

Early Lactation Success in a Multi-Ethnic Population (R40MC04294)

Final Comprehensive Report, March 2009

I. Introduction

A. Nature of the research problem

The current infant feeding recommendation is to breastfeed exclusively for the first 6 months of life with appropriate complementary feeding and continued breastfeeding thereafter. The breastfeeding experience in the early postpartum period sets the stage for whether the mother will sustain exclusive breastfeeding for as long as recommended. It has been documented that mothers who supplement their infants due to breastfeeding difficulties in this early period are likely to continue to supplement, which can lead to early cessation of breastfeeding. Breastfeeding success is clearly influenced by socio-cultural pressures and maternal educational level, but also by physiological factors (in the mother or the infant) that affect the onset of lactation. The high incidence of early breastfeeding problems may adversely affect the percentage of women who are willing to even attempt breastfeeding. Therefore it is critical to identify modifiable risk factors for breastfeeding difficulties, especially in vulnerable groups, so that we can develop feasible strategies to increase the exclusivity and duration of breastfeeding.

B. Purpose of the investigation

The purpose of this study is to help develop evidence-based strategies to increase the percentage of mothers who breastfeed exclusively during the first several months postpartum, particularly among minority populations. Our underlying premise is that a key determinant of the duration of exclusive breastfeeding is the mother's breastfeeding experience during the first week postpartum. We focused on primiparas because the incidence of early lactation difficulties is greater in first-time mothers, and the first breastfeeding experience strongly influences breastfeeding decisions with subsequent children. To achieve our goal, we followed women from a multi-ethnic population starting in late pregnancy and continuing until 2 months postpartum. Using a series of measurements, instruments and questionnaires, we collected information on the early breastfeeding experience and factors contributing to its success.

II. Brief review of the literature

In the past few decades, childbirth has become an increasingly medical event, with a large proportion of medicated or surgical deliveries. This may disrupt the natural processes required for the establishment of breastfeeding during the first week postpartum. Several studies have shown that newborns' suckling behavior is negatively affected by the use of labor pain medications (Ransjo-Advirson et al. 2001; Riordan et al. 2000). Suckling problems, which we define as suboptimal infant breastfeeding behavior (SIBB), are common in some populations: SIBB was evident in almost half of the infants on the day of birth and in 22% on day 3 in our previous study of 280 mother-infant pairs in California (Dewey et al. 2003).

In the first few days postpartum the onset of copious milk secretion, known as lactogenesis stage II, takes place. The production of milk during the first day postpartum is low (<100 ml per day), but a substantial increase in milk volume occurs between 36 and 92 hours postpartum (Neville & Morton 2001). Even though this process occurs in response to a predetermined set of hormonal changes, some women experience delayed onset of lactogenesis (OL). Prevalence of delayed OL, usually defined as OL after 72 hours postpartum, has been reported to be 22-31% among mothers in the U.S. (Dewey et al. 2003; Chapman & Perez-Escamilla 1999). Factors associated with an increased risk of delayed OL include primiparity (Dewey et al. 2003; Scott et al. 2007; Hilson et al. 2004), Cesarean section delivery (Dewey et al. 2003; Scott et al. 2007), particularly if it is an urgent one (Chapman & Perez-Escamilla 1999), stress during labor and delivery (Grajeda & Perez-Escamilla 2002; Dewey 2001), prolonged stage II labor (Dewey et al. 2003; Chapman & Perez-Escamilla 1999), maternal overweight (Dewey et al. 2003; Rasmussen et al. 2001), and flat or inverted nipples (Dewey et al. 2003).

Breastfed newborns typically lose weight during the first few days, which is normal, but excess neonatal weight loss can lead to severe dehydration and serious medical consequences. Inadequate suckling (SIBB) and low initial milk supply due to delayed OL can lead to insufficient milk transfer to the infant and result in excess weight loss. In general, neonatal weight loss $\geq 10\%$ of birth weight during the first few days of life is considered indicative of a problem. Reported prevalence of excess neonatal weight loss has ranged from 8 to 12% (Dewey et al. 2003; Manganaro et al. 2001). In our previous study, excess infant weight loss by day 3 was 7 times greater if the mother had delayed OL (40.4% vs. 5.7%, $p < 0.0001$) (Dewey et al. 2003).

There is evidence that mothers who experience these early breastfeeding problems (i.e., delayed OL and poor infant suckling behavior) are at higher risk for shorter breastfeeding duration (Riordan et al. 2000; Mizuno et al. 2004; Ceriani Cernadas et al. 2003). Thus, greater attention to lactation problems in the first week postpartum is needed.

