to the complex sets of interactions from which it arises" (Mukhopadhyay 1984:241). Decision modeling has been used to study economic decision making, specifically fertilizing decisions (Gladwin 1976), where to

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market fish (Quinn 1978), and farmers' cropping decisions (Bartlett 1977). More recently anthropologists have applied these methods to study medical decision making (Mathews 1982), including treatment choice in Mexico (Young 1981) and use of health care services in Costa Rica (Mathews and Hill 1990).

After an initial burst of enthusiasm for such models, it became apparent that this technique for studying decision making also had limitations. First, early works varied in the extent to which the proposed model was tested against real decisions and behaviors, even though there is often little relationship between the decisions people say they would make and what they subsequently do. While Quinn stated (1978:222) that "actual decision outcomes provide crucial verification of a model based on verbal reports," many works contained limited discussion of how well the model predicted behavior. More recent work (Young 1981; Mukhopadhyay 1984) has explicitly addressed this issue. Second, like many other anthropological approaches of the previous decade, decision making analyses stress coherence at the expense of intracultural variability. Young, for example, assumes (1981:5) that having a common culture provides members with "shared standards or rules for solving problems and selecting particular courses of action," an assumption undermined by recent works which stress differential access to cultural knowledge (Wright *et al.* 1993a; Browner 1991; Van der Geest 1991). In addition, these models cannot readily accommodate change without repeating the elaborate process required to elicit decision making rules and to test the resultant model against observed behavior. Developing methods to incorporate variability into decision models would provide an important advance. Finally, some have questioned (Chibnik 1980:109) whether "clear cut, consistently followed rules" exist for many of the choices people make. Clearly, people are often unable to articulate macrolevel factors that subliminally influence behavior, such as marketing practices or health care delivery.

Chibnik (1980) has proposed that accounting for choices can be done more simply by constructing a statistical profile, which identifies factors significantly associated with behavior. He uses this approach to explain the choices Belizian farmers in two villages make about cash cropping and wage labor. While this strategy identifies differences in behavior between groups of individuals who differ in specified dimensions (e.g., are older or have larger households), it "serves to decontextualize a process that is intimately related to the natural and cultural environment" (Stoner 1985) in which decisions are made. Further, it does not reveal how people think about the decisions at hand. Similar outcomes may be generated by different sets of conditions, while different outcomes may arise from a similar set of conditions (Mukhopadhyay 1984). Knowledge of cognitive processes is essential if the ultimate goal is to facilitate change in behavior since it is extremely difficult if not impossible to change such demographic characteristics as education or age.

### *Infant Feeding Practices*

Studies of infant feeding practices have identified a variety of factors which are related to the prevalence and duration of breastfeeding in particular populations. In the United States,

breastfeeding is most common among well-educated, middle-class, non-minority women who do not work outside the home (Wright *et al.* 1989, Ryan and Martinez 1989). While statistical analyses find associations between factors such as maternal employment or household income and feeding behaviors, they shed little light on the reasons behind the choices made by individual women. Further, studies of factors related to feeding practices do not permit us to distinguish between mothers who want to breastfeed and cannot, as compared to those who do not want to breastfeed and do not. Such women differ not only in their demographic characteristics but "also in their heads — the ideas, beliefs, and assumptions about infant feeding that make up the cognitive and affective dimensions of human behavior" (Van Esterik 1988:89).

The multitude of factors which influence how a woman decides to feed her baby could be articulated with decision models tested against subsequent feeding behaviors. In contrast to the types of decisions usually modeled, deciding whether to initiate breastfeeding is a low frequency decision with wide-ranging implications regarding how the mother will spend her time (possibly including whether she will work outside the home), how the household will spend its money (whether it can afford formula), and whether it will be possible for other caretakers to feed the child. Like other low-frequency decisions, the initial infant feeding choice should be more conscious than such common decisions as what clothing to wear, or how to organize the day's activities (Fjellman 1976). Further, some of the limitations of decision modeling could be overcome if the analysis was informed by ethnographic study of the larger social context, thereby permitting assessment of such potential unconscious influences on feeding behavior as hospital practices. Finally, since statistical analyses have revealed that the factors relevant to a woman in one set of circumstances may differ from those which inform the feeding choices of another woman (Wright *et al.* 1993b), expanding the model to include statistical relationships would permit the modeling of variability in feeding decisions. Decision modeling is quantitative in that it involves recording the number of responses and calculating proportions and percentages to test the model. However, integrating additional statistical analyses into the analysis of feeding choices could shed light on the relationships between individual characteristics, attitudes, beliefs and resulting behaviors. This combination of methods would make it possible to design effective interventions which actually address the barriers, both cognitive and situational, to breastfeeding in a particular population.

### *Overview of the Research Process*

While Gladwin (1989) has described methodologies used in developing and testing decision models, few publications have reported in detail the process whereby ethnographic interviews, survey interviews and statistical analyses can be integrated with decision modeling to predict behavior. This article reports on the process used to develop and test a model to predict the initial infant feeding decision, whether or not to breastfeed, of postpartum Navajo women. After constructing a preliminary decision model from ethnographic interviews (n = 35), survey interviews (n = 250) were conducted to test the preliminary model as well as to collect information relevant to

the testing of other hypotheses. Since it was clear from correlational studies in other populations that different criteria would be appropriate for different groups of women, we incorporated into a revised model demographic factors statistically associated in this population with the initial decision of whether to breastfeed. In addition, we used the errors we made in predicting behavior with the preliminary model to tell us more about the criteria actually used in making feeding decisions (cf. Mathews and Hill 1990). Finally, we tested the revised decision model with a new sample (n = 52). Thus, the process entailed the integration of both quantitative and qualitative methods as a means of understanding the initial infant feeding decision of Navajo women.

