Predicting breast-feeding attrition: adapting the Breast-feeding Attrition Prediction Tool

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Context: Current breast-feeding rates fall short of the recommendations set forth in Health People 2010. The Breast-feeding Attrition Prediction Tool (BAPT), administered in the postpartum period, has been useful in predicting breast-feeding attrition. However, assessing a woman’s intention to breast-feed prior to birth would identify women at risk for breast-feeding attrition. Purpose: The purpose of this study was to describe a revised BAPT, administered antepartally that measures intention to breast-feed. Methods: The BAPT, comprising 94 items on a 6-point Likert-type scale, was translated into Spanish and back-translated for accuracy. The BAPT was then revised by reducing the number of items to 35 (32 were used for analysis) and contracting the 6-point scale to 3 categories. A Bayesian item response model provided the psychometric properties of the revised BAPT. Results: The revised BAPT was completed by 143 Mexican American pregnant women. Items, some reverse scored, were recoded as “agree” versus “disagree.” Item analyses indicated a wide range of item discriminabilities, with most items being useful measures of intention to breast-feed. Person analyses provided scores for intention to breast-feed. A simpler scoring system was devised for applications. Conclusions: The revised BAPT shows promise as a measure of intention to breast-feed. The scoring system also indicates which women may need additional interventions to promote breast-feeding. Key words: Bayesian item response model, breast-feeding attrition, Breast-feeding Attrition Prediction Tool, infant feeding, instrument revision, intention to breast-feed

Breast-feeding has been recognized as the optimal method to nourish an infant. Women, particularly those of low-socioeconomic status and from minority groups, are weaning their infants before the recommended 1- to 2-year time frame. Not breast-feeding not only increases the infant morbidity and mortality but also increases the healthcare costs associated with illnesses related to bottle-feeding. In Healthy People 2010, the surgeon general stated that 75% of postpartum women should initiate breast-feeding, 50% should breast-feed until 6 months, and 25% should continue until their child is a year old. In 2005, 73% of Hispanic mothers initiated breast-feeding, and 23% continued to breast-feed for 6 months. Breast-feeding rates for the county in this study fell...
short of the surgeon general’s recommendations, with only 66.2% of mothers ever breast-feeding, while 29.1% continuing for 6 months.9

Researchers have identified that intention to exclusively breast-feed, delayed introduction of infant formula, attendance at breast-feeding support groups, and availability of breast pumps at work have been positively related to longer durations of breast-feeding among a group of predominately Hispanic women.11 Lack of confidence, embarrassment about feeding in public, loss of freedom, and lack of support from family and friends have been the concerns expressed by Hispanic women.12 In addition, some Hispanic women have perceived breast-feeding to be inconvenient and painful.13 The more acculturated Hispanic women have become to the United States, the less likely they have been to breast-feed.14–16 In a 1993 study on the US-Mexico border, the variables of degree of acculturation, age, and marital status were significantly associated with breast-feeding initiation, but occupational status, education, and income were not significantly associated with breast-feeding initiation.15

The Theory of Planned Behavior (TPB) offers a model for explaining, predicting, and influencing behavior.17 It assumes individuals will engage in a health behavior, such as breast-feeding, when they believe the action will result in a desired outcome, when the behavior is seen as worthwhile by their social network (subjective norm), and when they perceive the behavior as easy to perform (perceived behavioral control).17 The central factor in the TPB is the individual’s intention to perform a given behavior. Perceived behavioral control, how much effort an individual is willing to put forth to perform a behavior, is influenced by intentions. Intentions are influenced by available resources and opportunities—actual behavioral control, and the ease or difficulty of performing the behavior—perceived behavioral control.17

As mentioned above, Janke18 developed the Breast-feeding Attrition Prediction Tool (BAPT), using the TPB framework, to predict breast-feeding attrition. Sources of interference with a mother’s intent to breast-feed such as weak commitment, inadequate social and professional support, negative feelings created by breast-feeding, as well as the lack of knowledge, skills, or abilities to breast-feed were incorporated into the underlying constructs of the BAPT.19 In addition, Janke18 suggested that further research using the BAPT be conducted with culturally diverse populations and that a shortened version of the instrument with good reliability and validity be devised for future studies.

