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Social determinants of mixed feeding behavior among
HIV-infected mothers in Jos, Nigeria

A Thesis Submitted to the
Yale University School of Medicine
in Partial Fulfillment of the Requirements for the
Degree of Doctor of Medicine

by

Sheela Maru

2009

SOCIAL DETERMINANTS OF MIXED FEEDING BEHAVIOR AMONG HUMAN
IMMUNODEFICIENCY VIRUS-INFECTED MOTHERS IN JOS, NIGERIA

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Mixed feeding confers excess risk of mother-to-child transmission (MTCT) of Human Immunodeficiency Virus (HIV) compared with exclusive breastfeeding (EBF) and exclusive formula feeding (EFF). We undertook a quantitative and qualitative cross-sectional survey to identify the social determinants of mixed feeding among a subset of HIV-infected women enrolled in a MTCT prevention program in Jos, Nigeria. Of the 91 participants, 68(75%) exclusively formula fed, 7(8%) exclusively breastfed, and 16(18%) practiced mixed feeding. Of the mixed feeding women, 7 primarily formula fed and 9 primarily breastfed. Women who primarily formula fed described family pressure as the reason for mixed feeding, whereas women who primarily breastfed indicated insufficient breast milk. In a multivariate analysis, lack of partner support of the feeding decision predicted mixed feeding behavior (OR: 4.2; 95% CI: 1.2-14.9; $p=0.03$). Disclosure of HIV status was significantly correlated ($p<0.001$) with partner support. HIV prevention interventions aimed at reducing mixed feeding should encourage supportive partner relationships that facilitate disclosure of HIV status. Attention should also be made to the differing pressures faced by women attempting to exclusively breastfeed and exclusively formula feed.

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Note: This manuscript, in a different form, is currently in press in the journal

AIDS Care.

Introduction

Every year, approximately 40% of HIV-infected children worldwide become infected through breastfeeding, making breastfeeding the most prevalent mode of mother-to-child transmission (MTCT) of HIV.¹ In the setting of poor access to clean water and sanitation, HIV-infected mothers in Sub-Saharan Africa are faced with the choice of breastfeeding, which confers an increased risk of HIV, or formula feeding, which increases the risk of malnutrition, respiratory tract infections, and diarrheal diseases. The consequences of this choice have led the WHO to take a conservative approach: “When replacement feeding is acceptable, feasible, affordable, sustainable and safe, avoidance of all breastfeeding by HIV-infected mothers is recommended. Otherwise, exclusive breastfeeding is recommended during the first months of life.”²

Compared with exclusive formula feeding (EFF) or exclusive breastfeeding (EBF), “mixed feeding,” the practice of giving breast milk and any other liquid or food simultaneously, confers the highest risk of morbidity and mortality.^{3,4} Not only are infants deprived of the benefits of full breastfeeding, mixed feeding can increase HIV transmission up to two-fold over the approximate 20% risk of HIV acquisition during exclusive breastfeeding.⁴⁻⁷ The pathophysiology of increased transmission risk with mixed feeding is not fully understood; one hypothesis states that antigens in liquids other than breast milk promote inflammatory processes that cause damage to the developing gut of the infant. This damage is not necessarily intrinsically harmful, but it makes the gut of the baby more vulnerable to HIV infection.^{8,9}

Education on the importance of exclusive feeding practice (whether breast or formula feeding) has been integrated into counseling for prevention of mother to child transmission (PMTCT) programs for the last several years, yet these interventions have achieved only partial success.^{6, 10, 11} For example, studies have demonstrated that up to two-thirds of women in these settings are not able to correctly define EBF, and even when informed would not chose to practice EBF because water is seen as necessary for the infant.¹² The prevalence of mixed feeding in PMTCT programs is reported to be remarkably high, at 21-43%.^{10, 13} Understanding the determinants of mixed feeding behaviors in resource-poor settings is critical to the design of PMTCT programs. In the absence of such an understanding, intervention programs may do more harm than good. Indeed, provision of free formula in some PMTCT programs has resulted in increased rates of mixed feeding.^{14, 15}

The literature on the determinants of mixed feeding is limited. One study in Nairobi identified pressures from relatives, lack of privacy, the need to hide HIV status, perception that the infant was hungry or ready to start food, and maternal travel as reasons given by women for mixed feeding.¹⁰ Another qualitative study from India cited insufficient breast milk, post-cesarean pain, and the practical difficulties of substitute milk at night as the main reasons for mixed feeding in the first three days postpartum. The use of supplemental herbal preparations thought to improve the growth of children was the primary reason for continued mixed feeding beyond three days.¹³