III. Study Design and Methods

A. Study design and specific objectives

The study was a prospective cohort study of primiparous women in Sacramento, CA, a city that is one of the most integrated and ethnically diverse areas in the U.S. Women were recruited prenatally at 34-39 wk gestation. Women who agreed to participate were contacted in the hospital within 24 h of giving birth (considered "day 0") to determine if they were still eligible and willing to continue their participation in the study. If so, they were visited or contacted again on days 3, 7, 14, 30 and 60 postpartum.

Our specific objectives were:

1. To compare the incidence of early breastfeeding problems such as delayed onset of lactation, sub-optimal infant breastfeeding behavior, and sore nipples among three ethnic groups of primiparous women from an urban U.S. population. We planned to compare the experiences of African-American, Hispanic and non-Hispanic white women who all initiate breastfeeding.
2. To identify variables associated with delayed onset of lactation, sub-optimal infant breastfeeding behavior and sore nipples in the multi-ethnic cohort and within each of the 3 main ethnic groups.

3. To assess factors associated with exclusive breastfeeding at 1 mo postpartum in the multi-ethnic cohort, and within each of the three main ethnic groups, with a focus on two key sets of potential predictors: a) breastfeeding problems during the first week postpartum, and b) strength of prenatal breastfeeding intentions and breastfeeding self-efficacy.

4. To examine whether there is an interaction between the two sets of potential predictors listed in #3, i.e., whether the negative effect of early breastfeeding problems on exclusive breastfeeding at 1 mo is greater among mothers with weak breastfeeding intentions or low breastfeeding self-efficacy than in those with strong breastfeeding intentions or high breastfeeding self-efficacy.

In addition to the above objectives, we planned to examine other outcomes such as infant weight loss by day 3 postpartum, maternal concerns about "insufficient milk", and reasons given for supplementation and/or termination of breastfeeding.

B. Population studied

The site of recruitment was the University of California, Davis Medical Center in Sacramento, CA, a comprehensive care facility serves a predominantly low-income population. In 2004, the ethnic distribution of the population served was 39% non-Hispanic white, 27% Hispanic, 15% African-American, 5% Asian, and 14% other or mixed ethnicity.

C. Sample selection

All expectant primiparous women receiving prenatal care at a University of California Davis Medical Center clinic between January 2006 and December 2007 were screened for study eligibility. Selection criteria were: expecting first live-born infant, between 32-40 wk gestation at time of interview, single fetus, speaks either English or Spanish, and ZIP code in catchment area (8-mile radius of the University of California Davis Medical Center). Exclusion criteria were: referred to the University of California Davis Medical Center due to medical condition, known absolute contraindication to breastfeeding, or < 19 years old and not able to obtain parental consent.

D. Instruments used

Table 1 shows the schedule of data collection and the instruments used.

E. Statistical techniques employed

The prevalence of early breastfeeding problems was compared across ethnic groups using chi-squared tests and multiple variable logistic regression. A hierarchical series of multiple variable logistic regression models was used to examine independent effects of risk factors associated with early breastfeeding problems such as delayed OL and excess neonatal weight loss. A cumulative odds logistic regression model was used to study the mediating factors in the relationship between ethnicity and infant feeding intentions. Data analysis is continuing with respect to addressing objectives 3 and 4 above.

Table 1: Schedule of data collection

Data collected	Measurement Day						
	P	0	3	7	14	30	60
<i>Anthropometry</i>							
Birth weight recorded from medical record		X					
Infant weight			X	X			
Maternal weight and height				X			
<i>Labor and delivery</i>							
Labor and delivery data as recalled by mother (duration of stage I and stage II labor, delivery position, individuals present, Faces Pain Scale-Revised)		X					
Labor and delivery data from medical record or hospital staff (reproductive history, duration of labor, labor interventions and medication use, mode of delivery, perineum status, labor and delivery complications, gestational age, infant status at birth)		X					
Umbilical cord serum cortisol and erythropoietin		X					
Labor and delivery experience as assessed by mother (Childbirth Satisfaction Index)			X				
<i>Breastfeeding</i>							
Breastfeeding observation (IBFAT, positioning and latch style, infant oral structure exam, Faces Pain Scale)		X	X	X			
Breast/nipple exam (breast symmetry, nipple type, nipple sores)		X	X	X			
Breastfeeding intentions, self-efficacy, exposure, perceived social support and perceived norms	X						
Timing of first BF, number of feeds since birth		X					
Attitudes toward BF support, convenience, embarrassment			X				
Breastfeeding practices (frequency, longest interval between feeds, sleeping arrangements, supplements/pacifier use)		X	X	X	X	X	X
Breastfeeding problems (sore nipples, breast pain, too much or too little milk, difficulty latching) and how dealt with; use of bra or breast pads		X	X	X	X	X	X
Timing of onset of lactation (asked until onset has occurred)			X	X			
<i>Other</i>							
Demographic data (age, ethnicity, acculturation, marital status, education, economic status, medical history, smoking, postpartum living arrangements)	X						
Maternal depressive symptomatology (CES-D)	X				X		
Maternal or infant illness		X	X	X	X	X	X
Maternal employment or other activities outside the home; hormonal contraceptive use; breastfeeding support groups						X	X