**PURPOSE**

While it is helpful to predict breast-feeding attrition early in the postpartum period using the BAPT, it may be more useful to identify antenatally those women at risk for discontinuing breast-feeding, thus allowing for more timely interventions. The purpose of this research article is to describe the modification of the BAPT when translated into Spanish and administered to low-income Mexican American mothers prior to childbirth. The BAPT was adapted for use in a study to examine an intervention designed to increase the initiation and duration of breast-feeding in a low-income Mexican American population.20

**METHOD**

**Sample and setting**

Participants lived in a large southwestern city and the surrounding county with a population of approximately 1 million in 2004. Fifty-four percent of the population was Mexican American. Of the 66.2% of women in the area who initiated breast-feeding, only 29.1% continued for 6 months.21 Participants were recruited from the waiting rooms at 2 public health department maternity clinics. All participants identified themselves as Mexican Americans. One hundred mothers were recruited from each clinic. Women were excluded from the study if they delivered premature infants (<37 weeks), low-birth-weight infants (<2500 g), any infants with major congenital anomalies, or conditions requiring intensive care after birth.

Researchers stopped recruiting participants when 200 mothers meeting the study criteria were enrolled. Although 182 women completed the study, BAPT data were available only for 143 women. Attrition was due to lost follow-up, as some participants could not be located after discharge from the hospital. Sample size issues are elaborated further in the “Psychometric analyses” and “Discussion” sections.

**Instrument**

The BAPT is a 94-item, 6-point Likert-type scale composed of 4 subscales. Nine additional “fill in the blank/circle the answer” questions address information about current feeding practices and birth information. The tool, administered during the early postpartum period, has shown the potential for identifying women at risk for discontinuing breast-feeding. The subscales are positive breast-feeding sentiment (PBS), negative breast-feeding sentiment (NBS), social and professional support (SPS), and perceived behavioral control (PBC).
Subscale internal consistencies range from 0.79 to 0.85, with an overall internal consistency of 0.80.19

Janke used the BAPT to predict breast-feeding status at 8 weeks among 73% of 200 well-educated, white women.19 Dick et al6 used a revised version of the BAPT, with 269 predominately non-Hispanic white women who planned to breast-feed for 8 weeks. The Dick revised tool correctly predicted 78% of the women who quit before/or at 8 weeks and 68% of the women who continued after 8 weeks. In both of these studies, the BAPT was administered in the early postpartum period.

Procedures

Institutional review board approval was obtained from the university and Public Health Department. Women, enrolled during their second trimester of pregnancy, participated in a quasi-experimental study to test the effects of a culturally specific breast-feeding intervention. The intervention, including prenatal education and home-based postpartum support, was designed to increase the initiation of breast-feeding and its duration to 6 months among a group of low-income Mexican American women.20

All participants signed an informed consent form for this study. The participants completed the BAPT in the third trimester during a prenatal clinic visit. A member of the research team was present while the participants completed the BAPT. The research team included 2 bilingual International Board Certified lactation consultants and 3 certified lactation educators, 2 of whom were bilingual and bicultural.

Permission to use the BAPT in its original form was obtained from the author. Because most of the participants preferred to communicate in Spanish, the original BAPT was translated into Spanish. Two Spanish speakers, unrelated to the study, assessed the translated version for accuracy. Back-translation was done to ensure that the meaning of each item remained the same after translation into English.

The translated BAPT was first administered to 10 women. All of the participants said the tool was difficult to complete because of its length. In addition, all participants stated that they had difficulty differentiating between the points on the 6-point Likert-type scale. The tool was revised by reducing the 6-point scale to a 3-point scale (agree, neutral, or disagree) and decreasing the number of items from 103 to 35. In the revised instrument, 7 items comprised the PBS subscale, 13 the NBS subscale, 5 the SPS subscale, 7 the PBC subscale, and 3 items addressed intention to breast-feed. The revised BAPT thus consisted of 5 subscales, the first 32 items of which corresponded to the 4 subscales of the original BAPT. Items included in the revised BAPT were chosen on the basis of the pilot administration. Items excluded were the items that the 10 women left blank most often, while items included were the items answered most frequently.