Two small qualitative studies from South Africa outlined the range of factors leading to mixed feeding. One of the studies identified five influences on feeding decisions: “(1) social stigma of HIV infection; (2) maternal age and family influences on feeding practices; (3) economic circumstances; (4) beliefs about HIV transmission through breastmilk; and (5) beliefs about the quality of breastmilk compared to formula.”¹⁶ The other study assessed which factors enabled women to maintain exclusive feeding (EBF and EFF). For women attempting EBF, they identified factors of insufficient health worker support, family pressure to introduce other liquids, and lack of disclosure to key supporting family members. By 3 months, women were spending more time away from the home and were not able to maintain EBF during their absence. For women attempting EFF, the study identified fear of stigmatization and erratic supply of formula. They found that maintenance of exclusivity was bolstered by a strong knowledge and belief in the importance of exclusivity, supportive family members who were aware of their HIV status, not being away from home, and having the resources to conveniently prepare formula and make up for erratic formula supplies.¹⁷ Despite these important findings, quantitative investigations into the social determinants of mixed feeding are lacking. We conducted the present study, using both quantitative and qualitative methodologies, to verify and expand upon these initial results.

Statement of Purpose

The primary aim of this study was to identify the social determinants of mixed feeding. We hypothesized that the following six factors would be predictive of mixed feeding behavior: 1) financial difficulties 2) social stigma 3) disclosure of HIV status to partner 4) familial pressure 5) practical difficulties of EBF and EFF 6) partner support of feeding decision. We further hypothesized that the factors would play a different role for women attempting to exclusively formula feed versus those attempting to exclusively breastfeed. We examined these hypotheses in a cross-sectional analysis of 91 HIV-infected mothers enrolled in an ongoing cohort study. Through both bivariate and multivariate analyses, we identified factors that were predictors of mixed feeding. Through qualitative analysis of participant interviews, we described the nature of these factors, strategies used to address them, and differences between women who practice mixed feeding versus exclusive feeding.

Methods

Study Setting and Procedure

This study was conducted from July to September 2005 in Jos, Nigeria. We conducted interviews among 91 women of the 469 who were participating in the Jos Prevention of Mother to Child Transmission Cohort Study (Jos PMTCT Cohort Study). Our study was approved by the human ethics committees at the University Of Maryland School Of Medicine, USA and the Plateau State Specialist Hospital, Nigeria. The ethics committee proposals each included provisions for this feeding sub-study. The Jos PMTCT study is a longitudinal cohort of mother-child pairs who have received care and antiretroviral prophylaxis to prevent MTCT. The HIV–infected pregnant women were referred from four primary clinics to the tertiary care Plateau State Specialist Hospital in Jos, Nigeria. Women receiving antiretroviral treatment for maternal indications (typically, owing to CD4+ T-Cell counts less than 200 cells/microliter) were excluded from the study.

Women were enrolled at their first visit (<18 weeks gestation), at 25 weeks, at 34 weeks, or at delivery. All women were counseled on their feeding decisions prenatally. For women who chose formula feeding, nutrition counselors provided further education and training on formula preparation prior to discharge (within 2 days of delivery) and again at home visits undertaken at one week postpartum. The concepts of EBF and EFF were discussed and those women who chose formula feeding were provided with free canisters of powdered formula for the duration of the 12 month follow-up. Women were also asked about their

knowledge of feeding options and their intended choice of feeding method. Follow-up visits for mothers and children occurred at 1 week, 1 month, 3 months, 6 months, and 12 months post-delivery. At follow-up visits, women were questioned about what they had fed their infants. If participants reported mixed feeding, they were asked to specify a reason.

The present substudy is an analysis of all women who arrived for follow-up visits during a 10 week period between July and September 2005 and agreed to more in-depth interviews about infant feeding practices. This convenience sample represents 19.4% of the HIV-infected women in the study at the time.

Semi-structured Questionnaire

The women in this substudy were administered a 24-item semi-structured questionnaire that allowed for open-ended responses. I accompanied a trained counselor who conducted the interviews in a private area. The privacy of the interview prevented the mothers from feeling judged by their feeding practices and family and social circumstances. This privacy also helped to decrease the likelihood, particularly among those women who were knowledgeable about HIV transmission, that the study participants would provide socially desirable responses to the counselors. The status of 'mixed feeding' was determined by the counselor during the course of the semi-structured interview. The counselor was trained in assessing mixed feeding status by obtaining details on number and types of feeds during a 24 hour period. Mixed feeding was defined as the

practice of simultaneously feeding the infant both breast and any complementary feed.