*P=prenatal

IV. Detailed findings

A. Sample characteristics

Over the 24 months of study enrollment, 768 of those screened met the eligibility criteria and 532 of these women agreed to the prenatal interview (69% of those eligible). Acceptance rates varied significantly by ethnic category ($P = .0003$). Listed from highest to lowest, acceptance rates were as follows: Spanish-speaking Hispanic, 81%; African-American, 73%; white, non-Hispanic, 72%; mixed ethnicity, 70%; English-speaking Hispanic, 70%; and Asian, 52%. However, acceptance rates were not significantly different by education level ($P = .22$): < high school diploma, 77%; high school diploma, 67%; some college, 68%; college graduate, 70%. Reasons for refusal were: too busy, 51%; not interested, 25%; study too intrusive, 18%; doesn't want to be interviewed about breastfeeding, 3%; and miscellaneous, 2%.

The multi-ethnic sample consisted of 218 white, non-Hispanic women (41%), 142 Hispanic women (27%), 75 African-American women (14%), 64 Asian women (12%) and 33 women (6%) who self-identified from more than one major ethnic group. Subjects ranged in age from 16 to 41 years. Seventeen percent of subjects did not graduate from high school, 23% were high school graduates, 25% attended at least one year of college and 35% had at least a 4-year college degree. Overall, 49% of study subjects did not have private health insurance, our criterion for low income.

Of the 532 women enrolled prenatally, 40 (7.5%) were lost to follow-up by the time of delivery and 44 became ineligible for continued follow-up because the infant was born preterm ($n=11$), the mother was unable to breastfeed for medical reasons ($n=21$), or the mother chose not to initiate breastfeeding ($n=12$). Thus, 448 breastfeeding mother-infant pairs remained in the study for postnatal follow-up. Of these, 433 (97%) completed the day 3 interview (when several of the primary outcomes were assessed), and 418 (93%) completed the entire study.

B. Infant feeding intentions and actual breastfeeding practices

Most study participants intended to at least try breastfeeding. We measured strength of intention to exclusively breastfeed during the first 6 months postpartum (EBF intention), as assessed by the Infant Feeding Intentions Scale (Nommsen-Rivers and Dewey 2009). Total score ranges from 0 (no intention to breastfeed) to 16 (very strong intentions to exclusively breastfeed for 6 months). EBF intention is classified as low, moderate, strong, or very strong based on Infant Feeding Intention Scale score values of 0 – 7.5, 8 – 11.5, 12 – 15.5 or 16, respectively. In validation studies of the Infant Feeding Intentions Scale, these score ranges corresponded to planned EBF duration of < 1 month, 1 - < 3 months, 3 - < 6 months and 6 months, respectively (Nommsen-Rivers and Dewey 2009). In this sample of women, 9%, 18%, 32% and 42% were in the low, moderate, strong, and very strong range, respectively.

We examined whether modifiable factors explain demographic disparities in EBF intention. For this analysis, we used information collected prenatally with regard to exposure to BF by others (BF exposure), comfort with the idea of BF (BF comfort) and with formula-feeding (FF comfort), and BF self-efficacy. We found that FF comfort, BF comfort, and BF self-efficacy independently predicted EBF intention ($P < .0001$), but FF comfort had the largest effect: adjusted odds of stronger EBF intention increased 3-fold for each 1-level decrease (among 4 levels) in FF comfort. The unadjusted odds [95% confidence interval] of stronger EBF intention were 0.37

[0.24-0.58] for African-American versus non-African-American women; African-American women had higher FF comfort (2.08 [1.32-3.29]), but similar BF comfort, self-efficacy, and exposure. Lower EBF intention among African-American women was mediated by maternal education and FF comfort (accounting for 22% and 37% of the difference, respectively). Thus, FF comfort strongly predicts, and substantially mediates ethnic disparity in, EBF intention.

Of the 418 mother-infant pairs who completed the study, all of whom initiated breastfeeding, the percentage still breastfeeding was 90% at 2 wk, 85% at 1 mo and 78% at 2 mo. The percentage exclusively breastfeeding was 69% at 2 wk, 62% at 1 mo and 55% at 2 mo.