Face validity, the clarity of the instrument, was ensured when 4 maternal-child nurses (2 Mexican American, 2 non-Hispanic white) reviewed the adapted instrument. In addition, 2 Mexican American breast-feeding mothers reviewed the translated version. Content validity was based on the judgment of experts that the items in an instrument were relevant and appropriate. Two International Board Certified lactation consultants reviewed the revised BAPT and judged the items to be both relevant and appropriate.

Psychometric analyses

Overview

The revised BAPT contains 35 items, of which 32 are measured on a 3-point scale. Standard measurement models, based on linear models assuming continuous responses following a normal distribution, are inappropriate for this instrument. The measurement structure of the revised BAPT is modeled here as the Bayesian item response model. Item response theory, also known as latent trait theory, conceives a respondent’s response to an item as being explained by (1) her value on one or more latent traits, (2) the ease with which one can endorse the item, and (3) the degree to which the item discriminates values on the latent trait.22 It has been widely used in educational and psychological settings25 and has recently been applied in nursing research.24–26

The Bayesian approach to statistics conceives probability theory as the logic of coherent beliefs, which are represented as subjective probabilities.27 Bayesian statistical analysis takes a prior probability distribution, representing beliefs before observing the data, and combines it with the likelihood of the observations to obtain a posterior probability distribution of beliefs after observing the data. Although widely used in other disciplines28 and increasingly used in healthcare research,29 Bayesian statistical analysis has only recently been introduced into nursing research.19,30,31 Bayesian item response theory combines these two areas.32

Sample size

This sample of 143 was obtained from a predetermined maximum sample of 200. The stopping rule “Stop after \( N = 200 \)” is noninformative and does not affect the Bayesian inference.27 Concepts such as
power and significance are not used in the Bayesian inference.

Preliminary analyses

Extensive analyses of the 3-category items (not presented) revealed that respondents did not use all 3 response categories as expected. For the PBS, SPS, and PBC subscales, respondents used the “agree” versus “neutral” categories but not the “disagree” category on some items, the “agree” versus “disagree” categories but not the “neutral” on other items, or “agree” versus both the “neutral” and “disagree” categories equally often on still others. For the NBS subscale, respondents showed the same pattern but with “disagree” versus “agree” or “neutral” categories. Thus, the 3-category items were transformed into binary items. For items in the PBS, SPS, and PBC subscales, “agree” was deemed the response and “neutral” or “disagree” its complement. For items in the NBS subscale, “disagree” was deemed the response and “neutral” or “agree” its complement.

All 143 respondents presented incomplete data, with the number of missing data points ranging from 1 (0.7%) for items 1 and 4 to 18 (12.6%) for item 14. Missing data were assumed to be missing at random.35

Cronbach’s $\alpha$ (KR-20) was estimated to be .83 for the PBS subscale, .78 for the NBS subscale, .80 for the SPS subscale, .82 for the PBC subscale, and .86 for the entire revised BAPT. Only the first 32 items on the revised BAPT are computed in the analysis of predicting breast-feeding intention.

Psychometric model and model fitting

The psychometric model for each item was the 2-parameter logistic item response model. Each respondent was assumed to have a continuous latent trait representing her intention to breast-feed. Each item was assumed to have an intercept representing how easy it is for a respondent of average intent to endorse the item and a slope representing how well it discriminates various levels of the trait. The probability of a respondent endorsing an item was a logistic regression of the item response on the latent trait.22 The proposed model contained only 1 latent variable, not as might be expected, and 4 correlated factors representing the 4 subscales. The purpose of this analysis was to determine whether responses to the 32 items can be explained by intention to breast-feed, not whether they reflected a specified measurement structure.