I developed the semi-structured questionnaire by first observing counseling sessions and conducting exploratory interviews with several of the staff members involved in the study, including doctors, nurses, and counselors. The following key factors were identified by the staff as potentially influencing feeding decisions: 1) financial difficulties 2) social stigma 3) disclosure of HIV status to partner 4) familial pressure 5) practical difficulties of EBF and EFF 6) partner support of feeding decision. These factors were addressed in the semi-structured interviews by presenting a brief scenario of a hypothetical woman in the community who experienced each of these factors influencing her feeding choice. Each scenario was followed by a series of questions to probe the interviewee's experience. All counselors were fluent in English as well as Hausa, the predominant languages in Jos. Discussions were conducted in both languages and all responses were recorded in English on the questionnaires by the counselor. Questionnaire instruments are available from the authors upon request.

Statistical Analysis

The presence or absence of the factors for each woman was extracted from the semi-structured questionnaire responses for quantitative analysis. Data analysis was conducted using SPSS version 12.0 and SAS version 9.3.1 (SAS Institute, Carey, NC). I completed the statistical analysis with the help of

statistician Duncan Smith-Rohrberg Maru. All open-ended responses were coded by thematic category. Relationships between dichotomous variables and mixed feeding outcome were assessed using Fisher's exact test; odds ratios and asymptotic 95% confidence intervals were also constructed. Assessing associations between the predictor variables was performed through the Spearman rank correlation coefficient. A multivariate model was used to fit the data, using backward and forward stepwise regression approaches, with a p-value of 0.30 to enter and leave the model. All variables shown in Table 2 were entered into the initial model. Point estimates of the regression variables were also examined during this process. The Akaike information criterion (AIC) was used to assess model fit. The optimal model was chosen as the convergence of the forward and backward models, with consideration of parsimony to avoid overfitting the model.

Qualitative Analysis

I examined the specific challenges women faced with each factor and the strategies to overcome those challenges in the qualitative analysis. Mixed feeding women were divided into two categories: those who predominantly breastfed and those who predominantly formula fed. This was defined by their reported feeding choice at the start of the interview and their response to two questions asking the frequency of breastfeeding and the frequency of complementary feeding. The responses of the women who exclusively fed were examined for the women's ability to maintain either EBF or EFF. Qualitative data

from two focus group discussions of the same 6 social factors were also included.

These focus groups were conducted by the same counselors using the same semi-structured questionnaire. I was also present at these focus groups.

Results

The demographic and social characteristics of the study sample and the larger cohort are shown in Table 1. The study sample did not differ significantly from the larger cohort in any of these characteristics, with the exception of education. The study sample had a higher proportion of women who had graduated from high school than the larger cohort (52% vs. 39%, $p=0.002$). This may be due to the fact that the study sample was composed of women who made it to their follow-up visits. The mean age of participants in the current study was 27.3 years (SD=5.5), and more than 60% were between 20 and 29 years of age. Almost all were married (89%), and more than half were married before the age of 24. In occupation, the women were almost equally split between working (48%) and staying at home (38%). They were predominantly Christian (80%), with the minority being Muslim (8%). Most of the women (75%) enrolled in the study during their third trimester of pregnancy.

About half (46%) of women reported that they were not in danger of being thrown out of their home if their HIV status was known, while the other half (48%) felt they were in danger or did not know if they were. In unprompted questioning, 67% of women had knowledge of MTCT; this figure improved to almost all women (93%) when prompted. About half of women (49%) had no or just one child prior to their infant in the study. Prior to delivery, 26% of women planned to exclusively breastfeed and 65% planned to formula feed. Maternal baseline health was mixed, with 65% having a CD4+ T-cell Count of more than 200 cells and 34% less than 200 cells per microliter. A little more than half (55%) of

women could say certainly that they were their husband's only sexual partners. The remainder (45%) of women had husbands who definitely did or may have had multiple sexual partners.

Of the 91 participants, 68 (75%) were able to exclusively formula feed, 7 (8%) were able to exclusively breastfeed (of whom two practiced early weaning), and 16 (18%) were practicing mixed feeding. Of the mixed feeding women, 7 (44%) were primarily formula feeding and 9 (56%) were primarily breastfeeding. The difference between the exclusive and mixed feeding groups on the breakdown of primary feeding method (formula versus breast) was statistically significant (Fisher's exact p -value <0.001). The women who primarily formula fed tended to start mixed feeding soon after birth, with a mean age of infant onset at 6 days (SD: 13), and a median at 1 day (interquartile range: 1 to 3). The breastfeeding mothers tended to initiate mixed feeding later, with a mean at 67 days (SD: 62), and a median at 53 days (interquartile range: 19 to 105). This difference was statistically significant (Wilcoxon rank-sum statistic= 36; p -value = 0.02).