### *Phase I: Ethnographic Interviews and Development of Preliminary Decision Model*

Ethnographic interviews were conducted with thirty-five Navajo women and men between November 1988 and March 1989. The ethnographic interviews were conducted with a range of respondents, including older and more traditional women and men, as well as women of child-bearing age. The older respondents were frequently chosen based upon their reputations in the community as knowledgeable sources on traditional Navajo culture; some were approached more randomly, as they happened to be home when the interviewers drove by. The younger respondents were often acquaintances of the interviewers, associated with Navajo Community College, or approached randomly at clinics or flea markets. Twelve of the interviews were conducted in Navajo. Younger respondents usually spoke English in the interview, but expressed many ideas in Navajo. The interviews were conducted by four Navajo researchers fluent in the Navajo language, although the authors participated in a number of the interviews in both English and Navajo. All members of the interviewing staff had extensive experience with this type of interviewing, and three were able to act as knowledgeable consultants about Navajo life and thought.

The interviews were open-ended and wide-ranging in an attempt to explore how a variety of infant feeding practices are related to daily life, to family and kinship, to interactions with the health and human service institutions, and to change in the cultural determinants of these behaviors over time. Interviewers began with a general description of the research problem and avoided questions that would overly structure the response (cf. Schoepfle *et al.* 1984). In that way, subsequent questions could be generated from specific terms and situations that arose naturally from the respondent's own descriptive text. For example, many respondents noted that starting work or planning to go to work were obstacles to breastfeeding, which led to questions regarding the conditions under which working would be compatible with nursing. In some cases, the description was not very extensive and supplementary questions were asked based upon material from previous interviews. However, many interviews were quite detailed and comprehensive.

No attempt was made to interview any representative group in the ethnographic interview stage. Rather, we sought respondents who were articulate and knowledgeable about breastfeeding, including how social, economic, and cultural factors affect the decisions of mothers today. Respondents

ranged in age from late teens to mid-70s, and pursued a range of economic activities from shepherding to secretarial employment.

The interviews were tape recorded and transcribed in order to use each respondent's own words in the analysis; Navajo interviews were translated into English, with both versions appearing on the same page. Key words or phrases in the texts were identified that referred to important concepts, actions, and objects. For example, breastfeeding fit into a large corpus of belief regarding the traditional way of raising children (see Wright *et al.* 1993a), which in turn is a part of proper thinking, "yá'át'éehgo ntsáhákees," and proper behavior, "yá'át'éehgo na'adá." Careful literal translation of Navajo terms and the sentences in which they were embedded was used to develop folk definitions of important terms.

Analysis began with a modified debriefing procedure, in which the interviewers presented the interviews they had conducted to the assembled staff, including the consultants and investigators. These discussions provided an opportunity to explore in both languages relationships between important terms through the analysis of other structures implicit in the text, notably taxonomy and causality, and to confirm and synthesize the semantic structures emerging from the body of interviews. Although these formal structures are not noticeably apparent in the decision models, like the key words and important concepts, they informed discussion regarding the models.

The group then constructed the preliminary model (Figure 1) of the initial feeding decision, whether or not to breastfeed, based on the content of the interviews as well as the semantic structures which had emerged from previous analyses. Criteria that respondents themselves identified as influencing their decision-making processes, as well as those thought by either respondents or staff to have influenced other women, were formulated into decision nodes (enclosed in the shaded areas in the Figure). Two behavioral outcomes, starting breastfeeding and not starting breastfeeding (formula feeding only), were modeled; these are shown in Figure 1 in boxes. After much discussion, decision nodes were placed in an ordered sequence based on temporal relationships, logic, and generality. For example, a woman who perceives herself as unable to breastfeed will not consider whether work will interfere with nursing or whether breastfeeding is good for the mother.

The criteria that emerged ranged from conscious considerations commonly included in decision models ("Will breastfeeding interfere with my job? Can I afford to quit?") to background qualities of the respondent such as self-identified degree of traditionality. The preliminary model predicted that women who consider themselves traditional would breastfeed under all circumstances, except in the rare event that they knew they were not physically able to nurse. Traditionality was hypothesized as prescribing breastfeeding because, according to traditional belief, breastmilk was provided by the Holy People as the way for Navajo women to feed their infants, and breastfeeding models proper behavior which leads to a good life (Wright *et al.* 1993a). For other women, a whole series of conditions needed to be met if they were to breastfeed, including the belief that breastfeeding was best, that they wanted to breastfeed, and that nursing would not interfere with their job or school. If one of these conditions was not met, the model specified that the woman might still breastfeed if family or health care providers persuaded her to do so.