In accordance with Bayesian principles, the item parameters and latent trait were given prior distributions: The intercept for each item was assumed to follow a normal distribution with mean 0 and variance 10, and the slope for each item was assumed to follow a normal distribution with mean 0 and variance 2. The latent trait for each respondent was assumed to follow a normal distribution with mean 0 and variance 1. The posterior distributions for the intercepts, slopes, and traits given the observations were obtained via Bayes’s theorem using Markov Chain Monte Carlo computation with 20,000 samples.34 All convergence diagnostics were satisfactory. The Markov Chain Monte Carlo computations were conducted in WinBUGS, Version 1.4,35 and subsidiary analyses and graphics were conducted in R 2.4.1.36

RESULTS

Item parameters

Table 1 presents the posterior means for the intercepts and slopes coefficients for the 32 items, arranged by subscales. The larger the slope coefficient, the better the item discriminates levels of the trait. All slope coefficients were positive, with probability exceeding .99, except for items 5 (.98), 9 (.98), 16 (.96), 2 (.91), 3 (.88), and 6 (.80).

Figure 1 depicts the item characteristic curves for items 31, 17, and 6, which had the largest, middle, and smallest slope coefficients. These curves display how changes in the latent variable, intention to breast-feed, affect the probability of endorsing the item. As the latent variable increases from left to right along the bottom axis, the probability of agreeing with the item also increases. For item 31, with a slope of 2.27, small changes in the latent variable in the range of −1 to 1 induce large changes from .1 to .9 in the probability of endorsement. Item 31 well discriminates intention to breast-feed. For item 6, with a slope of 0.17, changes from −3 to 3 in the latent variable induce only small changes from .4 to .6 in the probability of endorsement. Item 6 poorly discriminates intention to breast-feed. Item 17, with a slope of 1.05, has an intermediate discriminability, as changes from 0 to 2 in the latent trait show a changes from .2 to .8 in the probability of agreement.

The item intercepts indirectly determine the probability of agreement with the item for a given level of the trait. The larger the intercept, the easier it is for a respondent to endorse it. Positive intercepts indicate agreement of more than 50%; negative intercepts indicate agreement of less than 50%. Item 4, with an intercept of 3.00, was the easiest to endorse, indicating that a respondent of average intention to breast-feed (trait level = 0) would agree with the item 95% of the time. Item 8, with an intercept of −1.35, was the most difficult to agree with (disagree as the item was reverse
### Table 1. Item analysis*

<table>
<thead>
<tr>
<th>Item</th>
<th>Observed</th>
<th>Fitted</th>
<th>Intercept</th>
<th>Slope</th>
<th>Weight</th>
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</table>

*PBS indicates positive breast-feeding sentiment; NBS, negative breast-feeding sentiment; SPS, social and professional support; and PBC, perceived behavioral control.

*PBS indicates positive breast-feeding sentiment; NBS, negative breast-feeding sentiment; SPS, social and professional support; and PBC, perceived behavioral control.

coded), indicating that a respondent of average intention to breast-feed (trait level = 0) would agree with the item 21% of the time.

The two columns labeled “observed” and “fitted” in Table 1 present the observed and average fitted proportions from the model. The fitted proportions were obtained by estimating the probability of agreement for each item at each trait level and averaging over the trait levels. The fitted proportions show little discrepancy from the observed, the maximum difference being 0.02.

### Figure 1. Item characteristic curves for selected items.

**Person parameters and scores for intention to breast-feed**

The Bayesian analysis yielded a value on the trait for each respondent. The scores ranged from −2.65 to 2.20 and were approximately normal (M = 0.01, SD = 0.91). The logistic item response model also yielded an intention to breast-feed score created as a weighted sum of the items. Each item is scored as the value of the corresponding slope coefficient if the respondent agrees with it versus zero otherwise, and the results are summed. Thus, a respondent agreeing only with the first 4 items in Table 1, and none of the remainder would get an intention score of 1.92 + 1.33 + 1.63 + 0.82. The intention to breast-feed scores ranged from 0.5 to 34.8 and were approximately normal (M = 20.9, SD = 7.6). Figure 2 presents the approximately linear relation, with correlation 0.98, between the trait from the Bayesian analysis and the score from the item response model. Points falling away from the body of the data contain missing data. The distributions of the trait and the score are presented as a rug plots along the bottom and left axes.