C. Prevalence of early breastfeeding problems

We evaluated early lactation success in the 448 primiparas for whom we had data during the first week postpartum. Key outcomes were sub-optimal infant breastfeeding behavior (SIBB), onset of stage II lactogenesis >72 h postpartum (delayed OL) and excess neonatal weight loss ($\geq 10\%$ of birth weight by 70-98 h). Prevalence of SIBB was 69% at 2-46 h, 34% at 3-4 d, and 24% at 1 wk of age, and did not differ by maternal ethnicity, age, income group or education. Delayed OL occurred in 42% of women (34% of African-Americans, 40% of Hispanics, and 44% of non-Hispanic whites and Asian-Americans); it was more common in women ≥ 30 y of age than in those < 30 y (56% vs. 37%, $p=0.0004$), and in those with some vs. no college education (47% vs. 36%, $p=0.03$). Excess neonatal weight loss (excluding infants who received ≥ 60 mL of formula at 0-48 h) occurred in 18% and was more common in infants of mothers with higher age (28% if ≥ 30 y vs. 14% if < 30 y, $p=0.01$), income (22% vs. 12%, $p=0.048$) and education (22% vs. 10%, $p=0.03$); differences across ethnic groups were marginally significant (8% of African-Americans, 11% of Hispanics, 18% of non-Hispanic whites and 31% of Asian-Americans; $p=0.08$).

D. Risk factors for early breastfeeding problems

In bivariate analyses, the variables associated with delayed OL ($P < .10$, unadjusted) were greater maternal age, education level, and body mass index (BMI), Cesarean delivery, birth weight > 3600 g, lower Apgar scores, edema postpartum, formula intake > 60 ml over first 48 h, and lack of nipple pain at 24 or 72 h postpartum. The final multiple variable logistic regression model included the following variables ($P < .05$, adjusted): maternal age, BMI, birth weight and formula use. There was a strong association between higher BMI and increased risk of edema ($P < .0001$); edema was significant in an alternate final model excluding BMI.

Delayed OL greatly increased the risk of excess neonatal weight loss (loss $\geq 10\%$ of birth weight): prevalence was 34.2% vs. 7.8% in those with vs. without delayed OL ($P < .0001$).

In bivariate analyses, excess weight loss (in infants receiving <60 ml formula during the first 48 h) was significantly associated ($p < 0.05$) with higher maternal age, education and income; longer labor, greater hourly fluid delivery to the mother during labor, birth weight, postpartum maternal edema, flat or inverted nipples, no formula use, and delayed OL. The hierarchical logistic regression model revealed only rate of intrapartum fluid delivery (IV + oral fluids <100 vs. 100-200 or >200 ml/hr, $p=0.015$ and 0.006 respectively), and delayed OL ($p < 0.001$) as significant independent predictors of excess weight loss. The adjusted relative risk (95% CI) of EWL was 3.7 (1.3, 10.2) when mothers received >200 vs. <100 ml/hr of fluids during labor and

3.6 (1.3, 10.1) when mothers received 100-200 ml/hr.

V. Discussion and interpretation of findings

A. Ethnic disparities in breastfeeding intentions

1. Conclusions

There are two findings of major importance in this first set of analyses. First, FF comfort had a *much* greater effect than BF comfort in predicting strength of intention to exclusively breastfeed. In a model with both of these covariates, the effect sizes for FF comfort were 2- to 6-fold greater than for BF comfort in predicting strength of EBF intentions. Secondly, FF comfort was the only psycho-social variable that significantly differed between African-Americans and non-African-Americans, and this difference explained a large portion (37%) of the ethnic difference in EBF intention. Of the four psycho-social variables examined, only FF comfort attenuated the disparity in EBF intentions between African-American and non-African-American women.

2. Study limitations

These results are limited in their generalizability. The relationships that we found between demographic, psycho-social and infant feeding intention measures may not be the same in other regions of the U.S. where breastfeeding rates are lower. For example, we did not find an association between maternal education level and either BF exposure or BF comfort, but this may not be the case in other regions.

3. Comparison with findings of other studies

While others have reported significant associations between breastfeeding psycho-social measures and breastfeeding intention (Mitra et al. 2004; Meyerink and Marquis 2002; Humphreys et al. 1998; Janke 1994; Wambach 1997; Scott 1999; Mahoney and James 2000; Wells et al. 2006), we believe this is the first study to examine the relative magnitude of the effects of breastfeeding versus formula feeding comfort on breastfeeding intention. Our results are consistent with the finding by Forste et al. (2001) that the primary reason indicated by black women for not breastfeeding was that they "preferred to bottle-feed."

4. Application of findings to MCH health care delivery situations

These results suggest that it is at least as important to consider attitudes towards formula feeding as it is to consider attitudes towards breastfeeding, when seeking to understand maternal breastfeeding intentions and design appropriate educational and counseling strategies.

5. Policy implications

Community and individual-level efforts that mention potential risks of formula feeding may be an effective strategy for narrowing the disparity in breastfeeding rates between African-American women and other U.S. women.