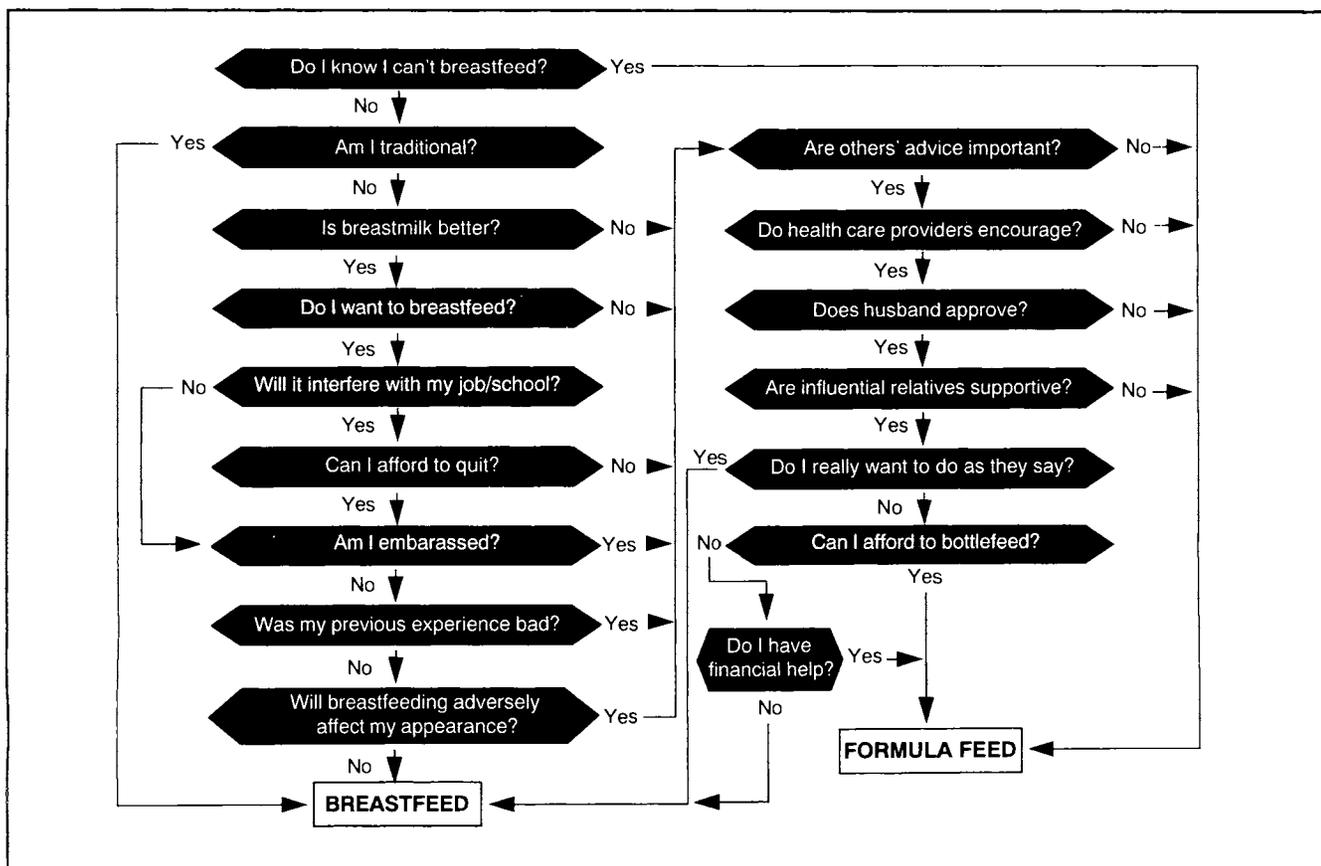


Figure 1. Preliminary Model of Initial Infant Feeding Decision of Navajo Mothers

### Phase II: Survey I

The next phase of the research entailed the development of a structured, open-ended questionnaire. The questionnaire included factors from the literature that are related to infant feeding behaviors in other populations (such as age and education), items identified from the ethnographic interviews as influencing feeding practices specifically among the Navajo (such as the belief that breastfeeding results in weight gain for the mother), and criteria which appeared in the decision model. The criteria were phrased as questions which incorporated the key words and concepts identified previously. Certain decision criteria were not explicitly written as questions because they seemed difficult to articulate ("Do I really want to do as [relatives] say?"). These items were largely covered with such open-ended questions as "Why did you decide not to breastfeed?" Although they did not address every criterion, answers to these open-ended questions frequently assisted with the development of the revised decision model.

We did not follow the usual practice of asking the decision criteria in the order diagrammed in the model (Gladwin 1989) because we wished to collect substantial additional information which would permit us to explore whether specific groups of women, such as young women or those with more education, used different criteria to decide how to feed their baby. Consequently, the structure of the questionnaire followed a logical interviewing sequence moving from more general

background questions to more specific items concerning feeding beliefs. Thus, after collecting demographic information, we asked each respondent how she fed her previous children, about the delivery and feeding of her current child, the factors and/or individuals which had influenced her choices regarding feeding methods, characteristics of her employment, reasons for changing feeding behaviors, and general attitudes about breast and formula feeding. The questions were generally asked in English, but appropriate Navajo translations were listed on the survey form to standardize question phrasing in Navajo.

Interviews were conducted with 250 Navajo women of childbearing age (Survey I) to identify determinants of infant feeding behavior as well as the appropriateness of the preliminary decision model. Two of the researchers involved in both the ethnographic interviews and the construction of the decision model conducted the interviews, which lasted one half to one hour. As in the ethnographic interviews, the survey was conducted in three communities which reflect the diversity in lifestyles on the reservation as well as variation in breastfeeding rates, including a rural community, an economically developed area of the reservation, and a town on the southeastern edge of the reservation. Respondents were approached while they waited for post-partum appointments at the U.S. Department of Agriculture Supplemental Food Program for Women, Infants and Children (W.I.C.) or at Indian Health Service (I.H.S.) clinics. Other interviews occurred in flea markets, at the campus of Navajo Community College, and in respondents' homes. The

