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Knowledge, Attitudes and Practices Regarding Infant Feeding Among HIV-Infected Pregnant Women in Gaborone, Botswana: A Cross-Sectional Survey

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Complete List of Authors:	Ndubuka, Justina; University of Liverpool, School of Population, Community & Behavioural Sciences Ndubuka, Nnamdi; AIDS Institute Partnership, Gaborone, Botswana, Botswana-Harvard School of Public Health Li, Ying; Third Military Medical University, Department of Social Medicine and Health Service Management, Marshall, Caitlin; University of Arizona, Mel & Enid Zuckerman College of Public Health Ehiri, John; University of Arizona, Mel & Enid Zuckerman College of Public Health, Division of Health Promotion Sciences
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Knowledge, Attitudes and Practices Regarding Infant Feeding Among HIV-Infected Pregnant Women in Gaborone, Botswana: A Cross-Sectional Survey

Justina Ndubuka[1], DVM, MPH

Nnamdi Ndubuka[2], MD, Dip HIV Mgt (SA), MPH

Ying Li[3], PhD, MSc

Caitlin M. Marshall[4], MPH

John Ehiri[4], PhD, MPH, MSc (Econ.)

Author for Correspondence:
John E. Ehiri, PhD

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ABSTRACT

Objectives: To assess knowledge, attitudes and practices regarding infant feeding among HIV-positive pregnant women in Gaborone, Botswana and factors that influences their infant feeding choices.

Design: A cross-sectional study.

Methods and study setting: The study assessed knowledge, attitudes and practices regarding infant feeding among 96 HIV-positive pregnant women by means of a questionnaire survey of women attending four public infectious disease control clinics in Gaborone, Botswana.

Results: Only about half of the women had knowledge about prevention of mother-to-child transmission (PMTCT) services related to breastfeeding, and very few (19.8%) chose to breastfeed their infants exclusively. Results of multiple logistic regression analysis showed that receiving infant feeding counselling as part of the PTMCT program was significantly associated with decision to exclusively breastfeed (OR[95%CI]: 5.38 [1.83, 15.81]). Similarly, HIV positive pregnant women who received breastfeeding counselling through the PMTCT program had higher knowledge of PMTCT practices related to appropriate infant feeding (OR[95%CI]: 5.91[1.06, 34.31]). Women who did not expressed perceptions of self (internalized) AIDS-related stigma had significantly higher knowledge of PMTCT practices related to infant feeding (OR [95%CI]: 5.91[1.69, 15.56]). Knowledge of PMTCT practices related to breastfeeding was negatively associated with the belief that breastfeeding could transmit HIV to the baby (OR[95%CI]: 9.73 [3.37, 28. 08]).

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Conclusion: Knowledge, attitudes and practices related to breastfeeding among HIV-infected pregnant women needs further improvement, and PMTCT program should strengthen nutrition counseling services to assist HIV-positive mothers in making informed and appropriate decisions regarding infant feeding.

Key words: Infant feeding, exclusive breastfeeding, exclusive formula feeding, HIV/AIDS, PMTCT, Botswana.

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ARTICLE SUMMARY

Article focus:

- To describe knowledge, attitudes and practices regarding infant feeding among HIV-positive pregnant women.
- To explore factors that influence knowledge, attitudes and practices related to breastfeeding among HIV-positive pregnant women.
- To provided evidence to improve breastfeeding practices for the prevention of mother-to-child transmission (PMTCT) program.

Key messages

- Overall, HIV-positive pregnant women had inadequate knowledge about PMTCT services related to breastfeeding, and very few chose to breastfeed their infants exclusively.
- PMTCT programs should strengthen counseling services to assist HIV-positive mothers in making informed and appropriate decisions regarding infant feeding.

Strengths and limitations of this study

- Results of this study provide an assessment of the effectiveness of implementation of the Botswana PMTCT guidelines.
- The main limitation is that only HIV-infected pregnant women who attended the four participating infectious disease control clinics (IDCCs) were included in the study. Therefore, findings from this study cannot be generalized to all HIV-infected pregnant women in the Botswana National PMTCT program.

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INTRODUCTION

Epidemiological data from the Joint United Nations Program on AIDS estimates the prevalence of HIV among adults aged 15-49 years in Botswana to be 23.40%, with more than 160,000 women aged 15-49 years currently living with HIV/AIDS.[1] According to the Republic of Botswana's Global AIDS Response Report prepared in collaboration with the Botswana National AIDS Coordinating Agency (NACA), the national prevalence of HIV among pregnant women aged 15-49 years is 30.4, with an estimated 13,072 HIV infected women giving birth annually.[2-3] In the absence of interventions to prevent transmission during pregnancy, delivery, or breastfeeding for HIV-infected pregnant women, it is estimated that 35% of births will result in mother-to-child transmission of HIV.[3-4] According to the World Health Organization (WHO), if effective interventions are implemented to prevent mother-to-child transmission (PMTCT), the rate can be reduced to less than 5%.[4]

Due to the transmissibility of HIV from mother to child, feeding of HIV-exposed infants remains a significant challenge in controlling the spread of HIV/AIDS. The dilemma concerning feeding infants of HIV-positive mothers is how to balance the risk of HIV transmission through breastfeeding with the risk of death from causes other than HIV such as pneumonia, diarrheal diseases and malnutrition among formula-fed infants.[5] Exclusive breastfeeding (EBF) plays a critical role in the overall health status of infants, and an estimated 13% of under-5 mortality could be prevented through optimal breastfeeding during the crucial first year of life.[6] Optimal breastfeeding is considered to

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be EBF for the first 6 months of life followed by continued breastfeeding combined with safe, nutritionally adequate complementary feeding up to 24 months of age.[7-9] EBF is regarded as a global health goal as a result of its strong association with reduced morbidity and mortality particularly in low-income countries where safe water and sanitation are often lacking.[10]

In Botswana, all pregnant women, regardless of their HIV status, are provided with education and counseling according to the infant and young child feeding guidelines (based on the WHO 2010 recommendations) during antenatal care (ANC) to ensure that they make informed and appropriate infant feeding choices.[3,9] For many years, the Government of Botswana (GoB) had recommended that HIV-infected women exclusively formula feed their infants and provided infant formula free-of-charge until the infant is one year of age to support this recommendation.[3] However, in 2011, the Botswana Ministry of Health (MoH) recommended exclusive formula feeding (EFF) for the first 6 months of life only for women whom formula feeding is acceptable, feasible, affordable, sustainable and safe (AFASS).[3,11,12] For HIV-positive mothers for whom formula feeding is not AFASS, optimal breastfeeding should be recommended and strongly encouraged. In 2011, the GoB revised the Botswana National PMTCT guidelines and initiated the use of highly active antiretroviral therapy (HAART) for all HIV-infected pregnant women regardless of their CD4 cell count. The program aimed at preventing prevention of mother-to-child transmission (PMTCT) provided HAART for pregnant women who would not have qualified based on their own CD4 cell count.[3] In addition, the guidelines were revised to allow HIV-infected women to make an informed

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decision on whether to breastfeed or formula feed their HIV-exposed infant based on the education and counseling received during ANC visits.[3] Effective implementation of these guidelines was expected to improve breastfeeding practices and ultimately enhance the long-term survival of HIV-exposed infants in the absence of HIV.

There is considerable literature on feeding practices in the context of PMTCT, yet there remains a gap in knowledge regarding HIV-infected pregnant or lactating women's knowledge, attitudes and practices (KAP) regarding infant feeding guidelines and the influence the guidelines have on infant feeding practices. In addition to this gap in knowledge, other researchers have argued that poor-quality counseling in PMTCT programs and the effects of mass media have created widespread confusion for HIV-infected mothers regarding feeding their infant despite the presence of national guidelines.[13] The women who may be confused by these messages often fail to receive advice to practice EBF which may result in mixed feeding and an increased risk of HIV transmission.[14] Thus, our study focused on eliciting information on existing KAP of infant feeding among HIV-infected women in Gaborone, Botswana in an effort to improve infant feeding practices in the context of antiretroviral therapy (ART).

A cross-sectional quantitative design was used to conduct this study in order to investigate how infant feeding practices among HIV-infected pregnant women in Gaborone, Botswana are influenced by the mother's knowledge, attitudes and practices. The main objectives of the study were to identify factors influencing infant feeding choices among HIV-infected pregnant women, to provide data for evidence-based

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decision making to improve the Botswana PMTCT program, and allow the Botswana MoH to assess the implementation of the revised guidelines in order to strengthen future efforts. It is hoped that findings from this study will be of value not only to the Botswana AIDS Control program, but also to other PMTCT programs in sub-Saharan Africa and other low and middle countries where pediatric HIV/AIDS is a public health challenge.

METHODS

A cross-sectional quantitative design was used for the study.

Setting

This study was conducted in four public infectious disease control clinics (IDCCs) located in Gaborone, Botswana, managed by the Gaborone City Council. These clinics were selected because the study population of interest (eligible HIV-infected pregnant women) access universal HAART prophylaxis at the facilities, and thus, provide a reliable sampling frame from which participants could be recruited.

Study population

All pregnant women that presented at any of the four IDCCs during the study period had an equal and independent chance of being included in the sample. [15] The attendance-booking registers in these clinics were used as the sampling frame. The study population included all HIV-infected pregnant women attending IDCCs in Gaborone for universal HAART program services during the study period. HIV-infected pregnant women who were Botswana citizens, aged 21 years and above, and willing to provide informed

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consent were eligible for inclusion in the study. Using the register of women who came for services at each IDCC, the first author [JN] and a local interpreter compiled a list of potentially eligible respondents. During informed consent, the rationale for the study was explained to potential respondents (in the local language, Setswana) and their voluntary participation was sought. All respondents were informed that if they chose not to participate, they would not lose any benefits from the Ministry of Health, and that they could withdraw from the study at any time. Women who volunteered to participate in the study were asked to sign the inform consent form. Those who could not read or write were asked to give their thumb print as a confirmation of their consent. Thus, participation in the study was entirely voluntary and no incentives were provided to respondents. Respondents were assured of confidentiality, and only study unique identification numbers were used on the questionnaires. Approval for this study was obtained from the Ethics Committee of the University of Liverpool, Liverpool, England and from the Botswana Ministry of Health through the Health Research and Development Committee (HRDC).

Data collection

Data were collected using a structured, interviewer-administered questionnaire. Eligible respondents were interviewed and data were transcribed from their medical records onto the questionnaire. The study questionnaire consisted of 33 items that were adapted from the WHO PMTCT assessment tool. [16] The questionnaire was translated into the local language (Setswana) and pre-tested on five IDCC attendees who were not involved in the

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final survey. The questionnaire had the following subsections: socio-demographic information, clinical information, knowledge about PMTCT, and infant feeding practices/intentions. Data were collected over a period of four weeks (June 11 to July 9, 2012) through interviews administered by an interpreter who was fluent in the local language (Setswana) and received training on ethical conduct of research and data collection.