### Scoring the revised BAPT

The revised BAPT can be simply scored to obtain an intention to breast-feed score. First, the NSB items are reversed scored so that “disagree” is “agree” and vice versa. Second, the “agree” responses are scored by the weights given in the “weight” column in Table 1, and the other two responses, “disagree” (“agree” for NBS) and “neutral,” are scored as zero. Items with zero weights are effectively unused, but leaving them in the
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Figure 2. Comparison of estimated trait values (circles) with BAPT score (line). Tick marks on axes indicate distribution of trait values on (horizontal) trait axis and distribution of BAPT scores on (vertical) score axis.

revised BAPT does no harm and leaves open the possibility of updating their weights with new data. Missing data, missing for random rather than systematic reasons, are scored as 0.5 times the item weight. Lastly, the item scores are then summed to obtain the intention to breast-feed score.

The scores would range from 0 to 38. Scores above 20 indicate an above-average intention, whereas scores below 20 indicate a below-average intention to breast-feed. The thusly revised BAPT scores in this sample were approximately normal ($M = 21.7$, $SD = 8.0$). The range from 16 to 27 captured approximately 50% of the sample. A reasonable cutoff for intensive education efforts appears to be 16.

DISCUSSION

The revised BAPT now focuses on determining a woman’s intention to breast-feed as well as demonstrating her likelihood to discontinue breast-feeding. It has adequate reliability for a revised instrument with a new population. Both the English and Spanish versions can be used for discriminating intentions concerning breast-feeding, and this provides a crucial addition to the toolkit of perinatal nurses who work with diverse populations.

Most women in this study had stronger positive than negative views of breast-feeding, as shown by more weights of 2 in the PBS subscale than in the NBS subscale (see Table 1). As all women attended maternity and Special Supplemental Nutrition Program for Women, Infants, and Children (WIC) clinics where breast-feeding is portrayed as the best way to feed an infant, the possibility of social response cannot be excluded. Specific items in the PBS scale that indicates a woman is more likely to breast-feed longer is her agreement with item 1, “Breast-feeding is more convenient than formula feeding”; item 7, “Breast-milk is more nutritious than infant formula”; item 19, “Breast-feeding helps you bond with your baby”; and item 20, “Breast-feeding is better than formula.” These findings are in agreement with Ryser who found in a similar population that as the negative breast-feeding sentiment decreases and positive breast-feeding sentiment increases, breast-feeding rates increase.

The influence of significant others through social support is shown by the agreement of women who breast-fed longer with the following items: item 22, “My mother thinks I should breast-feed”; item 23, “My mother-in-law thinks I should breast-feed”; and item 25, “My doctor thinks I should breast-feed.” Of note, the influence of the infant’s father is not as strong as that of mother and mother-in-law, possibly reflecting the importance in the Mexican American culture of support from female relatives for infant and child care. For this study, the influence of the physician (“my doctor”) was a positive influence in intending to breast-feed, as opposed to what was reported by Humphreys et al., who found in Atlanta that persons in a woman’s social network were more influential regarding the infant feeding method chosen than were traditional healthcare professionals, even though the WIC clinic was the most frequently cited source of breast-feeding knowledge. Bryant also found that the advice and encouragement from members of a woman’s social network are important for a successful lactation experience. It is important for the perinatal nurse to ask the new mother how her family and close friends think she should feed her infant; if her mother and mother-in-law are supportive, she may be more likely to breast-feed for a longer time than if they are not supportive of breast-feeding. It may be prudent for the perinatal nurse to talk with the new mother’s family members to encourage the mother’s choice of breast-feeding and provide education about how this choice is better for the newborn infant.