6. Suggestions for further research

Additional research on this topic in other areas of the country would be useful.

B. Prevalence of early breastfeeding problems

1. Conclusions

Our results indicate that a large proportion of first-time mothers face serious breastfeeding difficulties in the first few days postpartum, even in a population where intentions to breastfeed exclusively are strong. Delayed OL occurred in more than 40% of these mothers, and the percentage was even higher (56%) in primiparas over 30 y of age. Excess infant weight loss was also far more common (18%) than it should be, and was particularly common among infants of women over 30 (28%). The high prevalence of breastfeeding difficulties was evident across all four of the major ethnic groups.

2. Study limitations

More than 30% of eligible women declined to participate in the study, which creates the potential for bias. The subgroup with the lowest acceptance rate was Asian-American women, so the results for that subgroup may not be representative of Asian-Americans in the general population.

3. Comparison with findings of other studies

The prevalence of breastfeeding problems in this cohort was even higher than in our previous study of women in Davis, CA who generally had high educational and socio-economic status (Dewey et al., 2003), using identical methods for assessing these outcomes. For example, the prevalence of SIBB on day 0 was 69% in this study, compared to 57% among primiparas in our previous study ($p=0.02$). Similarly, the prevalence of delayed OL was 42% in this study, compared to 34% among primiparas in the previous study ($p=0.07$). By contrast, the prevalence of delayed OL in a cohort of 171 primiparous women in Peru, using identical methods for assessment, was only 17% (Matias et al, in submission). The reasons for these differences across populations are unclear, but we will be exploring them in future data analyses.

4. Application of findings to MCH health care delivery situations

Care providers need to be aware that early breastfeeding problems are very common, even among women who are highly motivated to breastfeed. Appropriate assessment of breastfeeding during the hospital stay, and in-person follow-up within the first 3-4 days postpartum that includes weighing the infant, should be universal. Care providers should be aware that, although breastfeeding difficulties in the first week may be common, mothers given appropriate guidance can overcome them and successfully establish exclusive breastfeeding, as is evident from the relatively high rate of EBF in this population at 2 mo postpartum (approximately 50%, taking into account the 33 women who never breastfed and thus were not included in the postnatal follow-up) compared to national data (37% in 2005, based on National Immunization Survey data).

5. Policy implications

These results suggest that early breastfeeding problems such as delayed OL have reached epidemic proportions among first-time mothers in the U.S. Policies to screen and provide extra guidance to the highest-risk women (see section C below) are needed.

6. Suggestions for further research

Further research in other areas of the country is needed to document whether the prevalences of these early breastfeeding problems are similar, or perhaps even higher, in other regions where social support for breastfeeding is weaker than in California.

C. Risk factors for early breastfeeding problems

1. Conclusions

Among primiparous women, mothers at highest risk for delayed OL are those who are overweight (which is associated with edema), over 30 years of age, have larger infants, or use > 60 mL of formula during the first 48 hours postpartum.

Our results confirm that delayed OL is a strong predictor of excess neonatal weight loss. A new finding in this study is that higher rates of intrapartum fluid delivery (by IV or orally) to the mother are also related to excess neonatal weight loss, independently of delayed OL. The risk of excess neonatal weight loss was 3.6 times greater if the mother received > 100 ml/h. Infant weight loss associated with maternal fluid receipt during labor likely represents loss of excess fluid (and thus may be benign), but a mechanism involving primarily non-fluid weight loss is possible (which may not be benign). We are continuing data analysis to understand the clinical consequences of infant weight loss that exceeds various cut-offs, taking into account the estimated proportion of this weight loss that may be due to maternal intrapartum fluids.

2. Study limitations

A strength of our study is that it was prospective, so we were able to evaluate risk factors that were present *before* the assessment of the key outcomes. Nonetheless, there is the potential for reverse causality with regard to the association between use of formula during the first 48 hours and delayed OL, i.e., women whose milk was late in “coming in” may have sensed this and begun using formula during the first two days. We plan to evaluate this issue by examining the reasons for supplementation during the first 48 hours.

3. Comparison with findings of other studies

In our previous study in Davis, CA, delayed OL was also associated with maternal overweight and higher infant birth weight. In that study, we also found independent associations with Cesarean section delivery and long duration of labor, but these were not observed in the Sacramento cohort. We will be exploring the reasons for these differences.

In the Davis cohort of primiparas, excess infant weight loss was associated with maternal overweight, duration of labor and Cesarean section delivery. In that study, we did not have data on maternal receipt of intrapartum fluids, which is likely to be a key intermediary variable. Given the strong influence of the latter on excess neonatal weight loss, it is not surprising that the risk factors identified in the Sacramento cohort, when controlling for intrapartum fluids, differ to some extent from those identified previously.