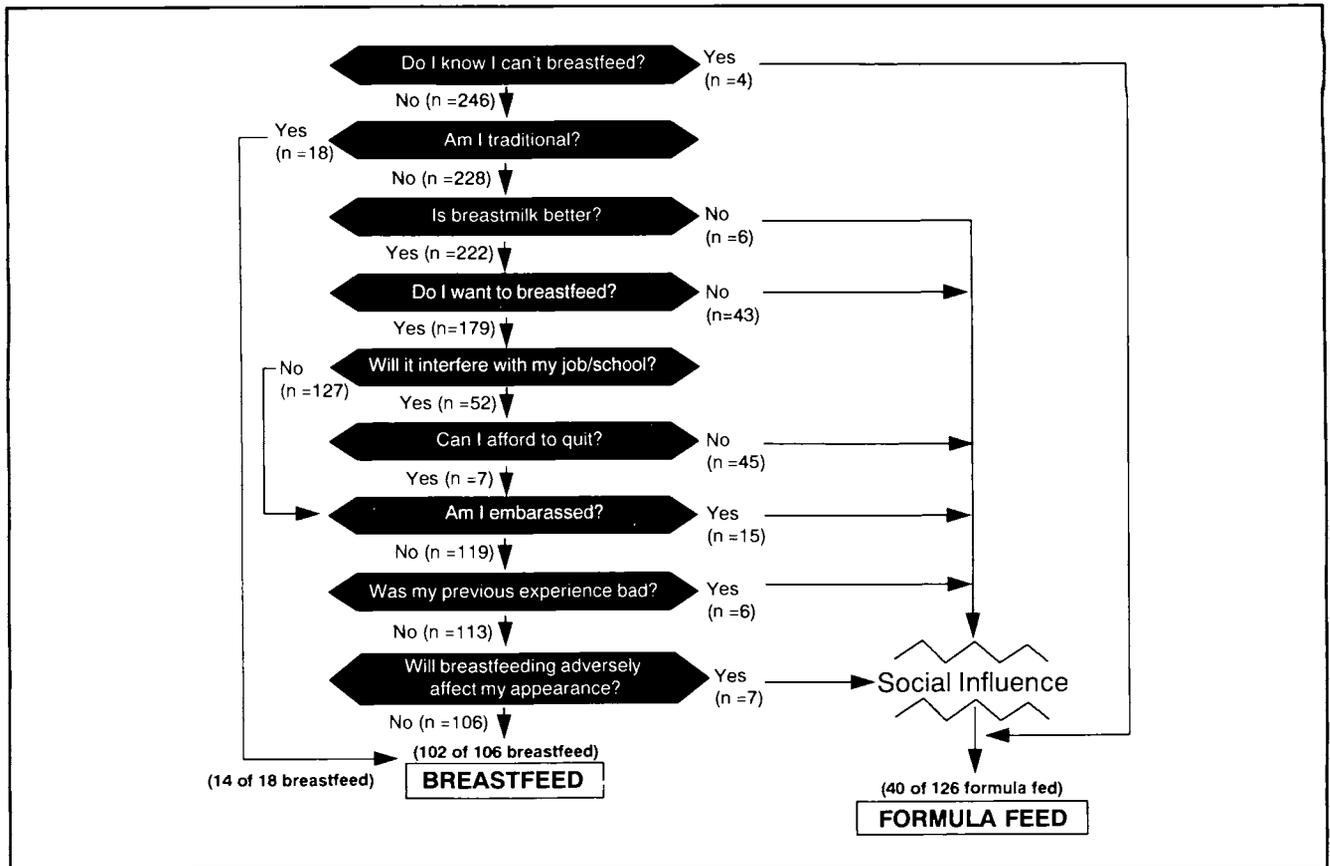


Figure 2. Comparison of Actual Feeding Behaviors of Navajo Women with Behavior Predicted in Preliminary Decision Model

sampling scheme was one of convenience. However, the sample interviewed was similar in age, parity, and prenatal care to a random sample of Navajo women in those communities who had given birth in 1986, suggesting that they are roughly representative of childbearing women.<sup>1</sup>

On average, women in the survey were 26 years old (range 14-42), had completed high school, and had 2.6 children. Slightly more than half (53%) were married. Most (66%) described themselves as being both modern and traditional, while 26% considered themselves modern, and 8% traditional. Sixty percent were neither working outside the home nor going to school. Eighty-one percent of the women reported initiating breastfeeding, of whom 48% also began using formula in the first week. The mean duration of nursing was 5.3 months among infants who were at least six months old at the time of the interview (Wright *et al.* 1993b). Thus, combination breast and bottle feeding was the norm during the first few months of life.

### Phase III: Testing and Revision of the Preliminary Decision Model Using Survey I Data

The preliminary decision model was tested by comparing the actual behavior of women (based on self report) who followed particular branches in the decision tree with what this model predicted they would do. For example, the number of

women who breastfed among women who did not consider themselves traditional, who thought breastmilk was best, who wanted to breastfeed, who did not anticipate problems with work, who were not embarrassed, who did not have bad previous breastfeeding experience, and who did not expect to have their appearance adversely affected by breastfeeding, was compared with the total number of women who met these criteria. Results of this analysis are discussed below and shown for the first part of the model in Figure 2.

The preliminary model predicted accurately the initial feeding behavior of one group of women, those who wanted to breastfeed and who encountered none of the obstacles specified, 100% of whom breastfed. However, it was less accurate in predicting the behavior of other women. For example, the model predicted that women who perceived themselves to be traditional would chose to breastfeed regardless of any other attributes. Only 14 of 18 such women actually chose to breastfeed, a 78% success rate. Similarly, employed women who anticipated problems with work were very likely to breastfeed, despite our prediction that they would not. In addition, certain questions were not asked as explicitly as needed in order to test the model, including whether the respondent wanted to follow the advice others had given her. Overall, the preliminary model predicted accurately the initial feeding decision of 62% of the respondents interviewed as part of Survey I.