Table 2 presents bivariate comparisons of characteristics of mixed feeding and non-mixed feeding (exclusive feeding) women. Of the six main factors tested, only partner support was significantly associated with mixed feeding behavior. Namely, women whose partner did not support their feeding decision were more likely to practice mixed feeding (OR: 4.2; 95% CI:1.2-14.4; $p=0.03$). Among the other demographic variables assessed, women who, at delivery, expressed their intent to breastfeed were more likely to practice mixed feeding

than those who did not (OR: 5.7; 95% CI:1.8-18.2; $p=0.008$). Additionally, disclosure of HIV status was significantly correlated with partner support of the feeding decision (Spearman correlation coefficient=0.52, $p<0.001$). In the multivariate analysis, in which all the variables of the bivariate analyses were originally entered into the model, only the lack of partner support in the feeding decision persisted as a significant predictor of mixed feeding (adjusted OR: 4.2; 95% CI: 1.2-14.9; $p=0.03$). Table 3 shows the results of the four variables that persisted in the final multivariate model and their significance.

The factor of practical difficulties was excluded from the final analysis because of the way the question was answered in the semi-structured questionnaire. Almost all of those who reported practical difficulties were referring to awaking at night to prepare bottles, and thus only formula feeding women reported practical difficulties. Since 91% of women who exclusively fed practiced formula feeding, compared with only 44% of mixed feeding women ($p<0.0001$), the practical difficulties variable was confounded and could not be used as a predictor of mixed feeding.

For the variable describing whether the woman desired to keep a family member's HIV status secret, all women in the mixed feeding category answered that they would. As such, there were no mixed feeding women who answered in the negative. As a result of this zero-valued cell, for both bivariate and multivariate analyses, the odds ratio estimates and chi-square (Wald) p -values failed to converge. Thus, although the Type III likelihood ratio estimates (which

did converge) suggested a role for this variable, it was kept out of the final multivariate analysis presented in Table 3.

Tables 4 and 5 summarize the qualitative results of the study. Table 4 presents the reasons women cited for mixed feeding and exclusive feeding. These are examined in two separate groups, those who were predominantly formula feeding and those who were predominantly breastfeeding. The analysis revealed that the groups described different experiences that led them to practice mixed feeding. The formula-feeding women primarily cited pressures from various parties (mother-in-laws, husbands, families, and society in general) as the primary cause of their failure to exclusively feed. For example, one woman stated, "My mother in-law came and told me to give breast, so I complied." Breastfeeding women, on the other hand, primarily discussed a perceived need to supplement breast milk with complementary feeds for the baby's nourishment: "Initially, breast milk was not enough, now she is taking breast but sometimes she still cries so I give her formula." Reasons for exclusive feeding varied, but often conveyed a sense that women wanted to protect their child from HIV: "[I] want my baby to be healthy, to not die." Participants also indicated responses to pressures from other people, health professionals or family, such as "[I was] educated not to mixfeed" and "My mother says I shouldn't give breast milk, [I have] fear of my mother."

Table 5 presents the challenges women described and strategies used to cope with them. Family pressure to breastfeed was dominated by the mother-in-law, as one woman stated: "my mother-in-law came during the delivery and

influenced my choice.” Participants experienced pressure from other members of the husband’s family and members of a woman’s own family as well (typically female members). Several women conveyed a number of different strategies for mediating family pressure, including self-assertion, using others’ authority, deception about HIV status, and HIV status disclosure. The social pressures women described involved harassment: “people called me a ‘wicked woman’ for not breastfeeding my baby”; rejection: “Whenever I cook food in the morning, I have always given some to the neighbors (that is custom here). Now they cover the food and throw it away when I leave”; and force: “the elderly woman called the doctor to hold me down and force me to breastfeed, even if it pained. I ran away from them.” Strategies shared to deal with social pressure focus on deception, “I tell others that my breast does not have enough milk in it, and that is why I must formula feed.” Practical and financial difficulties related to feeding were only faced by formula feeding women. Practical difficulties included preparing formula in the middle of the night, having insufficient resources for preparing the formula, maintaining sanitation of utensils, and experiencing fatigue. Strategies for dealing with practical difficulties included preparing formula in advance, demonstrating personal resilience, and receiving assistance from partners and relatives. Financial difficulties pertained to paying for fuel, transport, and formula (supplemental to the free formula provided by the study), and stemmed from lack of personal or partner income. Strategies for financial difficulties included assistance from relatives and missionaries, personal savings

for children, and alternative modes of transportation. Examples of partner support are also shown in Table 5.