Data analysis

All questionnaires were entered onto Excel spreadsheet and checked for accuracy and completeness. The data were then exported to Statistical Package for Social Sciences (SPSS) version 19 for analysis. With regard to knowledge of PMTCT and PMTCT practices during breastfeeding, we categorized participants' responses as representing "high" knowledge when a respondent gave correct responses to all of the questions; otherwise we categorized the respondent's as having "low" knowledge. Descriptive statistics were used to describe and summarize other variables such as socio-demographic characteristics of respondents, clinical information, knowledge about PMTCT, and the important person in decision-making on infant feeding choices. [15] Pearson Chi-Square or Fisher's Exact Test was used to compare results between groups. Multiple logistic regression analyses were also employed to control for possible confounding factors and to assess the separate effects of the study variables. Odds ratios (OR) with 95% confidence intervals (95%CI) were computed to assess factors associated with the choice

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of breastfeeding, knowledge of PMTCT and PMTCT practices related to breastfeeding. A two-tailed probability level of $p < 0.05$ was chosen as the level of statistical significance.

RESULTS

Characteristics of respondents

Of a total of 102 women from the IDCCs who were eligible for inclusion in the study, 96 volunteered to participate, yielding a response rate of 94.1%. The demographic characteristics of participants, including age, marital status, education, employment status and parity are shown in Table 1. The mean age of the respondents was 24.2 years (SD 0.96) with a range of 22 to 42 years. Respondents aged 21-25 years constituted the majority (43.8%; n=42). With regard to marital status, 42.7% (n=41) of respondents identified themselves as single, 4.2% (n=4) as married, and 50% (n=48) as co-habiting. Thirty percent (n=29) of the respondents completed junior secondary school education; 28.1% (n=27) completed senior secondary school education while only 7.3% (n=7) had university-level education. Regarding employment status of the respondents, 39.6% (n=38) were unemployed during the study period; 38.5% (n=37) were employed by the private sector while 8.3% (n=8) were government employees. About half of the study participants (53.1%; n=51) had 1-2 children; 34.4% (n=33) were pregnant for the first time, and 10.4% (n=10) had 2-4 children.

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All respondents were taking some form of HAART regimen at the time of interview. Table 1 shows that a majority of the respondents (85.4%; n=82) indicated that they received Atripla as their HAART regimen while 6.3% (n=6) received a combination of Combivir and Nevirapine (CBV+NVP). As shown in Table 1, nearly half of the respondents (55.2%; n=53) identified their husbands/partners as the most influential individual with regard to their choice of infant feeding method; whereas 33.3% (n=32) of respondents indicated their mothers had the greatest outside influence on their infant feeding choices. A total of 66 respondents (70.2%) indicated that they were counseled on infant feeding options recommended for HIV-infected women; 29.8% (n=28) of respondents did not receive such counseling.

As for KAP related to breastfeeding among the respondents, 56.3% of respondents believe that an infant of an HIV-infected mother could become infected with HIV when breastfed and 88.4% feared stigmatization related to HIV. Only about half of the HIV-infected women had high knowledge about PMTCT and PMTCT-related practices during breastfeeding. Less than one in five (19.8%) HIV-infected women made the decision to exclusively breastfeed their babies (Table 1).

Knowledge and practices related to breastfeeding among HIV-infected pregnant women

Data on knowledge and choice of breastfeeding method are presented in Table 2. Pearson Chi-Square (or Fisher's Exact Test) was used to determine associations between

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categorical data. Results indicated that choice of breastfeeding differed markedly among the respondents. Participants who received Atripla (FTC+TDF+EFV) and PMTCT counseling in the antenatal period were more likely to choose exclusive breastfeeding (P<0.01). Knowledge of PMTCT practices related to breastfeeding differed markedly by respondents' marital status, education level, parity, and whether or not they received infant feeding counseling during ANC. Similarly, beliefs about transmission of HIV to the baby through breastfeeding differed markedly by participants' marital status, parity, reason for HAART, stigma to HIV, whether or not they received infant feeding counseling during ANC, level of general knowledge about PMTCT and PMTCT practices related to breastfeeding (P<0.01). Single women under the age of 25 years who believed that breastfeeding could transmit HIV to the baby, and who received infant feeding counseling during ANC had higher general knowledge of PMTCT and PMTC practices related to breastfeeding, and were more likely to choose EBF.

Multiple logistic regression analysis was used to assess factors associated with knowledge and choice of infant feeding method. Results indicated that receiving infant feeding counseling as part of the PTMCT program was significantly associated with the decision to exclusively breastfeed (OR[95%CI]: 5.38 [1.83, 15.81]). Receiving infant infant feeding counseling as part of the PMTCT program was also, significantly associated with high knowledge of PMTCT practices related to breastfeeding (OR[95%CI]: 5.91[1.06, 34.31]). Women who did not expressed perceptions of self (internalized) AIDS-related stigma had significantly higher knowledge of PMTCT practices related to infant feeding (OR [95%CI]: 5.91[1.69, 15.56]). Knowledge of

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PMTCT practices related to breastfeeding was negatively associated with the belief that breastfeeding could transmit HIV to baby (OR[95%CI]: 9.73 [3.37, 28. 08]).

DISCUSSION

The basic ethical principle of 'informed choice' requires that HIV-positive women are provided with adequate information about their infant feeding options in the context of prevention of mother to child transmission of HIV. [17] This study observed that only about half of the HIV-infected women had knowledge of PMTCT and PMTCT practices related to breastfeeding. This finding is similar to that demonstrated by Hailu[18] who found that only 30.5% of women in Jimma, Ethiopia had sufficient knowledge of infant feeding options recommended for HIV-positive women. [18] Results revealed that counselling on infant feeding provided as part of the PMTCT program was significantly associated with knowledge of PMTCT practices related to breastfeeding [OR(95%CI): 5.91(1.06, 34.31)].

The Botswana Government had promoted exclusive formula feeding by HIV-infected women for many years but presently allows these women to make informed infant feeding choices.[3] However, informed decision-making can only take place when the women are provided with individualized, unbiased and accurate information about infant feeding options, and when this information is presented in a way that is compatible with women's beliefs and at an appropriate health literacy level.[17,19] The Botswana Family Health Survey showed that only 20% of mothers breastfed exclusively for the first six months.[20] Similarly, our study found that less than 1 in 5 (19.8%) HIV-infected mothers

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chose to exclusively breastfeed. This finding is in agreement with those of Tomasoni et al[21] and Hailu[18] who found similar low rates of EBF among HIV-positive mothers (46% and 13.4% respectively).

Previous studies have explored factors associated with choice of breastfeeding among HIV-infected women. A study by Hailu[18] found that the infant feeding choices made by lactating mothers in Ethiopia were significantly associated with their ages, while a South African study reported that sociocultural factors (including social stigma of HIV/AIDS, maternal age and family influences on feeding practices, economic circumstances, beliefs about HIV transmission through breast milk and beliefs about the quality of breast milk compared to formula) influenced the decision to exclusively breastfeed. As demonstrated in our study, counseling on infant feeding during antenatal visits was a predictor of infant feeding choices (OR[95%CI]: 5.38 (1.83, 15.81)).

It is noteworthy that women who did not expressed perceptions of self (internalized) AIDS stigma had significantly higher knowledge of PMTCT practices related to infant feeding (OR[95%CI]: 5.91(1.69, 15.56))This may be an indication of the barrier that AIDS-related stigma poses against uptake of PMTCT services among HIV infected pregnant women in the study setting. It is known that for social stigma to present a barrier against uptake of services, effected individuals must accept the devaluation and discrediting that accompany the stigma. They must perceive themselves as guilty of moral transgression and accept the blame put on them.

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Even in situations where a family's response to a HIV infected individual is positive, the fear of stigma and discrimination from the larger society can create a barrier against uptake of available services. It is important for PMTCT programs to address stigma in order to promote service uptake. Since many of the key influences on AIDS-related stigma and discrimination are broad-based and deeply rooted with the structures of communities, the most effective interventions would be those with sound theoretical foundations, and that include attention to individual as well as social and structural barriers. In a review of AIDS-related stigma in sub-Saharan Africa, Ehiri et al. presented the case for a multi-level approach that involves action directed at health workers, religious leaders, members of the judicial system, the media, people living with HIV/AIDs, and their family members.[22]

HIV-infected pregnant women are encouraged to exclusively breastfeed their infants for at least 6 months with proper HAART in both high and low-income countries owing to the proven benefits for both the mother and the infant.[23-24] For example, results of a clinical trial in Kenya indicated that giving breastfeeding women a triple-ARV regimen from late pregnancy to 6 months after birth is a safe, feasible way to reduce MTCT in resource-limited settings.[25] Similarly, one large study of 560 HIV-infected pregnant women in Botswana reported only 2 cases of post-natal transmission of HIV among infants of women who were adherent to ART.[26] A cohort study in India found higher rates of HIV-free survival in breastfed infants, reporting a cumulative 12-month mortality of formula-fed infants of 9.6% versus 0.68% among breastfed infants. The low rate of HIV transmission found in this study, in addition to the higher HIV-free survival rates in

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breastfed infants, support PMTCT universal ART for all HIV-infected pregnant women combined with breastfeeding in an attempt to balance the risk of HIV transmission with risk of infant mortality due to other causes.[27]

After reviewing results of their study in South Africa, Patel et al concluded that the recommendation of EBF for HIV-infected women should be further strengthened in resource-poor settings for long-term child health.[28] Their study demonstrated that EBF, combined with effective maternal/infant ART significantly reduced transmission of HIV to infants through breastfeeding.[29]

Evidence remains that there is significant benefit of breastfeeding regardless of the setting as it has been shown to result in positive health outcomes for infants, even in countries with reliable water and sanitation systems, where gastrointestinal problems and other infectious diseases are not a concern. In high-income countries, breastfeeding has been associated with reduced blood pressure and cholesterol levels as well as reduced risk of obesity and diabetes in adulthood.[30] From a life course approach, breastfeeding promotion can provide health benefits at the population level.[30] A longitudinal study which investigated the health effects of breastfeeding in high-income countries, with particular reference to diarrhea and ear infections, showed that breastfeeding has a protective effect for the outcomes of interest.[31] In addition, this study showed a dose-response relationship where the more breast milk the infant received in the first 6 months of life, the less likely the infant is to develop diarrhea and ear infections.

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Infant feeding counseling is vital for all mothers irrespective of their socioeconomic and HIV status. The WHO recommends that HIV-positive mothers be counseled on infant feeding options and be supported in whichever method they choose.[9] The Government of Botswana recommends that all pregnant women are provided with infant feeding information and counseling during antenatal care (ANC) regardless of their HIV status in order to ensure that they are supported in making informed infant feeding choices.[3] Unfortunately, results of this study show that nearly 30% of HIV-positive pregnant women indicated that they did not receive this service. Given the demonstrated positive relationship between counseling during ANC and knowledge of PMTCT practices related to breastfeeding as well as the women's decision to breastfeed, infant feeding counseling in the context of HIV needs to be strengthened in order to improve informed breastfeeding choices by HIV-positive mothers in Botswana.