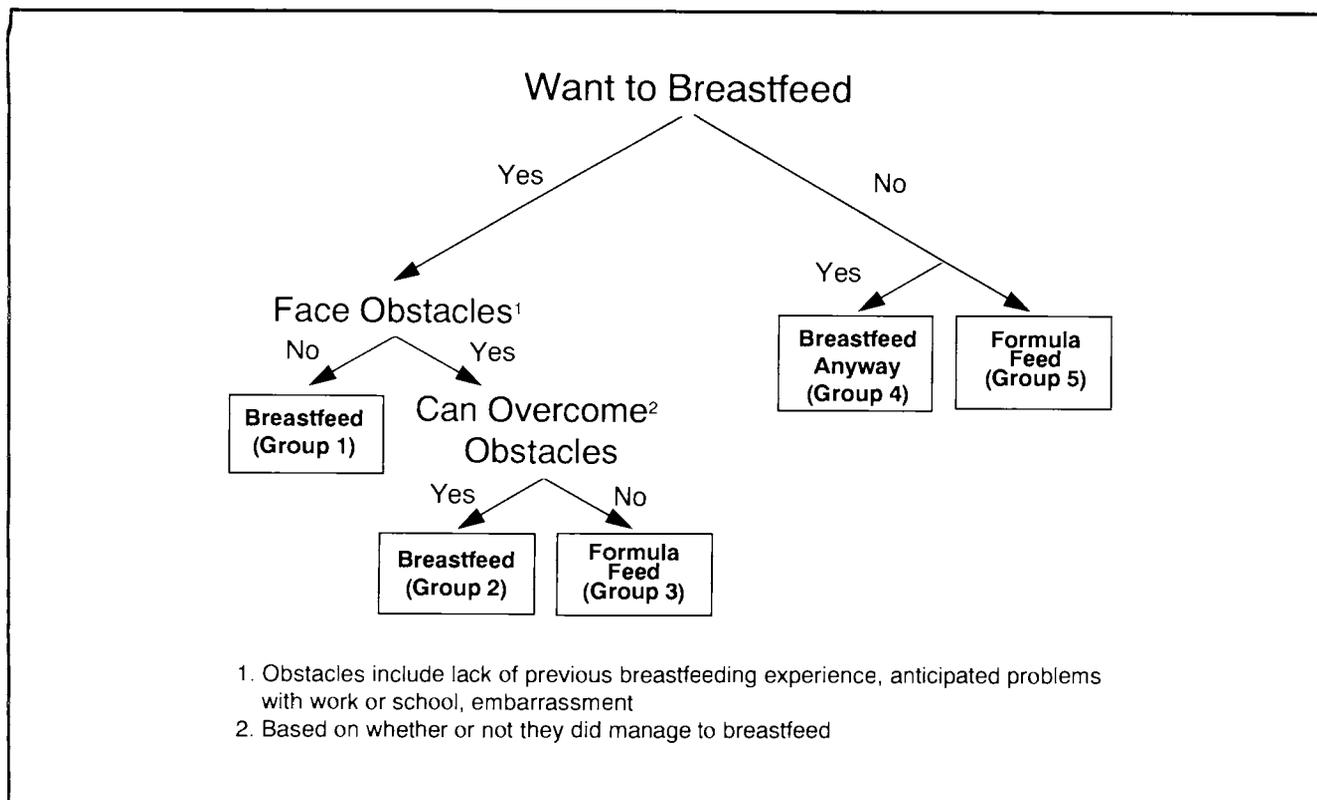


Figure 3. Categorization of Women in First Survey in Terms of Breastfeeding Correlates and Behavioral Outcomes

In an attempt to explore why the decision model predicted the behavior of a smaller percentage of respondents than is usually acceptable (Gladwin 1989:49), we identified several potential flaws. First, the model might be incomplete because certain decision criteria were left out. Secondly, the model might include irrelevant factors which did not actually influence the decision making process. Finally, the decision criteria might be out of order. These flaws would need to be addressed if we were to more accurately account for feeding behaviors.

To improve the decision model, we turned to quantitative methods, using SPSS to identify statistically significant correlates of initial feeding outcomes. This entailed crosstabulating a wide variety of demographic factors, such as maternal age and education, by whether or not the woman breastfed her most recent child. These analyses revealed that two factors<sup>2</sup> predicted the initiation of breastfeeding for a large percentage of respondents: the prenatal desire to breastfeed and previous breastfeeding experience. First, we found that, among the 250 women surveyed, 193 expressed a prenatal desire to breastfeed and 93% of these eventually did so; in contrast, of the 57 women who had expressed a desire not to breastfeed, only 40% did breastfeed their infants ( $\chi^2 = 80.71$ ;  $p < .00001$ ). Second, among the 126 women with previous breastfeeding experience, 91% breastfed their new infants; in contrast, of the 56 women who had not breastfed any of their older children, only 52% opted to breastfeed their newborns ( $\chi^2 = 41.5$ ;  $p < .0001$ ). Moreover, virtually all women (89%) with previous breastfeeding experience considered it to have been a “good” experience.

These associations also suggested an ordering and streamlining criterion: it seemed logical that characteristics which account for a large proportion of the variability in breastfeeding behavior for the entire group should appear among the first criteria in the model, with only a few subsequent criteria required to predict ultimate decisions. Finally, the preliminary decision model had accurately predicted the behavior of women who wanted to breastfeed and who did not face any obstacles, such as lack of previous breastfeeding experience, anticipated problems with work or school or embarrassment at breastfeeding. This finding suggested that women could be categorized in terms of the desire to breastfeed, obstacles to nursing, and, based on feeding outcome, their ability to overcome these obstacles.