The PBC subscale had the most items that had weights of 2 (see Table 1). This illustrates that women who believe they have the skills and determination to breast-feed are more likely to begin and continue to breast-feed for a longer time than do women without such confidence. The specific items in PBC that indicate stronger intention are item 26, “I have the
necessary skills to breast-feed”; item 28, “I know how to breast-feed”; item 29, “I am determined to breast-feed”; item 31, “Breast-feeding is easy”; and item 32, “I am confident I can breast-feed.” This subscale can be used by the perinatal nurse to screen pregnant women and new mothers for their perceived ability to breast-feed. If responses are in agreement with these items, the nurse may want to check the perceived skills by questioning how the woman plans to handle various situations, such as breast-feeding in public, or handling frequent nighttime feeds. The more the answers reflect a well thought-out plan, the more likely the perceived control will be successful. If however, the perceived control is not supported by strategies for handling common breast-feeding issues, the perinatal nurse can provide concrete suggestions for handling the common issues that will arise, or recommend accurate information sources, such as La Leche League. If a woman shows very little agreement with her perceived control of breast-feeding, the perinatal nurse can begin with more basic education about feeding an infant and how to address common problems.

In 1995, Best Start Social Marketing, a nonprofit organization, collaborated with the Food and Nutrition Service of the Department of Agriculture, to develop a comprehensive, national breast-feeding promotional campaign.40 The campaign, Loving Support, had as its major objective to encourage spouses, friends, and relatives of pregnant women who received WIC services to breast-feed rather than formula-feed. The program used the principles of social marketing41 to develop the marketing plan to promote breast-feeding over its competition, formula-feeding. The marketing plan included the product strategy (description of health and emotional benefits of breast-feeding); pricing strategy (eliminating the deterrents of breast-feeding); and placement and promotion strategy (promote breast-feeding in environments where pregnant women, their friends, and relatives receive infant feeding information). The campaign, piloted in 10 states, featured television and radio advertisements, billboards, pamphlets, posters, and staff support kits with resource information and promotional materials. Hartley and O’Connor42 evaluated the outcomes of the program in its early phases and found a significant increase in the number of low-income women (its target audience) who initiated breast-feeding and were breast-feeding 2 weeks later. The principles have since been incorporated in the WIC program’s breast-feeding promotion emphasis.

Ryser37 examined the breast-feeding rates among women who received the Best Start breast-feeding support program and compared them to rates among women who received similar prenatal care but did not receive the Best Start program. The breast-feeding initiation rate among the women in the treatment group was 61%, in comparison with 15% for women who did not receive the program. She used the BAPT (not revised) and reported higher scores for positive breast-feeding sentiment, lower scores for negative breast-feeding sentiment, higher scores for social and professional support, and higher breast-feeding control scores for the women in the treatment group than for women in the control group. The higher BAPT scores were translated into higher initiation rates of breast-feeding. Her use of the BAPT as a measure to support changes from an intervention is similar to our use of the BAPT, as well as our results are similar to hers. However, our revised BAPT is shorter, available in Spanish, and is simpler to complete, as it has only 35 items with 3 possible responses for each item. The last 3 items on the revised BAPT ask what feeding method the woman is planning to use, how long she plans to breast-feed, and when she decided to breast-feed.

A strength of this study is that the revised BAPT was administered during the last trimester of pregnancy, when feeding decisions are being finalized, rather than during the postpartum period when many women are more susceptible to making changes in feeding decisions on the basis of the stress of childbirth. Limitations of this study include the preliminary nature of these results. The sample size was adequate for determining the effect of an intervention, but was not designed for the testing of a revised instrument. Therefore, it is recommended that the revised BAPT be used with larger samples in a variety of settings and a more diverse population of women.

**IMPLICATIONS**

The revised BAPT can provide the perinatal nurse with information about a woman’s intention to breast-feed. For women with high intention, a discussion may ensue to determine whether she has the knowledge and skills to carry out her intention. For women with low intention, a discussion about reasons for not intending to breast-feed can provide the perinatal nurse with an opening to provide specific information to correct misconceptions that may be driving the low intention. In addition to predicting which pregnant women may be more at risk of early weaning, discussing the items on the revised BAPT with a pregnant woman can be the beginning for a conversation about breast-feeding attitudes and beliefs.
CONCLUSION

Breast-feeding an infant is a learned behavior that can be influenced by attitudes and beliefs about breast-feeding that have been formed over time. The revised BAPT can be used by perinatal nurses as a way to elicit negative attitudes or misconceptions about breast-feeding and address them before the infant is born as breast-feeding misconceptions result in practices that lead to early weaning.

REFERENCES


Title: Predicting Breast-feeding Attrition
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