Discussion

The quantitative and qualitative analyses presented here elucidate some of the social factors involved in mixed feeding behaviors among HIV-infected women in Nigeria. In the qualitative analyses, we found important differences between the mixed feeding women who primarily breastfed versus those who primarily formula fed. The predominantly formula feeding mothers reported family pressure to breastfeed. The predominantly breastfeeding mothers' main challenge in avoiding mixed feeding, on the other hand, was their perception that their milk was insufficient and needed supplementation. Perhaps as a result of these distinct pressures, mothers who initially formula fed initiated mixed feeding at a significantly earlier time than those who initially breastfed (median time to mixed feeding: 1 day versus 53 days). Irrespective of the intention to EFF or EBF, lack of partner support was identified in multivariate analyses as a significant predictor of mixed feeding behavior (adjusted odds ratio: 4.2). Additionally, disclosure of HIV status to the partner was significantly associated with partner support of the feeding decision. These results have important implications for the design of PMTCT programs.

As is found throughout much of Sub-Saharan Africa,^{16, 17} the stigma and social pressures surrounding HIV were frequently experienced in this cohort of women. Fewer than half of the women in our study (46%) could say for certain that they would not be thrown out of their homes if their partners knew their HIV status. Stigma played a different role for the mixed feeding women who predominantly breastfed versus those who predominantly formula fed. Family

pressure was experienced more by the mixed feeding mothers who predominantly formula fed. The pressure tended to revolve around ensuring that the women would breastfeed. The cause of this pressure is complicated as breastfeeding is seen as a norm in this society,¹⁸ and formula feeding is seen as a behavior of 'sick' or HIV-infected mothers.^{19, 20} The family pressure may be due to a deep belief in the value of breastfeeding for every infant or from the social stigma of formula feeding being associated with HIV. The qualitative analysis showed that both aspects exist for this cohort of women.

Predominantly breastfeeding women, on the other hand, did not report family pressure or social stigma as reasons why they practiced mixed feeding. The pressure they faced was to breastfeed in the first place. The qualitative analysis revealed stories of women's families and community members influencing the woman's feeding choice prior to delivery and pressuring them to breastfeed the new infant. It was then the belief that their milk was insufficient that led them to add complementary formula feeds. This belief matches other data obtained from a survey in Jos, in which uninfected mothers reported insufficient breast milk as a primary reason for mixed feeding,¹⁸ and data from other parts of Nigeria, where "Complementary foods are introduced as early as two months because of perceived lactation insufficiency."²¹

It is important to note that this study provided a free supply of formula to those mothers who chose to formula feed. It is likely that this incentive resulted in the large proportion (82%) of women who chose to formula feed. The women who chose to breastfeed, despite the incentive and perhaps for social, financial

or ethical reasons, were significantly more likely to mixed feed than those who chose to formula feed (Fisher's exact p -value <0.001). Thus, even in this cultural and economic setting favoring breastfeeding, those who chose to formula feed with the aid of a free supply of formula were able to maintain exclusive feeding better than those who chose to breastfeed. These results suggest that PMTCT programs providing free formula should focus significant counseling efforts on those mothers who choose to breastfeed to ensure exclusive feeding practices. It also suggests that, with the provision of free formula, PMTCT programs may recommend exclusive formula feeding over exclusive breastfeeding and as a result have a lower rate of mixed feeding.

The onset of mixed feeding in mothers attempting to EFF was significantly earlier (mean 6 days) than in mothers attempting to EBF (mean 67 days). Given the likely impact of the timing of mixed feeding on HIV transmission, this finding has critical implications for PMTCT programming. Other studies have shown that longer duration of breastfeeding increases the cumulative probability of HIV transmission.^{4, 22, 23} It is reasonable to extrapolate this evidence to mixed feeding, as the mode of transmission through breast milk is the same with the added factor of increased vulnerability to the virus from non-breast milk substances. The distinct times of onset of mixed feeding can be explained by the differing pressures that mothers experienced. For women trying to EFF, family pressure began as soon as the infant was brought home, since breastfeeding is considered to be the natural healthy norm and formula feeding is associated with illness and HIV. For women attempting to EBF, mixed feeding arose as their

child grew and had needs that seemed to be beyond what their breast milk could supply. These results point to differing counseling needs for women trying to EFF versus EBF, including possible early weaning for women trying to EBF and frequent follow-up in the initial weeks for women trying to EFF.