Five groups of women were identified using these variables (Figure 3). The first group consisted of women who wanted to breastfeed, who encountered no obstacles to their decision and who were, therefore, able to breastfeed successfully. Women in groups two and three wanted to breastfeed, but encountered obstacles such as lack of previous experience or problems with work or school. While those in group two apparently used strategies to overcome these obstacles, as demonstrated by their breastfeeding (some women used a breast pump or quit their job), women in group three did not attempt such solutions. Prior to the baby’s birth, those in groups four and five had not wanted to breastfeed; however, when the baby was born, women in group four initiated breastfeeding. Subsequently, we characterized women in each group both demographically and with reference to the criteria included in the preliminary decision

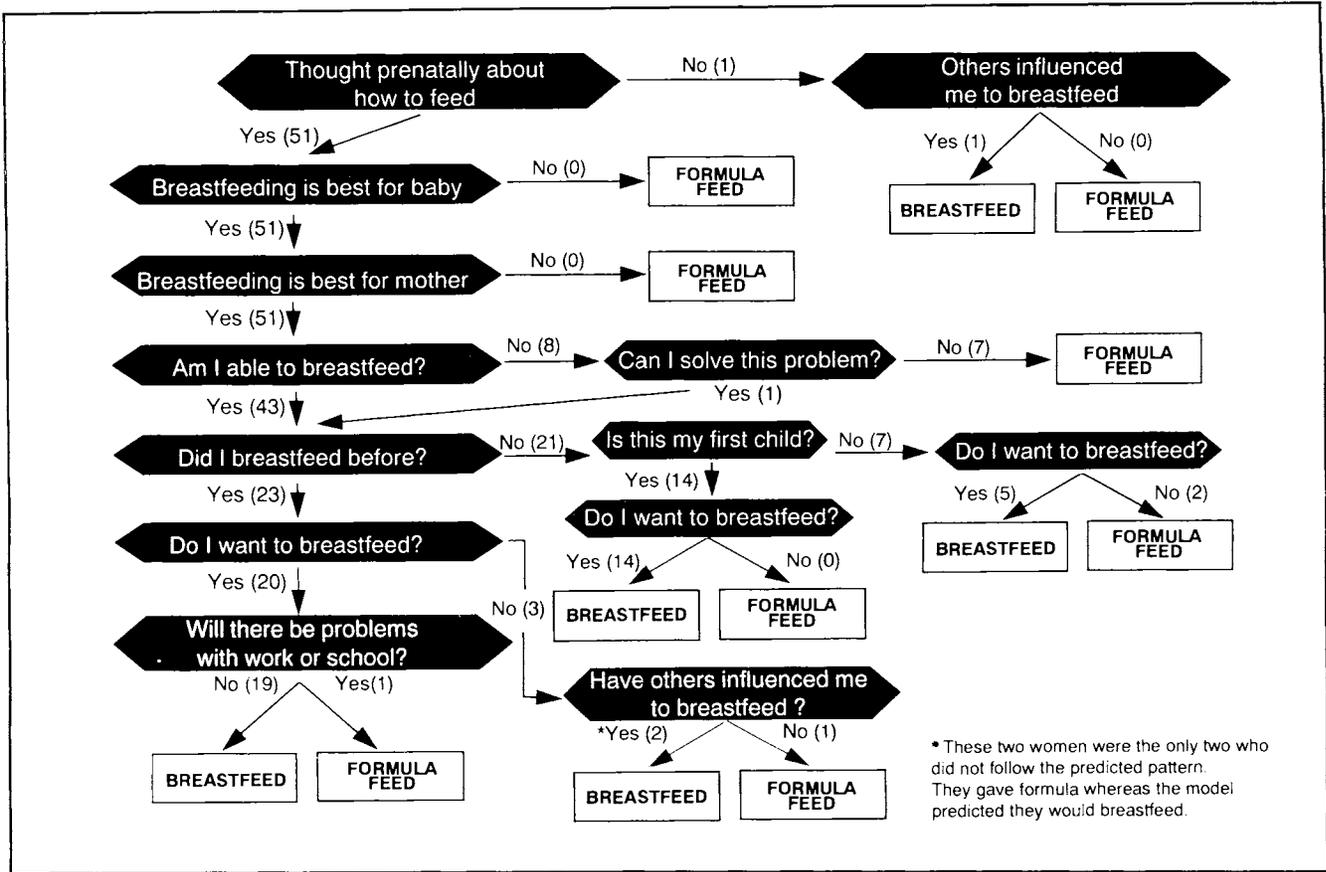


Figure 4. Revised Decision Model with Responses of 52 Additional Respondents

model in an attempt to determine whether other factors needed to be added to or eliminated from a revised decision model. We also reviewed the reasons women cited for their feeding behavior, when it did not follow the pattern we would have predicted from this preliminary model.

This technique identified several items in the preliminary decision model which contributed little to explaining subsequent behavior; these were eliminated from the revised model. For example, 20 of the 104 women in group two who breastfed claimed to be embarrassed; this feeling obviously did not deter them. (A similar proportion (2/12) of women in group three who said they wanted to breastfeed but did not subsequently do so also cited embarrassment.) In addition, a few women cited idiosyncratic reasons for not breastfeeding which had not been included in the original model. A revised decision model (Figure 4) was then constructed which eliminated unnecessary criteria and added the idiosyncratic reasons. The revised model successfully predicted the initial feeding decisions of 88% of Survey I respondents. However, additional testing was required to determine the extent to which the model would predict the behavior of an independent sample (Phase IV).

#### *Phase IV: Testing of the Revised Decision Model (Survey II)*

We developed a new questionnaire which contained the revised decision criteria in the order proposed by the decision

model. Interviews were then conducted (Survey II) with a new convenience sample of fifty-two postpartum women. Most of these women were acquaintances of the researchers who were known to have recently had a baby; virtually all lived in the more economically developed study site. Each time a response diverged from that predicted from the model, the interviewer collected additional information to help identify where the model was wrong. For example, most women assumed that they were physically able to breastfeed, so the question "Am I physically able to breastfeed?" only made sense to women who felt that some physical condition prevented their nursing. Thus after several interviews, this question was rephrased to "Do I know of any problem that would prevent me from breastfeeding?"