4. Application of findings to MCH health care delivery situations

Care providers should be aware that first-time mothers who are overweight, over 30 years of age, or whose infants weigh > 3600 g at birth are at higher risk for delayed OL and need anticipatory guidance to help them establish exclusive breastfeeding during the first week postpartum. In addition, formula supplementation that is not medically indicated should be discouraged. Use of less intrapartum maternal fluids when appropriate may reduce frequency of excess weight loss in the infant.

5. Policy implications

Policies to reduce maternal overweight and restrict use of formula during the first two days postpartum (unless medically indicated) may reduce the prevalence of breastfeeding difficulties during the first week postpartum.

6. Suggestions for further research

The clinical significance of excess infant weight loss associated with higher rates of maternal fluid delivery must be defined in order to optimize interpretation and management.

VI. List of products (abstracts shown in Appendix)

A. Abstracts

Nommsen-Rivers LA, Dewey KG, Chantry CJ. Mediating factors in the relationship between ethnicity and infant feeding intentions. *Experimental Biology*, April 2008.

Maalouf Z, Nommsen-Rivers LA, Chantry CJ, Dewey KG. Maternal depression, breastfeeding intentions and breastfeeding self-efficacy. *Experimental Biology*, April 2008.

KG Dewey, L Nommsen-Rivers, RJ Cohen, C Chantry, JM Peerson. Delayed lactogenesis and excess neonatal weight loss are common across ethnic and socioeconomic categories of primiparous women in northern California. *Experimental Biology*, April 2009.

Nommsen-Rivers LA, Cohen RJ, Chantry CJ, Peerson JM, Dewey KG. Risk factors for delayed onset of lactogenesis among northern California primiparous women. *Experimental Biology*, April 2009.

Chantry CJ, Dewey KG, Nommsen-Rivers LA, Peerson JM, Cohen RJ. Excessive weight loss in breastfed newborns relates to intrapartum fluid delivery to the mother. *Pediatric Academic Societies*, May 2009.

B. Papers in submission

Nommsen-Rivers LA, Cohen RJ, Chantry CJ, Dewey KG. Comfort with formula feeding helps explain ethnic disparity in intention to breastfeed.

Nommsen-Rivers LA, Dewey KG. Intra-ethnic validity and inter-ethnic comparability of the Infant Feeding Intentions Scale.

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Appendix: Abstracts of presentations and papers to date

Abstracts for Experimental Biology 2008:

Nommsen-Rivers LA, Dewey KG, Chantry CJ. Mediating factors in the relationship between ethnicity and infant feeding intentions.

We examined mediators between ethnicity and breastfeeding (BF) intentions. We interviewed 485 primiparous women at 34-40 wk gestation regarding: exposure to BF by others (BFE): never, a few times, often; comfort with idea of BF (BFC) and idea of formula-feeding (FFC): very uncomfortable=1, to very comfortable=4; and BF self-efficacy (BFSE). The Infant Feeding Intentions (IFI) Scale measured strength of intentions to exclusively BF. Subjects were 42% white, 23% Hispanic, 16% black, 13% Asian and 6% mixed. In a cumulative odds logit model with education level (ED), the adjusted odds (AOR [95% CI]) of being in a higher IFI category were 0.55 [0.32-0.93] for black vs. white women (not significant for other ethnicities). Black women had higher levels of FFC (AOR [CI] 1.94 [1.13-3.31]), but similar levels of BFC (1.33 [0.74-2.38]). Overall, increased BFE was predictive of higher BFC and BFSE, and lower FFC ($p < .0001$ for all). FFC, BFC, BFSE and ED explained 42% of variation in IFI ($p < .0001$), with FFC the strongest predictor: AOR of higher IFI level tripled with each successive decrease in FFC level ($p < .001$). Ethnicity was not significant when added to this model. Thus, modifiable factors mediate the relationship between ethnicity and IFI. Campaigns stressing risks of FF may be more effective than those stressing BF benefits for increasing BF rates.

Maalouf Z, Nommsen-Rivers LA, Chantry CJ, Dewey KG. Maternal depression, breastfeeding intentions and breastfeeding self-efficacy.