A majority of the women in this study (80.2%) opted to formula feed their babies. This could be explained by the fact that many health care workers commonly prescribe or encourage formula feeding despite the availability of evidence supporting EBF where formula feeding is not acceptable, feasible, affordable, sustainable and safe (AFASS). Doherty et al[32]conducted a series of qualitative interviews of a prospective cohort of 650 HIV-positive mothers in South Africa and considered the influence of healthcare workers on infant feeding choices. The study concluded that health workers possess significant influence over HIV-infected women's initial infant feeding choices. Doherty et al.[32] stated that some women expressed feeling pressured or 'forced' by their provider to choose a particular feeding method as a result of their HIV status. Available evidence

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shows that women who received formula company-produced infant feeding materials from their health providers at their first prenatal visit were more likely than those who did not receive these materials to stop breastfeeding before hospital discharge and before 2 weeks postpartum. Those who were uncertain about their decision to breastfeed, or with a plan to breastfeed 12 weeks or less, and who received the commercial materials from their health providers also had notably lower rates of exclusive breastfeeding and overall duration[33].

Thus, understanding ethical considerations and providing unbiased information about infant feeding options at the provider level has the potential to improve outcomes of PMTCT services in Botswana and similar low and middle income countries where mother-to-child transmission of HIV is a public health challenge.

Strengths and limitations

Results of this study provide a snapshot assessment of the effectiveness of implementation of the Botswana PMTCT guidelines of 2011 that provide HIV-infected pregnant women the opportunity to make informed infant feeding choices. The cross-sectional design used in this study limited the ability to demonstrate causality. The reported knowledge, attitudes, infant feeding choices or the personal characteristics of respondents who agreed to participate in the study, could have been different from those of participants who declined to participate. Only HIV-infected pregnant women who attended the four participating IDCCs during the period of the study participated in the

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study. Those that attended non-participating IDCCs were not interviewed. These patients might have had different KAP regarding infant feeding choices from those who were interviewed. Therefore, findings from this study cannot be generalized to all HIV-infected pregnant women in the Botswana National PMTCT program. This study had a low sample size, and was likely insufficiently powered to detect associations.

Implications

The findings of this study have implications for further research, public health policy and practice. For further research, firstly, more in-depth qualitative research is needed to better explore KAP regarding infant feeding choices among HIV-infected pregnant women in Gaborone, Botswana. Secondly, this study should be replicated at other IDCC sites as well as ANC clinics to warrant generalization of results to HIV-infected pregnant women elsewhere in Botswana. With regard to policy and practice, to effectively improve EBF rates amongst HIV-infected women, policy makers must make concerted efforts to advocate, promote, and sustain the universal HAART program for pregnant women, and strengthen ANC services. The Botswana Ministry of Health should provide adequate training of healthcare workers on infant feeding counseling for HIV infected women to ensure that they are in a good position to provide unbiased and balanced infant feeding counseling to their clients.

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Author affiliations

[1]School of Population, Community & Behavioural Sciences, University of Liverpool Liverpool L69 3BX, United Kingdom

[2]Botswana-Harvard School of Public Health, AIDS Institute Partnership, Gaborone, Botswana

[3]Department of Social Medicine & Health Service Management, Third Military Medical University, Chongqing, China

[4]Division of Health Promotion Sciences/Global health Institute, Mel & Enid Zuckerman College of Public Health, University of Arizona, Tucson, Arizona, USA

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Table 1: Characteristics of Participants

Characters		No.	%
Age group (years)	21-25	42	43.8
	26-30	30	31.3
	31-35	18	18.8
	36-40	5	5.2
	41-45	1	1
Marital status	Single	41	42.7
	Married	4	4.2
	Cohabiting	48	50.0
	Separated	3	3.1
Educational level	Primary school	15	15.6
	Junior secondary	29	30.2
	Junior secondary with additional training	8	8.3
	Senior secondary	27	28.1
	College or vocational training	10	10.4
	University	7	7.3
Employment status	Unemployed	38	39.6
	Government employee	8	8.3
	Private Employee	37	38.5
	Self-employed	7	7.3
	Volunteer	2	2.1
	Student	4	4.2
Parity	1-2	51	53.1
	3-4	10	10.4
	5 or more	2	2.1
	None	33	34.4
HAART Regimen received	Atripla (FTC+TDF+EFV)	81	84.4
	CBV+NVP	6	6.3
	CBV+Kaletra	5	5.2
	TDF+FTC+Kaletra		

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	Others	4	4.2
Reasons for receiving HAART	PMTCT (Universal HAART)	66	68.8
	Maternal Treatment	30	31.3
Most important person in making decision on infant feeding	My father	3	3.1
	My husband/partner	53	55.2
	My mother	32	33.3
	My Sister	5	5.2
	My Aunt	3	3.1
Feeding counseling during ANC(N=94)	Yes	66	70.2
	No	28	29.8
Chose to breastfeed	Yes	19	19.8
	No	77	80.2
Beliefs to breastfeeding transmit HIV to baby	Yes	54	56.3
	No	42	43.8
Stigma to HIV infection	Yes	84	88.4
	No	11	11.6
Knowledge about PMTCT	High	50	52.1
	Low	46	47.9
Knowledge about PMTCT during breastfeeding	High	49	51.0
	Low	47	49.0

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Table 2: Respondents' kknowledge of PMTCT and choice of breastfeeding

Variable	Choice of exclusive breastfeeding		Knowledge about PMTCT		Knowledge about PMTCT practice related to breastfeeding		Breastfeeding transmits HIV to baby	
	Yes No. (%)	No No. (%)	High No. (%)	Low No. (%)	High No. (%)	Low No. (%)	Yes No. (%)	No No. (%)
Age group (years)								
21-25	14(33.3)	28(66.7)	22(52.4)	20(47.6)	25(59.5)	17(40.5)	29(69.0)	13(31.0)
26-30	3(10.0)	27(90.0)	15(50.0)	15(50.0)	16(53.3)	14(46.7)	16(53.3)	14(46.7)
31-35	2(11.1)	16(88.9)	10(55.6)	8(44.4)	6(33.3)	12(66.7)	7(38.9)	11(61.1)
36-40	0(0.0)	5(100.0)	2(40.0)	3(60.0)	1(20.0)	4(80.0)	2(40.0)	3(60.0)
41-45	0(0.0)	1(100.0)	1(100.0)	0(0)	1(100.0)	0(0.0)	0(0.0)	1(100.0)
Marital status								
Single	12(29.3)	29(70.7)	34(82.9)	7(17.1)*	32(78.0)	9(22.0)*	39(95.1)	2(4.9)*
Married	0(0.0)	4(100.0)	3(75.0)	1 (25.0)	3(75.0)	1(25.0)	2(50.0)	2(50.0)
Cohabiting	6(12.5)	42(87.5)	12(25.0)	36(75.0)	13(27.1)	35(72.9)	13(27.1)	35(72.9)
Separated	1(33.3)	2(66.7)	1(33.3)	2(66.7)	1(33.3)	2(66.7)	0(0.0)	3(100.0)
Educational level								
Primary school	5(33.3)	10(66.7)	13(86.7)	2(13.3)*	9(60.0)	6(40.0)	13(86.7)	2(13.3)
Junior secondary	6(20.7)	23(79.3)	19(65.5)	10(34.5)	14(48.3)	15(51.7)	16(55.2)	13(44.8)
Junior secondary with additional training	3(37.5)	5(62.5)	3(37.5)	5(62.5)	5(62.5)	3(37.5)	6(75.0)	2(25.0)
Senior secondary	4(14.8)	23(85.2)	11(40.7)	16(59.3)	13(48.1)	14(51.9)	13(48.1)	14(51.9)
College or vocational training	1(10.0)	9(90.0)	0(0.0)	10(100.0)	4(40.0)	6(60.0)	3(30.0)	7(70.0)
University	0(0.0)	7(100.0)	4(57.1)	3(42.9)	4(57.1)	3(42.9)	3(42.9)	4(57.1)
Employment status								
Unemployed	10(26.3)	28(73.7)	23(60.5)	15(39.5)	23(60.5)	15(39.5)	24(63.2)	14(36.8)
Government employee	2 (25.0)	6(75.0)	3 (37.5)	5(62.5)	3(37.5)	5(62.5)	2(25.0)	6(75.0)
Private Employee	4(10.8)	33(89.2)	15(40.5)	22(59.5)	18(48.6)	19(51.4)	19(51.4)	18(48.6)
Self-employed	2(28.6)	5(71.4)	4(57.1)	3(42.9)	2(28.6)	5(71.4)	5(71.4)	2(28.6)
Volunteer	1(50.0)	1(50.0)	2(100.0)	0(0.0)	1(50.0)	1(50.0)	2(100.0)	0(0.0)
Student	0(0.0)	4(100.0)	3(75.0)	1(25.0)	2(50.0)	2(50.0)	2(50.0)	2(50.0)
Parity								
2-Jan	9(17.6)	42(82.4)	20(39.2)	31(60.8)*	20(39.2)	31(60.8)*	22(43.1)	29(56.9)*
4-Mar	1(10.0)	9(90.0)	9(90.0)	1(10.0)	7(70.0)	3(30.0)	8(80.0)	2(20.0)
5 or more	0(0.0)	2(100.0)	2(100.0)	0(0.0)	0(0.0)	2(100.0)	1(50.0)	1(50.0)