The revised decision criteria were extremely accurate in predicting the initiation of breastfeeding as reported by postpartum Navajo women (see Figure 4), with 96% of the respondents' behaviors following the predicted pattern. The major deviation was that the model predicted that two women who were advised to breastfeed, who had breastfed before but did not want to do so with this child, would nurse anyway. In fact, they chose to use formula with this child. There were two other women who wanted to breastfeed and who did not anticipate problems with work or school whom the model predicted would breastfeed. While these two women "tried" to nurse (thereby fulfilling the prediction if only minimally), they only breastfed on the first day after delivery.

Several criteria that had contributed to explaining the behavior of the 250 women were not relevant in the sample of

52; however, these questions may be pertinent for larger groups of women. For example, among the sample of 250, there were six women who did not believe that breastmilk was best for the baby, but none of the women in the smaller sample questioned whether breastfeeding was the best method from the baby's standpoint. Whether breastfeeding was considered to be good for the mother did not distinguish any respondents in the smaller group, and was not asked in that form in the larger survey. Thus it is not clear whether this question would be useful for a larger group.

Being physically able to breastfeed, as expected, was a necessary criterion in the model, and explains the choices of a small number of mothers. It is both intriguing and surprising that 8 of 52 women stated they could not breastfeed. In fact, the reasons specified were not absolute deterrents, but rather perceived obstacles. For example, one mother anticipated that her infant would be "milk intolerant," which she interpreted as rendering him unable to take breastmilk, based on a family history of gastrointestinal symptoms following milk consumption. Another woman was concerned that the medications she took for diabetes might be passed on to the baby through the breastmilk, so she gave formula only. These responses suggest that a perception of physical deterrents may provide a culturally acceptable reason for not breastfeeding, even if those obstacles might be solved by a woman with access to better information, or someone who was more determined. They also emphasized the necessity of exploring the meaning of particular decision criteria to the group being surveyed.

The question of whether the mother wants to breastfeed appears irrelevant for a first child: all these infants were breastfed even if the mother stated she did not want to nurse. Similar findings had emerged when the preliminary model was tested in the larger survey. However, whether a woman wants to breastfeed appears to be relevant to women who have older children, whether or not they were breastfed. (While it is common for women to use the same method to feed all their children, some women change their minds and breastfeed even if they have not in the past.) Women who had breastfed earlier children tended to breastfeed their most recent child, even if they claimed they did not want to nurse this child.

While maternal employment is generally considered (Jelliffe 1962:42) to be a major reason for the decline of breastfeeding, the perception that work or school would interfere with breastfeeding did not seem to affect the initial feeding choice in the second sample of 52 (Survey II). Only one mother who wanted to breastfeed perceived a problem with work or school which prevented her from doing it. (Unfortunately we do not know whether others worked or went to school but did not anticipate problems, since this question was asked later in the decision tree.) This is consistent with the findings for the larger sample in which work outside the home or school was not significantly associated with initiation of breastfeeding: almost all of those mothers who wished to breastfeed but perceived problems with work or school were able to initiate breastfeeding despite these perceptions (Wright *et al.* 1993b). Even those women in the second sample who stated they could not see how to solve the problems initiated breastfeeding. It should be noted that working or going to school, and particularly the baby's age at starting work, would be more likely to influence the duration of breastfeeding, both exclusive and partial, since

only a small percentage of women in this population start work soon after delivery (only seven percent of women in the larger sample started work within three weeks of the birth).

One of the interesting characteristics of the revised model is that some criteria appear at several places in the model, for groups of women who have answered previous questions differently. For example, "Do I want to breastfeed?" is a question relevant to women who have previously breastfed, to those who have older children that were not breastfed, as well as for those women having their first child. The model might work equally well with the two criteria, desire to breastfeed and previous breastfeeding experience, reversed indicating that these two criteria are not hierarchical with respect to each other. This type of situation in which the order is unimportant may be more common when the criteria one is modeling are glosses for complicated sets of attributes. For example, "Do I want to breastfeed?" is a complicated criterion which differs from the simpler "Do I have enough money to buy the seed?" common in agricultural decision modeling. Combining such criteria into a decision table, although inelegant in the middle of a decision model, could provide a means of eliminating the redundancy; others (Franzel 1984) have simply included both criteria within the model as we have.

### Discussion

This article has described one technique for integrating qualitative and quantitative methods to predict whether or not an infant is breastfed. Qualitative techniques such as ethnographic interviews and decision modeling were used to identify respondents' perceptions and to formulate and test hypotheses regarding factors which influence the infant feeding behavior of Navajo mothers. Statistical techniques were used to identify correlates of feeding behaviors, and to classify women into groups depending on the feeding behavior they chose. The insights from both approaches were used to develop a revised decision model which accurately predicted the feeding behaviors of a separate sample of Navajo mothers. The final model, constructed from a combination of qualitative and quantitative methods, accurately predicted a variety of influences in feeding decisions which would not have been possible using either method alone.

Open-ended ethnographic interviews were required for the elicitation of the respondent's own perceptions of criteria used in decision making about infant feeding, perceptions as yet uncontaminated by the researchers' presumptions. This approach contrasts with such structured methods as the Health Beliefs Model (Sweeney and Gulino 1987), in which the criteria are generated by the investigator rather than through elicitation of factors respondents themselves consider salient. The ethnographic interviews revealed how breastfeeding is regarded traditionally (Wright *et al.* 1993a), as well as potential barriers to breastfeeding, such as the notion that women gain weight when nursing, which might not have emerged had more structured methods been used. Thus, these interviews identified culturally specific hypotheses about factors related to infant feeding behaviors which could be tested quantitatively (Schoepfle *et al.* 1984), as well as appropriate wording and structuring of questions. However, simply because a certain factor is widely perceived as influencing feeding behavior does

not mean that the factor is associated with actual behavior. For example, since breastfeeding is highly valued in Navajo society, respondents' perceptions of factors related to feeding practices may include culturally acceptable reasons for not breastfeeding. Thus, these perceptions need to be tested against the actual behaviors of a larger, more representative group of women than would be possible using ethnographic interviews.