Depressive symptoms (DS) are associated with lower breastfeeding (BF) rates, but the causal direction is not clear. Our objective was to examine whether a high level of DS is predictive of prenatal infant feeding intentions (IFI), and if so, how breastfeeding self-efficacy (BFSE) may mediate the association. A multi-ethnic sample of nulliparae ($n=485$) were interviewed at 34-40 weeks gestation regarding DS (elevated=CES-D score ≥ 16), BFSE (low if score below median) and IFI. The (IFI) Scale measured strength of intentions to exclusively breastfeed, which has been shown to be strongly associated with actual BF practices. In a cumulative odds logit model with education level, the adjusted odds (95% Confidence Interval) of being in a higher IFI category were 0.63 (0.40-0.99) for those with elevated DS (ref=not elevated). Controlling for education, a pregnant woman with DS had 1.8 (CI, 1.13-3.11) times the odds of having low BFSE than a woman without DS. Furthermore, the adjusted odds of being in a higher IFI category for a pregnant woman with low BFSE were 0.22 (CI, 0.15-0.33, ref=high BFSE). These results underscore the importance of taking prenatal DS into account when examining how BF practices relate to maternal mood postpartum. They suggest that treating prenatal depressive symptoms may contribute to higher rates of BF success, and that improving a woman's BFSE may attenuate the effects of DS on IFI.

Abstracts for Experimental Biology 2009:

KG Dewey, L Nommsen-Rivers, RJ Cohen, C Chantry, JM Peerson. Delayed lactogenesis and excess neonatal weight loss are common across ethnic and socioeconomic categories of primiparous women in northern California.

We evaluated early lactation success in a multi-ethnic cohort of 448 primiparas in Sacramento, CA. Key outcomes were sub-optimal infant breastfeeding behavior (SIBB), onset of stage II lactogenesis >72 h postpartum (delayed OL) and excess neonatal weight loss ($\geq 10\%$ of birth weight by 70-98 h). Prevalence of SIBB was 69% at 2-46 h, 34% at 3-4 d, and 24% at 1 wk of age, and did not differ by maternal ethnicity, age, income group or education. Delayed OL occurred in 42% of women (34% of African-Americans, 40% of Hispanics, and 44% of non-Hispanic whites and Asian-Americans); it was more common in women ≥ 30 y of age than in those < 30 y (56% vs. 37%, $p=0.0004$), and in those with some vs. no college education (47% vs. 36%, $p=0.03$). Excess neonatal weight loss (excluding infants who received ≥ 60 mL of formula at 0-48 h) occurred in 18% and was more common in infants of mothers with higher age (28% if ≥ 30 y vs. 14% if < 30 y, $p=0.01$), income (22% vs. 12%, $p=0.048$) and education (22% vs. 10%, $p=0.03$); differences across ethnic groups were marginally significant (8% of African-Americans, 11% of Hispanics, 18% of non-Hispanic whites and 31% of Asian-Americans; $p=0.08$). We conclude that early breastfeeding problems such as delayed OL have reached epidemic proportions in this population of primiparas, especially among women with greater age and education. Further analyses will explore the biological and behavioral underpinnings for these findings.

Nommsen-Rivers LA, Cohen RJ, Chantry CJ, Peerson JM, Dewey KG. Risk factors for delayed onset of lactogenesis among northern California primiparous women.

Our objective was to determine factors associated with delayed onset of lactogenesis (delayed OL)—defined as onset of stage II lactogenesis after 72 h postpartum (pp)—among a multi-ethnic sample of primiparae who initiated breastfeeding (N=415). Prevalence of delayed OL was 42%. Variables associated with delayed OL ($P < .10$, unadjusted) were greater maternal age, education level, and body mass index (BMI), Cesarean delivery, birth weight > 3600 g, lower Apgar scores, edema pp, formula intake > 60 ml over first 48 h, and lack of nipple pain at 24 or 72 h pp. A hierarchical series of multiple variable logistic regression models were used to examine independent effects of the above variables on the risk of delayed OL. The final model included the following significant ($P < .05$, adjusted) variables: maternal age, BMI, birth weight and formula use. There was a strong association between higher BMI and increased risk of edema ($P < .0001$); edema was significant in an alternate final model excluding BMI. Delayed OL increased the risk of excess neonatal weight loss (loss $\geq 10\%$ of birth weight): prevalence was 34.2% versus 7.8% among infants of mothers with versus without delayed OL ($P < .0001$). We conclude that delayed OL is common among this sample of California primiparae and is associated with both biological and behavioral factors.

Abstract for Pediatric Academic Societies, 2009:

Chantry CJ, Dewey KG, Nommsen-Rivers LA, Peerson JM, Cohen RJ. **Excessive weight loss in breastfed newborns relates to intrapartum fluid delivery to the mother.**

Background: Excess weight loss (EWL) in term breastfed infants can result in morbidity including hyperbilirubinemia or hypernatremic dehydration. Known risk factors include delayed lactogenesis and sub-optimal infant breastfeeding behavior, but few studies are available.

Objective: The objective of this study was to evaluate potentially modifiable risk factors for EWL among infants born to a multi-ethnic population of primiparae.