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None	9(27.3)	24(72.7)	19(57.6)	14(42.4)	22(66.7)	11(33.3)	23(69.7)	10(30.3)
HAART Regimen received								
Atripla (FTC+TDF+EFV)	17(21.0)	64(79.0)*	43(53.1)	38(46.9)*	42(51.9)	39(48.1)*	48(59.3)	33(40.7)
CBV+NVP	1(16.7)	5(83.3)	2(33.3)	4(66.7)	3(50.0)	3(50.0)	1(16.7)	5(83.3)
CBV+Kaletra	1(20.0)	4(80.0)	5(100.0)	0(0.0)	4(80.0)	1(20.0)	4(80.0)	1(20.0)
TDF+FTC+Kaletra								
Others	0(0.0)	4(100.0)	0(0.0)	4(100.0)	0(0.0)	4(100.0)	1(25.0)	3(75.0)
Reasons for receiving HAART								
PMTCT	15(22.7)	51(77.3)	36(54.5)	30(45.5)	36(54.5)	30(45.5)	42(63.6)	24(36.4)*
Maternal Treatment	4(13.3)	26(86.7)	14(46.7)	16(53.3)	13(43.3)	17(56.7)	12(40.0)	18(60.0)
Most important person in making decision on infant feeding								
My father	2(66.7)	1(33.3)	3(100.0)	0(0.0)	1(33.3)	2(66.7)	3(100.0)	0(0.0)
My husband/partner	10(18.9)	43(81.1)	27(50.9)	26(49.1)	25(47.2)	28(52.8)	30(56.6)	23(43.4)
My mother	7(21.9)	25(78.1)	15(46.9)	17(53.1)	19(59.4)	13(40.6)	16(50.0)	16(50.0)
My Sister	0(0.0)	5(100.0)	4(80.0)	1(20.0)	2(40.0)	3(60.0)	4(80.0)	1(20.0)
My Aunt	0(0.0)	3(100.0)	1(33.3)	2(66.7)	2(66.7)	1(33.3)	1(33.3)	2(66.7)
Stigma to HIV infection								
Yes	16(19.0)	68(81.0)	47(56.0)	37(44.0)	47(56.0)	37(44.0)*	51(60.7)	33(39.3)*
No	3(27.3)	8(72.7)	3(27.3)	8(72.7)	2(18.2)	9(81.8)	3(27.3)	8(72.7)
Feeding counseling during ANC								
Yes	18(27.3)	48(72.7)*	41(62.1)	25(37.9)*	42(63.6)	24(36.4)*	44(66.7)	22(33.3)*
No	1(3.6)	27(96.4)	8(28.6)	20(71.4)	7(25.0)	21(75.0)	10(35.7)	18(64.3)
Beliefs to breastfeeding transmit HIV to baby								
Yes	14(25.9)	40(74.1)	38(70.4)	16(29.6)*	39(72.2)	15(27.8)*	–	–
No	5(19)	37(77)	12(28.6)	30(71.4)	10(23.8)	32(76.2)	–	–
Knowledge about PMTCT								
High	13(26.0)	37(74.0)	–	–	–	–	38(76.0)	12(24.0)*
Low	6(13.0)	40(87.0)	–	–	–	–	16(34.8)	30(65.2)
Knowledge about PMTCT during breastfeeding								
High	9(18.4)	40(81.6)	–	–	–	–	39(79.6)	10(20.4)*
Low	10(21.3)	37(78.7)	–	–	–	–	15(31.9)	32(68.1)

☼Pearson Chi-Square or Fisher's Exact Test was used to compare results between groups.
*P<0.05

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Table 3: Multi logistic analysis of factors associated with choice of infant feeding options, knowledge of PMTCT, and knowledge of PMTCT practices related to breastfeeding

Variable	Choice of exclusive breastfeeding OR(95%CI)*	High knowledge of PMTCT OR(95%CI)**	High knowledge of PMTCT during breastfeeding OR(95%CI)**	Breastfeeding could transmit HIV to baby*
Marital status				
Single	–	1	–	–
Married	–	34.37 (0.72,46.77)	–	–
Cohabiting	–	8.17 (0.07, 13.00)	–	–
Separated	–	0.75(0.02, 31.77)	–	–
Educational level				
Primary school	–	1	–	–
Junior secondary	–	8.81 (0.63, 21.89)	–	–
Junior secondary with additional training	–	6.24 (0.65, 64.38)	–	–
Senior secondary	–	1.49(0.0.11,20.57)	–	–
College or vocational training	–	1.77 (0.0.19, 15.82)	–	–
University	–	–	–	–
Stigma to HIV infection				
Yes			1	–
No			5.91(1.69, 15.56)	–
Feeding counseling during ANC				
No	1	–	1	–
Yes	5.38 (1.83, 15.81)	–	5.91(1.06, 34.31)	–
Knowledge about PMTCT during breastfeeding				
Yes	–	–	–	1
No	–	–	–	9.73 (3.37, 28. 08)

**Adjusted for age and education.*

*** Adjusted for age*

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STROBE Statement—Checklist of items that should be included in reports of ***cross-sectional studies***

	Item No	Recommendation	Page # in Manuscript
Title and abstract	1	(*a*) Indicate the study's design with a commonly used term in the title or the abstract	1
		(*b*) Provide in the abstract an informative and balanced summary of what was done and what was found	2
Introduction			
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported	5-6
Objectives	3	State specific objectives, including any pre-specified hypotheses	6-7
Methods			
Study design	4	Present key elements of study design early in the paper	8
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	8
Participants	6	(*a*) Give the eligibility criteria, and the sources and methods of selection of participants	8-9
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	9
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group	*9*
Bias	9	Describe any efforts to address potential sources of bias	10
Study size	10	Explain how the study size was arrived at	8-9
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	10
Statistical methods	12	(*a*) Describe all statistical methods, including those used to control for confounding	10-11
		(*b*) Describe any methods used to examine subgroups and interactions	10-11
		(*c*) Explain how missing data were addressed	N/A
		(*d*) If applicable, describe analytical methods taking account of sampling strategy	N/A
		(*e*) Describe any sensitivity analyses	N/A

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Results			
Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed	11
		(b) Give reasons for non-participation at each stage	N/A
		(c) Consider use of a flow diagram	
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders	11
		(b) Indicate number of participants with missing data for each variable of interest	N/A
Outcome data	15*	Report numbers of outcome events or summary measures	11-12
Main results	16	(*a*) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included	12-13
		(*b*) Report category boundaries when continuous variables were categorized	N/A
		(*c*) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	N/A
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses	N/A
Discussion			
Key results	18	Summarise key results with reference to study objectives	14,15
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias	19-20
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	14-19
Generalisability	21	Discuss the generalisability (external validity) of the study results	20
Other information			
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	N/A

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*Give information separately for exposed and unexposed groups.

Note: An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at http://www.plosmedicine.org/, Annals of Internal Medicine at http://www.annals.org/, and Epidemiology at http://www.epidem.com/). Information on the STROBE Initiative is available at www.strobe-statement.org.

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Knowledge, Attitudes and Practices Regarding Infant Feeding Among HIV-Infected Pregnant Women in Gaborone, Botswana: A Cross-Sectional Survey

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Knowledge, Attitudes and Practices Regarding Infant Feeding Among HIV-Infected Pregnant Women in Gaborone, Botswana: A Cross-Sectional Survey

Justina Ndubuka[1], DVM, MPH

Nnamdi Ndubuka[2], MD, Dip HIV Mgt (SA), MPH

Ying Li[3,4], PhD, MSc

Caitlin M. Marshall[4], MPH

John Ehiri[4], PhD, MPH, MSc (Econ.)

Author for Correspondence:
John E. Ehiri, PhD

Author affiliations

[1]School of Population, Community & Behavioural Sciences, University of Liverpool Liverpool L69 3BX, United Kingdom

[2]Botswana-Harvard School of Public Health, AIDS Institute Partnership, Gaborone, Botswana

[3]Department of Social Medicine & Health Service Management, Third Military Medical University, Chongqing, China

[4]Division of Health Promotion Sciences/Global health Institute, Mel & Enid Zuckerman College of Public Health, University of Arizona, Tucson, Arizona, USA

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ABSTRACT

Objectives: To assess knowledge, attitudes and practices regarding infant feeding among HIV-positive pregnant women in Gaborone, Botswana, and factors that influences their infant feeding choices.

Design: A cross-sectional study.

Methods and study setting: Questionnaire survey of 96 HIV positive pregnant women attending four public infectious disease control clinics in Gaborone, Botswana. .

Results: Only about half of the study participants had knowledge about prevention of mother-to-child transmission (PMTCT) services related to breastfeeding, and very few (19.8%) chose to breastfeed their infants exclusively. Results of multiple logistic regression analysis showed that receiving infant feeding counselling as part of the PTMCT program was significantly associated with decision to exclusively breastfeed (OR[95%CI]: 5.38 [1.83, 15.81]). Similarly, HIV positive pregnant women who received breastfeeding counselling through the PMTCT program had higher knowledge of PMTCT practices related to appropriate infant feeding (OR[95%CI]: 5.91[1.06, 34.31]). Women who did not expressed concern about HIV stigma had significantly higher knowledge of PMTCT practices related to infant feeding (OR [95%CI]: 5.91[1.69, 15.56]). Knowledge of PMTCT practices related to breastfeeding was negatively associated with the belief that breastfeeding could transmit HIV to the baby (OR[95%CI]: 9.73 [3.37, 28. 08]).

Conclusion: Knowledge, attitudes and practices related to breastfeeding among HIV positive pregnant women needs further improvement, and PMTCT program should

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strengthen infant feeding counseling services to assist HIV positive mothers in making informed and appropriate decisions regarding infant feeding.

Key words: Infant feeding, exclusive breastfeeding, exclusive formula feeding, HIV/AIDS, PMTCT, Botswana.

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ARTICLE SUMMARY

Article focus:

- To describe knowledge, attitudes and practices regarding infant feeding among HIV positive pregnant women.
- To explore factors that influence knowledge, attitudes and practices related to breastfeeding among HIV positive pregnant women.
- To provide evidence to improve infant feeding practices for the prevention of mother-to-child transmission of HIV.

Key messages

- Overall, HIV positive pregnant women had inadequate knowledge about PMTCT services related to infant feeding, and very few chose to breastfeed their infants exclusively.
- PMTCT programs should strengthen counseling services to assist HIV positive mothers in making informed and appropriate decisions regarding infant feeding based on the World Health Organization's 2010 guidelines on HIV and infant feeding in the context of HIV.

Strengths and limitations of this study

- Results of this study provide a snap shot assessment of the quality of implementation of Botswana's PMTCT guidelines.
- The main limitation is that only HIV infected pregnant women who attended the four participating infectious disease control clinics (IDCCs) were included in the study. This limits the ability to generalize findings to all HIV infected pregnant women in Botswana's National PMTCT program.