Other studies have presented data indicating the importance of partner support in determining feeding behaviors.^{10, 17, 24} This is supported here by the multivariate results showing the lack of partner support as a risk factor for mixed feeding. Additionally, in the qualitative portion, women reported that partners provided emotional support and strength to confront family pressure and social stigma. A qualitative study from South Africa resonated with these findings, which showed that exclusive feeding was bolstered by family members who were aware of their HIV status.¹⁷ As such, partner counseling programs should be incorporated into PMTCT programming and encourage women to disclose their status as well as prepare couples for potential pressures and stigma that they may face.

In contrast to social stigma, family pressure, and partner support, specific knowledge of HIV transmission patterns did not impact feeding behaviors in our cohort. In fact, prompted knowledge of MTCT was 93% prior to any specific intervention. Lack of understanding around transmission was therefore an unlikely cause of mixed feeding in our study population. In other populations where knowledge may be lower, however, it is quite possible that this would be a more important factor.

There are some important limitations that temper the results of this study. The study population was from a small, convenience sample from a single locale, limiting the generalizability of our conclusions. This sample, however, did not significantly differ from the larger study on key demographic and biological characteristics. Additionally, the issues discussed in the study are likely to be faced by women in other geographic areas and provide a basis for testable hypotheses. Another limitation was that the small sample size decreased the power with which we could detect significant differences in mixed feeding behavior on the basis of predictor variables. Finally, while mixed feeding status was probed for by a trained counselor and precautions were taken to prevent women from providing socially desirable responses, mixed feeding status was ultimately based on self-report by the women. There is no reason to expect that there would be systematic biases in these data, but it is worth noting that we did not have an objective assessment of our main outcome.

These limitations notwithstanding, the results of this study can be used to inform interventions targeting feeding behaviors among HIV-infected women. The women in this study themselves identified several strategies to mitigate the pressures that they were facing to formula feed. Feeding counseling may provide these strategies as examples to women facing the same issues. Some of these strategies were shared during focus group meetings. Regular group support meetings may aid women who live in the same social milieu to share strategies with each other. Identifying strategies that address issues surrounding

partner support and disclosure may be particularly helpful in advancing PMTCT interventions among these women.

Further Research

The results of the present study point to several topics that need further investigation which may yield useful knowledge for the prevention of mother to child transmission of HIV. First, the main quantitative result of lack of partner support as a predictor of mixed feeding should be confirmed in a larger cohort of women. Second, the intervention that logically follows, partners counseling to prevent mixed feeding, should be tested against routine support for PMTCT. The qualitative analysis looked at two categories of women who were mixed feeding, those who primarily formula fed and those who primarily breastfed. This separation was unique and resulted in ascertaining different reasons for mixed feeding. Further investigation of mixed feeding would benefit from analyzing subjects in these two distinct groups. Intervention studies should be done that separate these groups of women and provide them with appropriate counseling services. Finally, interventions aimed at counseling partners should be examined in all aspects of PMTCT, beyond transmission through breast milk.

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Table 1. Baseline Demographic and Social Characteristics of the Jos PMTCT Cohort Study Population and the Population for the Current Sub-Study

Characteristic	Jos PMTCT Cohort Study Participants not in present study (N=469-91=378)	Jos PMTCT Cohort Study Participants in present study (N=91)
	Value (%)	Value (%)
Age, Mean Years (SD)	26.6 (4.7)	27.3 (5.5)
Age (Years)		
15 to 19	18 (5%)	5 (5%)
20 to 24	111 (29%)	22 (24%)
25 to 29	159 (42%)	37 (41%)
30+	87 (23%)	27 (30%)
Not Known	3 (1%)	0 (0%)
Marital Status		
Currently Married	352 (93%)	81 (89%)
Not Currently Married	26 (7%)	10 (11%)
Age at Marriage		
<15	11 (3%)	1 (1%)
15 to 19	123 (33%)	20 (22%)
20 to 24	151 (40%)	37 (41%)
25 to 29	74 (20%)	26 (29%)
30+	6 (2%)	0 (0%)
Missing	13 (3%)	7 (8%)
Education Level		
Primary (0-5)	56 (15%)	2 (2%)
Secondary (6-11)	176 (47%)	42 (46%)
Graduate (12+)*	146 (39%)	47 (52%)
Occupation		
Housewife or Unemployed	152 (40%)	35 (38%)
Student	22 (6%)	6 (7%)
Working	180 (48%)	44 (48%)
Other	24 (6%)	6 (7%)
Religion		
Catholic	83 (22%)	21 (23%)
Protestant	183 (48%)	51 (56%)
Pentecostal	34 (9%)	9 (10%)
Muslim	73 (19%)	7 (8%)
Others	5 (1%)	3 (3%)
Gestational Age at Enrollment		
First Trimester	18 (5%)	0 (0%)
Second Trimester	109 (29%)	23 (25%)
Third Trimester	248 (66%)	68 (75%)
Not Known	3 (1%)	0 (0%)