Design/Methods: 448 primigravidae were recruited prenatally and data collected prospectively on breastfeeding intentions; demographics; labor, delivery and birth outcomes; infant breastfeeding behaviors; formula and pacifier use; onset of lactogenesis and nipple type and pain. EWL was defined as >10% of birth weight at 3 d of age (70-98 hrs). Logistic regression analysis (SAS v 9.2) was used to evaluate performance of a pre-planned theoretical model to identify independent predictors of EWL.

Results: EWL occurred in 14% of 315 infants for whom these data were available, including 18% of infants receiving <60 ml formula total since birth and 19% of exclusively breastfed infants. In bivariate analysis, EWL in those receiving <60 ml formula was significantly associated ($p<0.05$) with higher maternal age, education and income; longer labor, greater hourly fluid delivery to the mother during labor, birthweight, postpartum maternal edema, flat or inverted nipples, no formula use, and delayed lactogenesis. In the hierarchical logistic regression model, only rate of intrapartum fluid delivery (IV + oral fluids <100 vs. 100-200 or >200 ml/hr, $p=0.015$ and 0.006 respectively), and delayed lactogenesis (after 72 hrs, $p<0.001$) were significant independent predictors of EWL. The adjusted relative risk (95%CI) of EWL was 3.7 (1.3, 10.2) when mothers received >200 vs. <100 ml/hr of fluids during labor and 3.6 (1.3, 10.1) when mothers received 100-200 ml/hr.

Conclusions: EWL is common in this population and related to higher rates of intrapartum fluid delivery independently of delayed lactogenesis. The association with maternal fluid receipt during labor likely represents loss of excess fluid, but a mechanism involving non-fluid weight loss is also possible. The clinical significance of EWL attributable to higher rates of maternal fluid delivery must be defined to optimize management of the breastfed newborn.

Abstracts of papers in submission:

Nommsen-Rivers LA, Cohen RJ, Chantry CJ, Dewey KG. **Comfort with formula feeding helps explain ethnic disparity in intention to breastfeed**

Objectives. We examined whether modifiable factors explain demographic disparities in breastfeeding (BF) rates.

Methods. We interviewed 532 expectant primiparae regarding: exposure to BF by others (BF exposure), comfort with ideas of BF (BF comfort) and formula-feeding (FF comfort), and BF self-efficacy. Logistic regression was used to evaluate the independent and mediating effects of these variables on intention to exclusively BF (EBF intention).

Results. FF comfort, BF comfort, and BF self-efficacy independently predicted EBF intention ($P < .0001$), but FF comfort had the largest effect: adjusted odds of stronger EBF intention increased 3-fold for each 1-level decrease (among 4 levels) in FF comfort. The unadjusted odds [95% confidence interval] of stronger EBF intention were 0.37 [0.24-0.58] for African-American versus non-African-American women; African-American women had higher FF comfort (2.08 [1.32-3.29]), but similar BF comfort, self-efficacy, and exposure. Lower EBF intention among African-American women was mediated by maternal education and FF comfort (accounting for 22% and 37% of the difference, respectively).

Conclusion. FF comfort strongly predicts, and substantially mediates ethnic disparity in, EBF intention. Interventions to increase BF may be more effective if information regarding FF risks is included.

Nommsen-Rivers LA, Dewey KG. **Intra-ethnic validity and inter-ethnic comparability of the Infant Feeding Intentions Scale**

In conducting research addressing existing socio-demographic disparities in breastfeeding rates, it is important to use assessment tools that are comparable across ethnic groups. The Infant Feeding Intentions (IFI) scale provides a quantitative measure of the strength and duration of maternal exclusive breastfeeding (EBF) intentions. IFI score ranges from 0 (no intention to ever breastfeed) to 16 (very strong intentions to EBF for 6 months). The objective of this study was to examine intra- and inter-ethnic validity of the IFI scale. The IFI scale was administered to 218 non-Hispanic white, 75 African-American, 80 English-speaking Hispanic, 62 Spanish-speaking Hispanic, and 64 Asian expectant primiparae. Subjects were also asked to estimate their planned duration of EBF. The IFI scale was examined for intra-ethnic internal consistency and construct validity, and for comparability across the above 5 ethnic categories. For all 5 ethnic categories, principal component analysis separated the 5-item scale into the same two factors: intention to initiate breastfeeding and intention to continue EBF. Across ethnic categories, the range in Cronbach's alpha was .70-.85 for the initiation factor and .90 - .93 for the continuation factor. Within each ethnic category, IFI score increased as planned duration of EBF increased (rank-sum test, $P < .0001$ for all). Within the planned EBF categories of <1, 1- <3, 3-<6 and ≥ 6 months, the range in median IFI score across ethnic categories was 5-8, 9-10, 12-14, and 16-16, respectively. The IFI scale provides a valid measure of infant feeding intentions in diverse populations of English and Spanish speaking primiparae and may be a useful research tool for understanding disparities in breastfeeding rates across socio-demographic groups.