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INTRODUCTION

Epidemiological data from the Joint United Nations Program on AIDS estimates the prevalence of HIV among adults aged 15-49 years in Botswana to be 23.40%, with more than 160,000 women aged 15-49 years currently living with HIV/AIDS.[1] According to the Republic of Botswana's Global AIDS Response Report prepared in collaboration with the Botswana National AIDS Coordinating Agency (NACA), the national prevalence of HIV among pregnant women aged 15-49 years is 30.4%, with an estimated 13,072 HIV infected women giving birth annually.[2-3] In the absence of interventions to prevent transmission during pregnancy, delivery, or breastfeeding for HIV infected pregnant women, it is estimated that 35% of births will result in mother-to-child transmission of HIV.[3-4] According to the World Health Organization (WHO), if effective interventions are implemented to prevent mother-to-child transmission (PMTCT), the rate can be reduced to less than 5%.[4]

Due to the transmissibility of HIV from mother to child, feeding of HIV-exposed infants remains a significant challenge in controlling the spread of HIV/AIDS. The dilemma concerning feeding infants of HIV positive mothers is how to balance the risk of HIV transmission through breastfeeding with the risk of death from causes other than HIV such as pneumonia, diarrheal diseases, and malnutrition among formula-fed infants.[5] Exclusive breastfeeding (EBF) plays a critical role in the overall health of infants. It is estimated that 3% of all under-5 mortalities in low income countries could be prevented through optimal breastfeeding during the crucial first year of life.[6] Optimal breastfeeding

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is considered to be EBF for the first 6 months of life, followed by continued breastfeeding combined with safe and nutritionally adequate complementary feeding up to 24 months of age.[7-9] EBF is regarded as a global health goal given its strong association with reduced morbidity and mortality particularly in low-income countries where safe water and sanitation are often lacking.[10]

In 2011, the Government of Botswana (GoB) revised the Botswana National PMTCT guidelines and initiated the use of highly active antiretroviral therapy (HAART) for all HIV infected pregnant women regardless of their CD4 cell count. The goal was to prevent mother-to-child transmission of HIV by providing HAART to pregnant women who would otherwise, not qualify for treatment, based on their CD4 cell count.[3] For many years, the GoB had recommended that HIV infected women exclusively formula feed their infants and provided infant formula free-of-charge until the infant is one year of age to support this recommendation.[3] However, in 2011, the Botswana Ministry of Health (MoH) recommended exclusive formula feeding (EFF) for the first 6 months of life only for women for whom formula feeding is acceptable, feasible, affordable, sustainable and safe (AFASS).[3,11,12] Botswana has one of the most comprehensive maternal and child health services in sub-Saharan Africa, with nearly 95% of pregnant women receiving prenatal care, and having their deliveries attended by a health professional in a health facility.[9] During prenatal visits all pregnant women regardless of their HIV status, are provided with education and counseling according to the country's infant and young child feeding guidelines (based on the WHO 2010 recommendations[9]) to ensure that they make informed and appropriate infant feeding choices.[3,9] They are also

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assessed for AFASS using the following criteria: piped water in the house or yard (safety); electricity, gas or paraffin for cooking fuel (feasibility); disclosure of HIV status by 3 weeks after birth (acceptability); having someone in the household employed (affordability and sustainability); and access to a fridge for storage of prepared formula (safety). Depending on outcome of the AFASS assessment, HIV infected pregnant women are supported in their decision to either formula feed or breastfeed their infant. For HIV positive mothers for whom formula feeding is not AFASS, optimal breastfeeding should be recommended and strongly encouraged.

Exclusive breast feeding has traditionally been promoted as an important intervention to prevent child morbidity and mortality in low income countries. In addition to the nutritional value of breast milk for infants during their first months of life, dependence on breast milk reduces their exposures to contaminated food and drinks, and also protects them against diarrhea through the anti-infective properties of breast milk. With the emergence of evidence linking breast feeding with mother-to-child-transmission of HIV, many women are conflicted on the issue of whether or not to breast fed their babies. Research evidence has also shown that poor-quality counseling in PMTCT programs and the effects of mass media have created widespread confusion for HIV infected mothers regarding feeding their infant despite the presence of national guidelines.[13] Women who may be confused by these messages often fail to receive advice to practice EBF which may result in mixed feeding and an increased risk of HIV transmission.[14] The main objectives of the study were to identify factors that influence infant feeding choices of HIV infected pregnant women, to provide data for evidence-based decision to improve

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the quality of Botswana's PMTCT program, and to allow Botswana MoH to assess implementation of the revised guidelines in order to strengthen future efforts. It is hoped that findings from this study will be of value not only to the Botswana AIDS Control Program, but also to other PMTCT programs in sub-Saharan Africa and other low and middle countries where pediatric HIV/AIDS is a public health challenge.

METHODS

A cross-sectional design was used for the study.

Setting

The study was conducted in four public infectious disease control clinics (IDCCs) in Gaborone, Botswana, managed by the Gaborone City Council. These clinics were selected because the study population of interest (eligible HIV infected pregnant women) they provide access to universal HAART prophylaxis, and thus, constitute a reliable sampling frame from which participants were recruited.

Study population

The study population included all HIV infected pregnant women attending IDCCs in Gaborone for universal HAART program services during the study period. All HIV infected pregnant women who presented at any of the four IDCCs during the study period had an equal and independent chance of being included in the study.[15] HIV infected pregnant women who were Botswana citizens, aged 21 years and above, and willing to

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participate in the study by providing informed consent were eligible for inclusion. During informed consent, the rationale for the study was explained to potential respondents (in the local language, Setswana) and their voluntary participation was sought. All respondents were informed that their participation was voluntary, and that if they chose not to participate, they would not lose any benefits from their health facility. They were also informed of their right to withdraw from the study at any time. Women who volunteered to participate in the study were asked to sign the inform consent form. Those who could not read or write were asked to give their thumb print as a confirmation of their consent. Thus, participation in the study was entirely voluntary and no incentives were provided to respondents. Respondents were assured of confidentiality, and only study unique identification numbers were used on the questionnaires. Approval for the study was obtained from the Ethics Committee of the University of Liverpool, England and from the Botswana Ministry of Health through the Health Research and Development Committee (HRDC).

Data collection

Data were collected using a structured, interviewer-administered questionnaire. Eligible respondents were interviewed and data were transcribed from their medical records onto the questionnaire. The questionnaire consisted of 33 items that were constructed based on a review of the literature.[16] The questionnaire was translated into the local language (Setswana) and pre-tested on five IDCC attendees who were not involved in the final survey. The questionnaire had the following subsections: socio-demographic information,

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clinical information, knowledge about PMTCT, and infant feeding practices/intentions. Items of the questionnaire elicited information on participants' sociodemographic characteristics, their knowledge of the objectives of HAART, knowledge of mother-to-child transmission of HIV, strategies to reduce mother-to-child transmission of HIV during pregnancy, knowledge of infant feeding practices in the context of HIV, the benefits of exclusive breastfeeding, knowledge of the role of mixed feeding (breastfeeding and formula feeding) in mother-to-child transmission of HIV, access to infant feeding counseling in the context of HAART, infant feeding choices and reasons for the choices, important persons in the decision to breastfeed or formula feed, etc. Data were collected over a period of four weeks (June 11 to July 9, 2012) through interviews administered by an interpreter who was fluent in the local language (Setswana) and received training on ethical conduct of research and data collection.

Data analysis

All questionnaires were entered onto Excel spreadsheet and checked for accuracy and completeness. The data were then exported to the Statistical Package for Social Sciences (SPSS) version 19 for analysis. With regard to knowledge of PMTCT and PMTCT practices during breastfeeding, we first provided a summary of the number of correct responses by participants, and later categorized the responses as either "high" knowledge when a respondent responded correctly to all of the questions, or "low" knowledge when a participant responded incorrectly to one or more of the questions. Descriptive statistics were used to describe and summarize other variables such as socio-demographic

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characteristics of respondents, clinical information, knowledge of PMTCT, and the important person in decision-making on infant feeding choices.[15] Pearson Chi-Square or Fisher's Exact Test was used to compare results between groups. Multiple logistic regression analyses were also employed to control for possible confounding factors and to assess the separate effects of the study variables. Odds ratios (OR) with 95% confidence intervals (95% CI) were computed to assess factors associated with the choice of breastfeeding, knowledge of PMTCT and PMTCT practices related to breastfeeding. A two-tailed probability level of $p < 0.05$ was chosen as the level of statistical significance.

RESULTS

Characteristics of respondents

Of a total of 102 women from the infectious disease control clinics (IDCCs) who were eligible for inclusion in the study, 96 volunteered to participate, yielding a response rate of 94.1%. The demographic characteristics of participants, including age, marital status, education, employment status and parity are shown in Table 1. Respondents aged 21-25 years constituted the majority (43.8%; n=42). With regard to marital status, a majority (92.7%, n=89) of the respondents identified themselves as single or co-habiting. Only 7.3% (n=7) had university-level education. Regarding employment status of the respondents, 39.6% (n=38) were unemployed during the study period. About half of the study participants (53.1%; n=51) had 1-2 children; and 34.4% (n=33) were pregnant for the first time.

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All respondents were taking some form of HAART regimen at the time of the study. Table 1 shows that a majority of the respondents (85.4%; n=82) indicated that they received Atripla as their HAART regimen while 6.3% (n=6) received a combination of Combivir and Nevirapine (CBV+NVP). As shown in Table 1, nearly half of the respondents (55.2%; n=53) identified their husbands/partners as the most influential individual with regard to their choice of infant feeding method. Only 66 of the respondents (70.2%) indicated that they were counseled on infant feeding options recommended for HIV infected women.

As for KAP related to breastfeeding among the respondents, 56.3% of respondents believed that an infant of an HIV infected mother could become infected with HIV when breastfed, and 88.4% were concerned about AIDS stigma related to HIV and infant feeding choices. Only about half of the respondents had high knowledge about PMTCT and PMTCT-related practices related to breastfeeding. Less than one in five (19.8%) made the decision to exclusively breastfeed their babies (Table 1).

Knowledge and practices related to breastfeeding among HIV infected pregnant women

Data on knowledge and choice of breastfeeding method are presented in Table 2. Pearson Chi-Square (or Fisher's Exact Test) was used to determine associations between categorical data. Multiple logistic regression analysis was used to assess factors associated with knowledge and choice of infant feeding method. Results indicated that

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receiving infant feeding counseling as part of the PTMCT program was significantly associated with the decision to exclusively breastfeed (OR[95%CI]: 5.38 [1.83, 15.81]). Receiving infant infant feeding counseling as part of the PMTCT program was also, significantly associated with high knowledge of PMTCT practices related to breastfeeding (OR[95%CI]: 5.91[1.06, 34.31]). Women who did not express concern about AIDS stigma had significantly higher knowledge of PMTCT practices related to infant feeding (OR [95%CI]: 5.91[1.69, 15.56]). Knowledge of PMTCT practices related to breastfeeding was negatively associated with the belief that breastfeeding could transmit HIV to baby (OR[95%CI]: 9.73 [3.37, 28. 08]).

DISCUSSION

The basic ethical principle of 'informed choice' requires that HIV positive women are provided with adequate information about their infant feeding options in the context of prevention of mother to child transmission of HIV.[17] This study observed that only about half of the HIV infected women had knowledge of PMTCT and PMTCT practices related to breastfeeding. This finding is similar to that demonstrated by Hailu[18] who found that only 30.5% of women in Jimma, Ethiopia had sufficient knowledge of infant feeding options recommended for HIV positive women.[18] Results revealed that counselling on infant feeding provided as part of the PMTCT program was significantly associated with knowledge of PMTCT practices related to breastfeeding [OR(95%CI): 5.91(1.06, 34.31)]. Although the Botswana National PMTCT guideline recommends that all pregnant women be counseled on infant feeding choices, only 70% of the respondents indicated that they

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received such counseling. This suggests that gaps exist within the PMTCT program guidelines and actual practice.