Table 2. Comparative Characteristics of Mixed Feeders and Non-Mixed Feeders (N=91)

Factor	Mixed Feeding (n=16)	Not Mixed Feeding (n=75)	OR (95% CI)	p-value
<i>Feels pressure from family</i>	12 (75.0%)	39 (52.0%)	2.8 (0.8-9.4)	0.11
<i>Social Stigma</i>	8 (53.3%)	35 (47.3%)	1.3 (0.4-3.9)	0.78
<i>Non-disclosure to partner of HIV status</i>	8 (50.0%)	55 (75.3%)	3.1 (1-9.3)	0.07
<i>Partner does not support feeding decision</i>	9 (60.0%)	63 (86.3%)	4.2 (1.2-14.4)	0.03
<i>Financial Difficulties</i>	6 (66.7%)	39 (68.4%)	0.9 (0.2-4.1)	1.00
Age ≤ 24	7 (43.8%)	20 (26.7%)	2.1 (0.7-6.5)	0.23
Not high school graduate	9 (56.3%)	35 (46.7%)	1.5 (0.5-4.4)	0.59
Presented to clinic in third trimester	12 (75.0%)	56 (74.7%)	1.0 (0.3-3.5)	1.00
Not a wage-earner	11 (68.8%)	36 (48.0%)	0.4 (0.1-1.3)	0.17
Christian	14 (87.5%)	67 (89.3%)	0.8 (0.2-4.4)	1.00
Lack of unprompted Knowledge of MTCT	2 (12.5%)	28 (37.3%)	4.2 (0.9-19.7)	0.08
Intention to Breastfeed	11 (68.8%)	21 (28.0%)	5.7 (1.8-18.2)	0.003
CD4+ T Cell Count ≤ 200	9 (56.3%)	50 (67.6%)	0.6 (0.2-1.9)	0.40
Husband has multiple wives	7 (43.8%)	34 (45.3%)	0.9 (0.3-2.8)	1.00
Non-disclosure to family/others of HIV status	10 (33.3%)	42 (56.0%)	2.5 (0.8-8.2)	0.16
Danger of being thrown out of home if HIV+	8 (50.0%)	36 (48.0%)	1.1 (0.4-3.2)	1.00
Desire to keep HIV within family a secret	16 (100.0%)	62 (83.8%)	--* --*	0.12

Italicized factors are the main variables from the semi-structured questionnaire. Other factors are from the larger Jos PMTCT cohort study database. Since we used Fisher's exact test, some p-values were exactly equal to 1 (which is impossible for parametric tests like chi-square). *Owing to the presence of a cell of 0 in the 2x2 table, the OR estimate for this variable failed to converge.

Table 3. Multivariate Analysis of the Factors Impacting Mixed Feeding (N=91)

<i>Covariate</i>	<i>Adjusted OR (95% CI)</i>	<i>p-value</i>
Non-disclosure to family/others of HIV status	2.1 (0.6 to 7.5)	0.23
Lack of unprompted Knowledge of MTCT	3.2 (0.6 to 16.5)	0.16
Non-disclosure to partner of HIV status	3.7 (0.9 to 15.2)	0.07
Partner does not support feeding decision	4.2 (1.2 to 14.9)	0.03

Table 4. Qualitative Analysis of Semi-Structure Questionnaires and Focus Groups**Reasons given for mixed feeding**Predominantly formula feeding mothers giving some breast milk

Pressure from mother-in-law

"My mother in-law came and told me to give breast, so I complied."

Pressure from husband

"Pressure from [my] husband to breast-feed."

Pressure from family and society

"I was pressurized to give breast, so I gave for one week, and then I told them that there is no milk in my breast"

Pressure from society

"People pressurize[d] me when they came to greet me and the baby was crying."

Practical Difficulties

"When I had to travel."

Cognitive Difficulties

Woman says she wants to stop giving breast milk; counselor thinks she has cognitive deficits

Predominantly breastfeeding mothers giving complementary feeds

To give traditional concoctions to an unwell child

"My baby is sick. I gave her traditional concoction yesterday, 3 times a day. I give her another twice a day. I will give them until she is okay."