In an attempt to overcome some of the limitations of natural decision modeling pointed out in earlier critiques, statistical analyses were used to identify where the model had failed, to see if additional decision criteria could be identified. First, major correlates of breastfeeding were identified and combined with feeding outcomes to classify women into groups depending on whether they faced and were able to overcome obstacles to breastfeeding. Comparison of the groups revealed that some of the original decision criteria were irrelevant, while others needed to be added. This type of approach may have particular utility where decisions are affected both by the perceptions of the actors as well as unconscious structural and/or demographic factors, such as, in the case of breastfeeding, the provision of formula in the hospital. Thus, errors discovered in the model provided additional information about relevant criteria, which were used to create a revised, improved model tested against the feeding behaviors of a second survey sample. The final decision model, which incorporated insights from both the preliminary decision model and statistical modeling, accurately predicted the feeding outcomes of 96% of a new sample.

To some extent, this combination of techniques assists in modeling intracultural variability and change. Selection of a large, diverse sample from different regions assured that a variety of conditions and lifestyles would be considered in the formulation of the decision criteria. Since one component of intracultural variability is a matter of the context within which decisions are made, these are modeled by creating separate "branches," i.e., separating out employed women from those who work at home, for whom somewhat different criteria may apply. However, subgroups may perceive and respond to criteria differently, which would result in unpredictable behaviors, unless subgroup status is itself a criterion in the model. Decision modeling incorporates change if a person moves from one condition to another, but does not incorporate other kinds of change, such as adding a decision criteria which did not previously exist. For example, models of breastfeeding among the Navajo would have been very different for the period before formula became widely available on the reservation. Change of this magnitude can only be addressed through additional ethnographic research.

One of the strengths of decision models as they are traditionally constructed is that they are cognitively salient, i.e., they reflect the factors that informants identify as relevant to decision making. The final model we constructed here included items presumed to be cognitively salient, since they had been elicited from the ethnographic interviews. However, the model also contained criteria not elicited from ethnographic interviews, such as demographic characteristics and preattentive factors (Gladwin and Murtaugh 1980), which may or may not be cognitively salient. For example, while respondents did not identify that whether this was a first or subsequent child was an important consideration in their feeding practices, the effect of birth order may have been preattentive, affecting the decision of how to feed without the respondent's being aware of the

influence. The success of the revised model in predicting the behaviors of the second sample suggests that many of the items included had some cognitive salience, despite the fact that they were not developed using qualitative methods. In addition, incorporating these factors into the model made the model more capable of handling more complex situations than those traditionally modeled, as well as permitting one model to be used for different groups of women, such as traditional and acculturated. Thus, unlike natural decision models which consider cognitively salient factors exclusively, the final model developed here contains both emic and etic elements.

The combination of techniques used is effective for identifying target groups for interventions. Statistical analyses revealed that multiparous Navajo women who lack previous breastfeeding experience are clearly at risk of not breastfeeding. However, the decision model revealed that many women who formula feed only do so, not because they think that formula is better food for a baby, but because of the perception that they are unable to breastfeed, a notion not shared by physicians. This finding suggests that interventions should focus, not on emphasizing the benefits of breastfeeding which are generally known, but rather on addressing the perceived barriers to nursing and on targeting types of mothers for certain messages. We have used these findings to design a breastfeeding promotion project in one area which has used a variety of social marketing techniques (Manoff 1985) to publicize culturally relevant messages about breastfeeding. Both locally designed radio spots and educational brochures given out to pregnant women and their families addressed concerns raised in ethnographic and survey interviews about breastfeeding. In addition, a major component of the intervention has focused on removing barriers to exclusive breastfeeding in the health care system, particularly reviewing and changing hospital policies and educating health care providers on how to better manage and promote breastfeeding.

In conclusion, this article has demonstrated that combining qualitative methods such as decision modeling with statistical analyses provides a wealth of information about the factors, both cognitive and structural, which influence infant feeding behaviors. Using this combination of techniques permits the identification of the types of Navajo women who are least likely to breastfeed, as well as providing information about the issues which inform their choice. Further, including decision criteria which had been elicited from ethnographic interviews in a survey questionnaire along with other questions provided a less cumbersome method of developing and testing decision models than those traditionally used. Finally, rather than simply indicating that the model was inaccurate, errors produced in earlier versions of the model proved to be valuable sources of information which permitted refinement and correction of the model. Thus, we would concur with Stoner's conclusion (1985: 45) that for complex decisions, qualitative and quantitative methods "are perhaps best seen to be complementary rather than competitive, for each provides a measure of insight the other may inadequately provide."

#### NOTES

<sup>1</sup> The medical record numbers of all 2,034 women who had given birth in 1986 and who received health care at one of the three research sites were provided by the Indian Health Service. A random sample of 375 women was selected for chart review to assess how representative

those interviewed in the survey were of all women bearing children in those research areas. Women interviewed were very similar to those whose records were reviewed in age, parity, and amount of prenatal care. While it appears a much smaller proportion of those in the record check were said to be enrolled in WIC (53% vs. 85% of those interviewed), this probably reflects underreporting on the part of Indian Health Service providers since informal estimates place WIC enrollment at 80% or more.

<sup>2</sup> A third variable, research site, also related to initiation of breastfeeding. We speculate that this finding reflects differences in the influence of the health care system. Specifically, the hospital at one site was more likely to give formula to newborns in the hospital, to delay in getting the infant to the breast, and to separate infants from their mothers. In contrast, at the other two research sites, it was common for infants to room-in, a practice strongly associated with higher breastfeeding rates (Neifert and Seacat 1986).

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