The Botswana Government had promoted exclusive formula feeding by HIV infected women for many years but presently allows these women to make informed infant feeding choices.[3] However, informed decision-making can only take place when the women are provided with individualized, unbiased and accurate information about infant feeding options, and when this information is presented in a way that is compatible with women's beliefs and at an appropriate health literacy level.[17,19] This underscores the need for training and re-training of maternal and child health workers in the rational, principles, and methods of infant feeding counseling in the context HIV infection, based on WHO and national guidelines on infant feeding in the context of HIV.[3,9] Similarly, providing every pregnant woman with a brief guidance manual on infant feeding in the context of HIV infection written in the local language, and with appropriate pictorial explanations might help to ensure that all deserving mothers have access to uniform standard information based upon which they can make informed choices about infant feeding.

The Botswana Family Health Survey showed that only 20% of mothers breastfed exclusively for the first six months.[20] Similarly, our study found that less than 1 in 5 (19.8%) HIV infected mothers chose to exclusively breastfeed. This finding is in agreement with those of Tomasoni et al[21] and Hailu[18] who found similar low rates of EBF among HIV positive mothers (46% and 13.4% respectively).

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Previous studies have explored factors associated with choice of breastfeeding among HIV infected women. The study by Hailu[18] found that infant feeding choices made by lactating mothers in Ethiopia were significantly associated with their age, while a South African study reported that sociocultural factors (including social stigma of HIV/AIDS, maternal age and family influences on feeding practices, economic circumstances, beliefs about HIV transmission through breast milk and beliefs about the quality of breast milk compared to formula) influenced the decision to exclusively breastfeed. As demonstrated in our study, counseling on infant feeding during antenatal visits was an important predictor of infant feeding choices.

It is noteworthy that women who did not expressed concern about AIDS stigma had significantly higher knowledge of PMTCT practices related to infant feeding. This may be an indication of the barrier that AIDS-related stigma poses against uptake of PMTCT services among HIV infected pregnant women in the study setting. It is known that for social stigma to present a barrier against uptake of services, effected individuals must accept the devaluation and discrediting that accompany the stigma. They must perceive themselves as guilty of moral transgression and accept the blame put on them.

It is important for PMTCT programs to address stigma in order to promote service uptake. Since many of the key influences on AIDS-related stigma and discrimination are broad-based and deeply rooted with the structures of communities, the most effective interventions would be those with sound theoretical foundations, and that include attention to individual as well as social and structural barriers. In a review of AIDS-

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related stigma in sub-Saharan Africa, Ehiri et al.[22] presented the case for a multi-level approach that involves action directed at health workers, religious leaders, members of the judicial system, the media, people living with HIV/AIDs, and their family members.

HIV-infected pregnant women are encouraged to exclusively breastfeed their infants for at least 6 months with proper HAART in both high and low-income countries owing to the proven benefits of breastfeeding for both the mother and the infant.[23-24] For example, results of a clinical trial in Kenya indicated that giving breastfeeding women a triple-ARV regimen from late pregnancy to 6 months after birth is a safe, feasible way to reduce MTCT in resource-limited settings.[25] A cohort study in India found higher rates of HIV-free survival in breastfed infants, reporting a cumulative 12-month mortality of formula-fed infants of 9.6% versus 0.68% among breastfed infants[26]. Indeed, WHO's recommendation that all mothers who are known to be HIV-infected either on lifelong ART or not, who exclusively breastfeed their infants should do so for 6 months, introduce appropriate complementary foods thereafter and continue breastfeeding for the first 12 months of life is based on a plethora of research that demonstrate the positive effect of exclusive breastfeeding on HIV-free survival of infants born to HIV infected mothers.[27-32]

Evidence shows that there is significant benefit of breastfeeding regardless of the setting as it has been shown to result in positive health outcomes for infants, even in countries with reliable water and sanitation systems, where gastrointestinal problems and other infectious diseases are not a concern.[33-34]

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A majority of the women in this study (80.2%) opted to formula feed their babies. This could be explained by the fact that many health care workers commonly prescribe or encourage formula feeding despite the availability of evidence supporting EBF where formula feeding is not acceptable, feasible, affordable, sustainable and safe (AFASS). Doherty et al[34] conducted a series of qualitative interviews of a prospective cohort of 650 HIV positive mothers in South Africa and considered the influence of healthcare workers on infant feeding choices. The study concluded that health workers possess significant influence over HIV infected women's initial infant feeding choices. Doherty et al.[34] stated that some women expressed feeling pressured or 'forced' by their provider to choose a particular feeding method as a result of their HIV status. Available evidence shows that women who received formula company-produced infant feeding materials from their health providers at their first prenatal visit were more likely than those who did not receive these materials to stop breastfeeding before hospital discharge and before 2 weeks postpartum. Those who were uncertain about their decision to breastfeed, or with a plan to breastfeed for 12 weeks or less, and who received the commercial materials from their health providers also had notably lower rates of exclusive breastfeeding and overall duration.[35]

Thus, understanding ethical considerations and providing unbiased information about infant feeding options at the provider level has the potential to improve outcomes of PMTCT services in Botswana and similar low and middle income countries where mother-to-child transmission of HIV is a public health challenge.

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Strengths and limitations

Given the small size for this study, results provide only a snapshot assessment of the effectiveness of implementation of the Botswana PMTCT guidelines of 2011, which provide HIV infected pregnant women the opportunity to make informed infant feeding choices. It is important to note that only HIV infected pregnant women who attended the four study IDCCs during the period of the study period were recruited. Those that attended non-participating IDCCs were not interviewed. These patients might have had different KAP regarding infant feeding choices from those who were interviewed. Therefore, findings from this study cannot be generalized to all HIV infected pregnant women in the Botswana National PMTCT program.

Implications

Pediatric AIDS remains a major contributor to child mortality in resource poor countries; thus, interventions that seek to significantly reduce mother-to-child transmission of HIV have the potential to contribute towards achievement of the Millennium Development Goal of reducing child mortality by two thirds by 2015 from the 1990 level.

The finding that a majority of the participants do not receive the recommended counseling on infant feeding underscores the need for PMTCH programs in low income countries to take proper care to understand global and national recommendations on infant feeding in the context of HIV, and to find appropriate ways to communicate research evidence to HIV infected women so they can make informed choices regarding infant feeding option.

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The finding that a majority of the respondents in this study (92.7%, n=89) identified themselves as either single or co-habiting calls for a need to target this population group with interventions to reduce HIV infection through reduction of risky sexual behaviors.

Further research using qualitative or mixed method approaches are need to explore enablers and barriers in provision of infant feeding counseling recommended for all HIV infected pregnant women. Efforts should be made to understand health workers' challenges in implementing this recommendation, and the reasons why some HIV infected women do not receive infant feeding counseling need to be explored. To gather generalizable information that can be used to improve the quality of Botswana's PMTCT program, it would be beneficial to replicate this study at other IDCC sites as well as ANC clinics in the country. To effectively improve EBF rates amongst HIV infected women, policy makers must make concerted efforts to advocate, promote, and sustain the universal HAART program for pregnant women, and strengthen ANC services. The Botswana Ministry of Health should provide adequate training of healthcare workers on infant feeding counseling for HIV infected women to ensure that they are in a good position to provide unbiased and balanced infant feeding counseling to their clients.

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Table 1: Characteristics of Participants (N=96)

Characteristics		No.	%
Age group (years)	21-25	42	43.8
	26-30	30	31.3
	31-35	18	18.8
	36-40	5	5.2
	41-45	1	1

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Marital status	Single	41	42.7
	Married	4	4.2
	Cohabiting	48	50.0
	Separated	3	3.1
Educational level	Primary school	15	15.6
	Junior secondary	29	30.2
	Junior secondary with additional training	8	8.3
	Senior secondary	27	28.1
	College or vocational training	10	10.4
	University	7	7.3
Employment status	Unemployed	38	39.6
	Government employee	8	8.3
	Private Employee	37	38.5
	Self-employed	7	7.3
	Volunteer	2	2.1
	Student	4	4.2
Parity	1-2	51	53.1
	3-4	10	10.4
	5 or more	2	2.1
	None	33	34.4
HAART Regimen received	Atripla (FTC+TDF+EFV)	81	84.4
	CBV+NVP	6	6.3
	CBV+Kaletra	5	5.2
	TDF+FTC+Kaletra		
	Others	4	4.2
Reasons for receiving HAART	PMTCT (Universal HAART)	66	68.8
	Maternal Treatment	30	31.3
Most important person in making decision on infant feeding	My father	3	3.1
	My husband/partner	53	55.2
	My mother	32	33.3
	My Sister	5	5.2
	My Aunt	3	3.1
Received Infant feeding counseling during ANC (N=94)	Yes	66	70.2
	No	28	29.8

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Chose to breastfeed	Yes	19	19.8
	No	77	80.2
Believe breastfeeding transmits HIV to baby	Yes	54	56.3
	No	42	43.8
Concerned about HIV stigma	Yes	84	88.4
	No	11	11.6
Knowledge of PMTCT	1 correct response	4	4.2
	2 correct response	17	17.7
	3 correct response	25	26.0
	4 correct response	50	52.1
Knowledge of PMTCT related to breastfeeding	1 correct response	1	1.0
	2 correct response	0	0.00
	3 correct response	2	2.1
	4 correct response	5	5.2
	5 correct response	13	13.5
	6 correct response	26	27.1
	7 correct response	49	51.0

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Table 2: Respondents' kknowledge of PMTCT and choice of breastfeeding