To supplement breast milk-- breastmilk is insufficient

"There are too many people in our house, and I don't get enough to eat, so I don't have enough breast milk. My mother-in-law introduced the formula and buys it for me."

Improper weaning off of breast

"[There was] pressure from family, so [I] breast fed for 3 months, then gave formula."

Lack of knowledge regarding MTCT

She delivered at the hospital and says that no one explained to her about why mixed feeding is not good.

Reasons given for exclusive feeding

To protect child from HIV

"[I] want my baby to be healthy, to not die."

To follow what was instructed by health professional

Advised not to give breastmilk

Educated not to mixfeed

Pressure from others

"My mother says I shouldn't give breast milk, [I have] fear of my mother."

Financial Incentive

"Formula is available for free."

Table 5. Qualitative Analysis of Interviews and Focus Groups: Challenges and Strategies

Types of Family Pressure

Mother-in-law

"My mother-in-law came during the delivery and influenced my choice."

Woman's family

"I breast feed because if I don't, my mother will ask questions and I won't know what to say."

Strategies to deal with family pressure

Living Separately

"I don't live with relations."

Deception

"[I] say that my breast has problems [or] is diseased [or] has an abscess."

Using Husband's authority

"My husband tells them he doesn't want his baby to be breastfed."

Hiding

"They don't know that I formula feed, I hide in my bedroom."

Using Hospital's Authority

"I tell them the hospital says I shouldn't give breastmilk."

Strongly stating preference, using woman's own authority

"I tell them I prefer formula and they don't talk again."

Reveal HIV status to family

"Previously my family did not know my status, but once I started formula feeding my baby, my mother would follow me to the hospital every time I went because she wanted to know why I wasn't breast feeding. Finally I told her my status."

Types of Financial Difficulties

Shortage of fuel

"When I run out of kerosine, I boil water at the neighbor's house."

Money for transportation

"Transportation money to come and pick up the milk [is a difficulty], because my salary is inconsistent."

Lack of partner financial support

"Now I do [have financial difficulty] because my husband just died last week."

Lack of personal income

"[I have financial difficulty] because I'm not working."

Shortage of formula

"I have had to buy formula 3 times, when it runs out."

Strategies to deal with Financial Difficulties

Assistance from missionaries

"I work with the missionaries who help."

Assistance from family

"My mother provides financial support, [and my] brother [and] mother-in-law."

Personal savings for child

"I try to save for when I run out of formula."

Alternative modes of transport

"When I don't have transport money, I trek."

Table 5 (continued)Types of Practical Difficulties

Preparing formula at night

"I have a back ache from waking up at night and preparing the baby's meal."

Lack of resources to boil water

"At night there is not kerosine to light the stove."

Inability to maintain sanitation of utensils

"[It is] difficult to keep utensils clean."

General fatigue

"I get too tired sometimes."

Maternal urge to breast feed

"It is natural to breast-feed, and not being able to is a very painful thing. Sometimes I shed tears for it."

Strategies to deal with practical difficulties

Make formula in advance

"I premake formula for night-time feeding."

Resilience

"I'm hard working and used to it."

Assistance from family

"My mother-in-law helps."

Types of Social Stigma

Stigma of not breast feeding

"People called me a "wicked woman" for not breast-feeding my baby. They said that it was my fault the baby died. They said that if I ever get pregnant again they will force me to breastfeed."

Stigma of HIV

"When I formula feed my baby everyone knows why... Whenever I cook food in the morning, I have always given some to the neighbors... Now they cover the food and throw it away when I leave."

Strategies to deal with social stigma

Deception

"I tell others that my breast does not have enough milk in it, and that is why I must formula feed."

Examples of Partner Support and Status Disclosure

"When I found out my status, my husband and I laughed over the results. We took it easily. For the feeding decision, my husband advised me to go to my mother-in-law's place and let her see me breast-feeding. I went for 3 weeks, then I returned home and switched over to formula feeding."

"When I found out my status, I wept and told my husband. He said that it's ok, it is an act of God. But I tried to commit suicide with drugs and a knife. My husband called my sister to help me. I wanted to tell my parents about my status, but the nurse advised against it. We made the decision to give formula to the baby together. My husband supports me very well."

"The first people who I told my status to were my own parents. They encouraged me to tell my husband. I told my husband and he supports me. We decided to formula feed our baby."

"When I got my HIV test done, my husband was with me. When the results came back I showed them to him right away. So he has known since the beginning and has supported me with my choice to formula feed the baby."