Variable	Choice of exclusive breastfeeding		Knowledge about PMTCT		Knowledge about PMTCT practice related to breastfeeding		Breastfeeding transmits HIV to baby	
	Yes No. (%)	No No. (%)	High No. (%)	Low No. (%)	High No. (%)	Low No. (%)	Yes No. (%)	No No. (%)
Age group (years)								
21-25	14(33.3)	28(66.7)	22(52.4)	20(47.6)	25(59.5)	17(40.5)	29(69.0)	13(31.0)
26-30	3(10.0)	27(90.0)	15(50.0)	15(50.0)	16(53.3)	14(46.7)	16(53.3)	14(46.7)
31-35	2(11.1)	16(88.9)	10(55.6)	8(44.4)	6(33.3)	12(66.7)	7(38.9)	11(61.1)
36-40	0(0.0)	5(100.0)	2(40.0)	3(60.0)	1(20.0)	4(80.0)	2(40.0)	3(60.0)
41-45	0(0.0)	1(100.0)	1(100.0)	0(0)	1(100.0)	0(0.0)	0(0.0)	1(100.0)
Marital status								
Single	12(29.3)	29(70.7)	34(82.9)	7(17.1)*	32(78.0)	9(22.0)*	39(95.1)	2(4.9)*
Married	0(0.0)	4(100.0)	3(75.0)	1 (25.0)	3(75.0)	1(25.0)	2(50.0)	2(50.0)
Cohabiting	6(12.5)	42(87.5)	12(25.0)	36(75.0)	13(27.1)	35(72.9)	13(27.1)	35(72.9)
Separated	1(33.3)	2(66.7)	1(33.3)	2(66.7)	1(33.3)	2(66.7)	0(0.0)	3(100.0)
Educational level								
Primary school	5(33.3)	10(66.7)	13(86.7)	2(13.3)*	9(60.0)	6(40.0)	13(86.7)	2(13.3)
Junior secondary	6(20.7)	23(79.3)	19(65.5)	10(34.5)	14(48.3)	15(51.7)	16(55.2)	13(44.8)
Junior secondary with additional training	3(37.5)	5(62.5)	3(37.5)	5(62.5)	5(62.5)	3(37.5)	6(75.0)	2(25.0)
Senior secondary	4(14.8)	23(85.2)	11(40.7)	16(59.3)	13(48.1)	14(51.9)	13(48.1)	14(51.9)
College or vocational training	1(10.0)	9(90.0)	0(0.0)	10(100.0)	4(40.0)	6(60.0)	3(30.0)	7(70.0)
University	0(0.0)	7(100.0)	4(57.1)	3(42.9)	4(57.1)	3(42.9)	3(42.9)	4(57.1)
Employment status								
Unemployed	10(26.3)	28(73.7)	23(60.5)	15(39.5)	23(60.5)	15(39.5)	24(63.2)	14(36.8)
Government employee	2 (25.0)	6(75.0)	3 (37.5)	5(62.5)	3(37.5)	5(62.5)	2(25.0)	6(75.0)
Private Employee	4(10.8)	33(89.2)	15(40.5)	22(59.5)	18(48.6)	19(51.4)	19(51.4)	18(48.6)
Self-employed	2(28.6)	5(71.4)	4(57.1)	3(42.9)	2(28.6)	5(71.4)	5(71.4)	2(28.6)
Volunteer	1(50.0)	1(50.0)	2(100.0)	0(0.0)	1(50.0)	1(50.0)	2(100.0)	0(0.0)
Student	0(0.0)	4(100.0)	3(75.0)	1(25.0)	2(50.0)	2(50.0)	2(50.0)	2(50.0)
Parity								
2-Jan	9(17.6)	42(82.4)	20(39.2)	31(60.8)*	20(39.2)	31(60.8)*	22(43.1)	29(56.9)*
4-Mar	1(10.0)	9(90.0)	9(90.0)	1(10.0)	7(70.0)	3(30.0)	8(80.0)	2(20.0)
5 or more	0(0.0)	2(100.0)	2(100.0)	0(0.0)	0(0.0)	2(100.0)	1(50.0)	1(50.0)

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None	9(27.3)	24(72.7)	19(57.6)	14(42.4)	22(66.7)	11(33.3)	23(69.7)	10(30.3)
HAART Regimen received								
Atripla (FTC+TDF+EFV)	17(21.0)	64(79.0)*	43(53.1)	38(46.9)*	42(51.9)	39(48.1)*	48(59.3)	33(40.7)
CBV+NVP	1(16.7)	5(83.3)	2(33.3)	4(66.7)	3(50.0)	3(50.0)	1(16.7)	5(83.3)
CBV+Kaletra	1(20.0)	4(80.0)	5(100.0)	0(0.0)	4(80.0)	1(20.0)	4(80.0)	1(20.0)
TDF+FTC+Kaletra								
Others	0(0.0)	4(100.0)	0(0.0)	4(100.0)	0(0.0)	4(100.0)	1(25.0)	3(75.0)
Reasons for receiving HAART								
PMTCT	15(22.7)	51(77.3)	36(54.5)	30(45.5)	36(54.5)	30(45.5)	42(63.6)	24(36.4)*
Maternal Treatment	4(13.3)	26(86.7)	14(46.7)	16(53.3)	13(43.3)	17(56.7)	12(40.0)	18(60.0)
Most important person in making decision on infant feeding								
My father	2(66.7)	1(33.3)	3(100.0)	0(0.0)	1(33.3)	2(66.7)	3(100.0)	0(0.0)
My husband/partner	10(18.9)	43(81.1)	27(50.9)	26(49.1)	25(47.2)	28(52.8)	30(56.6)	23(43.4)
My mother	7(21.9)	25(78.1)	15(46.9)	17(53.1)	19(59.4)	13(40.6)	16(50.0)	16(50.0)
My Sister	0(0.0)	5(100.0)	4(80.0)	1(20.0)	2(40.0)	3(60.0)	4(80.0)	1(20.0)
My Aunt	0(0.0)	3(100.0)	1(33.3)	2(66.7)	2(66.7)	1(33.3)	1(33.3)	2(66.7)
Concerned about AIDS stigma								
Yes	16(19.0)	68(81.0)	47(56.0)	37(44.0)	47(56.0)	37(44.0)*	51(60.7)	33(39.3)*
No	3(27.3)	8(72.7)	3(27.3)	8(72.7)	2(18.2)	9(81.8)	3(27.3)	8(72.7)
Received infant feeding counseling during ANC								
Yes	18(27.3)	48(72.7)*	41(62.1)	25(37.9)*	42(63.6)	24(36.4)*	44(66.7)	22(33.3)*
No	1(3.6)	27(96.4)	8(28.6)	20(71.4)	7(25.0)	21(75.0)	10(35.7)	18(64.3)
Believed breastfeeding transmits HIV to baby								
Yes	14(25.9)	40(74.1)	38(70.4)	16(29.6)*	39(72.2)	15(27.8)*	–	–
No	5(19)	37(77)	12(28.6)	30(71.4)	10(23.8)	32(76.2)	–	–
Knowledge of PMTCT								
High	13(26.0)	37(74.0)	–	–	–	–	38(76.0)	12(24.0)*
Low	6(13.0)	40(87.0)	–	–	–	–	16(34.8)	30(65.2)
Knowledge about PMTCT related to breastfeeding								
High	9(18.4)	40(81.6)	–	–	–	–	39(79.6)	10(20.4)*
Low	10(21.3)	37(78.7)	–	–	–	–	15(31.9)	32(68.1)

☼*Pearson Chi-Square or Fisher's Exact Test was used to compare results between groups.*

**P<0.05*

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Table 3: Multi logistic analysis of factors associated with choice of infant feeding options, knowledge of PMTCT, and knowledge of PMTCT practices related to breastfeeding

Variable	Choice of exclusive breastfeeding OR(95%CI)*	High knowledge of PMTCT OR(95%CI)**	High knowledge of PMTCT during breastfeeding OR(95%CI)**	Breastfeeding could transmit HIV to baby*
Marital status				
Single	–	1	–	–
Married	–	34.37 (0.72, 46.77)	–	–
Cohabiting	–	8.17 (0.07, 13.00)	–	–
Separated	–	0.75(0.02, 31.77)	–	–
Educational level				
Primary school	–	1	–	–
Junior secondary	–	8.81 (0.63, 21.89)	–	–
Junior secondary with additional training	–	6.24 (0.65, 64.38)	–	–
Senior secondary	–	1.49(0.0.11, 20.57)	–	–
College or vocational training	–	1.77 (0.0.19, 15.82)	–	–
University	–	–	–	–
Concerned about HIV stigma				
Yes			1	–
No			5.91(1.69, 15.56)	–
Received infant feeding counseling during ANC				
No	1	–	1	–
Yes	5.38 (1.83, 15.81)	–	5.91(1.06, 34.31)	–
Knowledge of PMTCT related to breastfeeding				
Yes	–	–	–	1
No	–	–	–	9.73 (3.37, 28. 08)

**Adjusted for age and education.*

*** Adjusted for age*

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Knowledge, Attitudes and Practices Regarding Infant Feeding Among HIV-Infected Pregnant Women in Gaborone, Botswana: A Cross-Sectional Survey

Justina Ndubuka[1], DVM, MPH

Nnamdi Ndubuka[2], MD, Dip HIV Mgt (SA), MPH

Ying Li[3,4], PhD, MSc

Caitlin M. Marshall[4], MPH

John Ehiri[4], PhD, MPH, MSc (Econ.)

Author for Correspondence:
John E. Ehiri, PhD

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ABSTRACT

Objectives: To assess knowledge, attitudes and practices regarding infant feeding among HIV-positive pregnant women in Gaborone, Botswana, and factors that influences their infant feeding choices.

Design: A cross-sectional study.

Methods and study setting: ~~T~~Questionnaire survey of ~~he study assessed knowledge, attitudes and practices regarding infant feeding among~~ 96 HIV -positive pregnant women attending four public infectious disease control clinics in Gaborone, Botswana. ~~by means of a questionnaire survey of women attending four public infectious disease control clinics in Gaborone, Botswana~~.

Results: Only about half of the study participants ~~women~~ had knowledge about prevention of mother-to-child transmission (PMTCT) services related to breastfeeding, and very few (19.8%) chose to breastfeed their infants exclusively. Results of multiple logistic regression analysis showed that receiving infant feeding counselling as part of the PTMCT program was significantly associated with decision to exclusively breastfeed (OR[95%CI]: 5.38 [1.83, 15.81]). Similarly, HIV positive pregnant women who received breastfeeding counselling through the PMTCT program had higher knowledge of PMTCT practices related to appropriate infant feeding (OR[95%CI]: 5.91[1.06, 34.31]). Women who did not expressed concern about ~~did not expressed perceptions of self (internalized)~~ HIV ~~AIDS related~~ stigma had significantly higher knowledge of PMTCT practices related to infant feeding (OR [95%CI]: 5.91[1.69, 15.56]). Knowledge of PMTCT practices related to breastfeeding was negatively associated with the belief that

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breastfeeding could transmit HIV to the baby (OR[95%CI]: 9.73 [3.37, 28. 08]).

Conclusion: Knowledge, attitudes and practices related to breastfeeding among HIV positive ~~infected~~ pregnant women needs further improvement, and PMTCT program should strengthen infant feeding ~~nutrition~~ counseling services to assist HIV ~~-~~positive mothers in making informed and appropriate decisions regarding infant feeding.

Key words: Infant feeding, exclusive breastfeeding, exclusive formula feeding, HIV/AIDS, PMTCT, Botswana.

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ARTICLE SUMMARY

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Article focus:

- To describe knowledge, attitudes and practices regarding infant feeding among HIV -positive pregnant women.
- To explore factors that influence knowledge, attitudes and practices related to breastfeeding among HIV -positive pregnant women.
- To provided evidence to improve infant breastfeeding practices for the prevention of mother-to-child transmission of HIV(PMTCT) program.

Key messages

- Overall, HIV positiveHIV positive pregnant women had inadequate knowledge about PMTCT services related to infant breastfeeding, and very few chose to breastfeed their infants exclusively.
- PMTCT programs should strengthen counseling services to assist HIV -positive mothers in making informed and appropriate decisions regarding infant feeding based on the World Health Organization's -2010 guidelines on HIV and infant feeding in the context of HIV.

Strengths and limitations of this study

- Results of this study provide a snap shot n assessment of the quality effectiveness of implementation of the Botswana's PMTCT guidelines.
- The main limitation is that only HIV -infected pregnant women who attended the four participating infectious disease control clinics (IDCCs) were included in the

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study. This limits the ability ~~erefore, findings from this study cannot be~~ to generalize findings ~~d~~ to all HIV -infected pregnant women in ~~the~~ Botswana's National PMTCT program.

INTRODUCTION

Epidemiological data from the Joint United Nations Program on AIDS estimates the prevalence of HIV among adults aged 15-49 years in Botswana to be 23.40%, with more than 160,000 women aged 15-49 years currently living with HIV/AIDS.[1] According to the Republic of Botswana's Global AIDS Response Report prepared in collaboration with the Botswana National AIDS Coordinating Agency (NACA), the national prevalence of HIV among pregnant women aged 15-49 years is 30.4%, with an estimated 13,072 HIV infected women giving birth annually.[2-3] In the absence of interventions to prevent transmission during pregnancy, delivery, or breastfeeding for HIV -infected pregnant women, it is estimated that 35% of births will result in mother-to-child transmission of HIV.[3-4] According to the World Health Organization (WHO), if effective interventions are implemented to prevent mother-to-child transmission (PMTCT), the rate can be reduced to less than 5%.[4]

Due to the transmissibility of HIV from mother to child, feeding of HIV-exposed infants remains a significant challenge in controlling the spread of HIV/AIDS. The dilemma concerning feeding infants of HIV -positive mothers is how to balance the risk of HIV transmission through breastfeeding with the risk of death from causes other than HIV

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such as pneumonia, diarrheal diseases, and malnutrition among formula-fed infants.[5] Exclusive breastfeeding (EBF) plays a critical role in the overall health ~~status~~ of infants. ~~,~~ It is ~~and an~~ estimated ~~I~~that 3% of all under-5 mortalities~~y~~ in low income countries could be prevented through optimal breastfeeding during the crucial first year of life.[6] Optimal breastfeeding is considered to be EBF for the first 6 months of life, followed by continued breastfeeding combined with safe and~~,~~ nutritionally adequate complementary feeding up to 24 months of age.[7-9] EBF is regarded as a global health goal given ~~as a result of~~ its strong association with reduced morbidity and mortality particularly in low-income countries where safe water and sanitation are often lacking.[10]

In 2011, the Government of Botswana (GoB) revised the Botswana National PMTCT guidelines and initiated the use of highly active antiretroviral therapy (HAART) for all HIV infected pregnant women regardless of their CD4 cell count. The goal was to prevent mother-to-child transmission of HIV by providing HAART to pregnant women who would otherwise, not qualify for treatment, based on their CD4 cell count.[3] ~~In Botswana, all pregnant women, regardless of their HIV status, are provided with education and counseling according to the infant and young child feeding guidelines (based on the WHO 2010 recommendations) during antenatal care (ANC) to ensure that they make informed and appropriate infant feeding choices.[3,9]~~ For many years, the ~~Government of Botswana (~~GoB~~)~~ had recommended that HIV -infected women exclusively formula feed their infants and provided infant formula free-of-charge until the infant is one year of age to support this recommendation.[3] However, in 2011, the Botswana Ministry of Health (MoH) recommended exclusive formula feeding (EFF) for

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the first 6 months of life only for women for whom formula feeding is acceptable, feasible, affordable, sustainable and safe (AFASS).[3,11,12] Botswana has one of the most comprehensive maternal and child health services in sub-Saharan Africa, with nearly 95% of pregnant women receiving prenatal care, and having their deliveries attended by a health professional in a health facility.[9] During prenatal visits all pregnant women regardless of their HIV status, are provided with education and counseling according to the country's infant and young child feeding guidelines (based on the WHO 2010 recommendations[9]) to ensure that they make informed and appropriate infant feeding choices.[3,9] ~~During ANC, pregnant women are counseled on the pros and cons of both breastfeeding and formula feeding in the context of HIV in order to enable them make informed infant feeding choices. Additionally, t~~They are ~~are~~ also assessed for AFASS using the following criteria:- piped water in the house or yard (safety); electricity, gas or paraffin for cooking fuel (feasibility); disclosure of HIV status by 3 weeks after birth (acceptability); having someone in the household employed (affordability and sustainability); and access to a fridge for storage of prepared formula (safety). Depending on ~~the~~ outcome of the AFASS assessment, ~~the~~ HIV infected pregnant women are supported in their decision to ~~choice of encouraged to~~ either formula feed or breastfeed their infant. ~~-~~

~~-~~For ~~HIV positive~~HIV positive mothers for whom formula feeding is not AFASS, optimal breastfeeding should be recommended and strongly encouraged.~~-~~ ~~In 2011, the GoB revised the Botswana National PMTCT guidelines and initiated the use of highly active antiretroviral therapy (HAART) for all HIV infected pregnant women regardless~~

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~~of their CD4 cell count. The program aimed at preventing prevention of mother-to-child transmission (PMTCT) provided HAART for pregnant women who would not have qualified based on their own CD4 cell count.[3] In addition, the guidelines were revised to allow HIV-infected women to make an informed decision on whether to breastfeed or formula feed their HIV-exposed infant based on the education and counseling received during ANC visits.[3] Effective implementation of these guidelines was expected to improve breastfeeding practices and ultimately enhance the long-term survival of HIV-exposed infants in the absence of HIV.~~

Exclusive breast feeding has traditionally been promoted as an important intervention to prevent child morbidity and mortality in low income countries. In addition to the nutritional value of breast milk for infants during their first months of life, dependence on breast milk reduces their exposures to contaminated food and drinks, and also protects them against diarrhea through the anti-infective properties of breast milk. With the emergence of evidence linking breast feeding with mother-to-child-transmission of HIV, many women are conflicted on the issue of whether or not to breast fed their babies.

~~There is considerable literature on feeding practices in the context of PMTCT, yet there remains a gap in knowledge regarding HIV-infected pregnant or lactating women's knowledge, attitudes and practices (KAP) regarding infant feeding guidelines and the influence the guidelines have on infant feeding practices. In addition to this gap in knowledge, other~~ R~~r~~esearch evidence has also shown ~~ers have argued~~ that poor-quality counseling in PMTCT programs and the effects of mass media have created widespread confusion for ~~HIV-infected~~HIV infected mothers regarding feeding their infant despite

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the presence of national guidelines.[13] W~~The w~~omen who may be confused by these messages often fail to receive advice to practice EBF which may result in mixed feeding and an increased risk of HIV transmission.[14] ~~Thus, our study focused on eliciting information on existing KAP of infant feeding among HIV infected women in Gaborone, Botswana in an effort to improve infant feeding practices in the context of antiretroviral therapy (ART).~~

~~A cross-sectional quantitative design was used to conduct this study in order to investigate how infant feeding practices among HIV infected pregnant women in Gaborone, Botswana are influenced by the mother's knowledge, attitudes and practices.~~ The main objectives of the study were to identify factors that influenc~~ing~~ infant feeding choices of ~~among HIV-infected~~HIV infected pregnant women, to provide data for evidence-based decision ~~making~~ to improve the quality of Botswana's PMTCT program, and to allow ~~the~~ Botswana MoH to assess ~~the~~ implementation of the revised guidelines in order to strengthen future efforts. It is hoped that findings from this study will be of value not only to the Botswana AIDS Control P~~p~~rogram, but also to other PMTCT programs in sub-Saharan Africa and other low and middle countries where pediatric HIV/AIDS is a public health challenge.

METHODS

A cross-sectional ~~quantitative~~ design was used for the study.

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Setting

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The~~is~~ study was conducted in four public infectious disease control clinics (IDCCs) ~~located~~ in Gaborone, Botswana, managed by the Gaborone City Council. These clinics were selected because the study population of interest (eligible ~~HIV-infected~~HIV infected pregnant women) they provide access to universal HAART prophylaxis ~~at the facilities~~, and thus, constitute ~~provide~~ a reliable sampling frame from which participants were ~~could be~~ recruited.

Study population

~~All pregnant women that presented at any of the four IDCCs during the study period had an equal and independent chance of being included in the sample.~~[15] ~~The attendance booking registers in these clinics were used as the sampling frame.~~ The study population included all ~~HIV-infected~~HIV infected pregnant women attending IDCCs in Gaborone for universal HAART program services during the study period. All HIV infected pregnant women who ~~that~~ presented at any of the four IDCCs during the study period had an equal and independent chance of being included in the study~~ample.~~[15] ~~HIV-infected~~HIV infected pregnant women who were Botswana citizens, aged 21 years and above, and willing to participate in the study by providing~~e~~ informed consent were eligible for inclusion ~~in the study~~. ~~Using the register of women who came for services at each IDCC, the first author [JN] and a local interpreter compiled a list of potentially eligible respondents.~~ During informed consent, the rationale for the study was explained to potential respondents (in the local language, Setswana) and their voluntary participation was sought. All respondents were informed that their participation was

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voluntary, and that if they chose not to participate, they would not lose any benefits from the ~~Ministry of Health~~ir health facility. They were also informed of their right to ~~, and that they could~~ withdraw from the study at any time. Women who volunteered to participate in the study were asked to sign the inform consent form. Those who could not read or write were asked to give their thumb print as a confirmation of their consent. Thus, participation in the study was entirely voluntary and no incentives were provided to respondents. Respondents were assured of confidentiality, and only study unique identification numbers were used on the questionnaires. Approval for th~~e~~is study was obtained from the Ethics Committee of the University of Liverpool, ~~Liverpool,~~ England and from the Botswana Ministry of Health through the Health Research and Development Committee (HRDC).

Data collection

Data were collected using a structured, interviewer-administered questionnaire. Eligible respondents were interviewed and data were transcribed from their medical records onto the questionnaire. The ~~study~~ questionnaire consisted of 33 items that were constructed based on a review of the literature~~were adapted from the WHO PMTCT assessment tool~~.[16] The questionnaire was translated into the local language (Setswana) and pre-tested on five IDCC attendees who were not involved in the final survey. The questionnaire had the following subsections: socio-demographic information, clinical information, knowledge about PMTCT, and infant feeding practices/intentions. Items of the questionnaire elicited information on participants' sociodemographic characteristics, their knowledge of the

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objectives of HAART, knowledge of mother-to-child transmission of HIV, strategies to reduce mother-to-child transmission of HIV during pregnancy, knowledge of infant feeding practices in the context of HIV, the benefits of exclusive breastfeeding, knowledge of the role of mixed feeding (breastfeeding and formula feeding) in mother-to-child transmission of HIV, access to infant feeding counseling in the context of HAART, infant feeding choices and reasons for the choices, important persons in the decision to breastfeed or formula feed, etc. Data were collected over a period of four weeks (June 11 to July 9, 2012) through interviews administered by an interpreter who was fluent in the local language (Setswana) and received training on ethical conduct of research and data collection.

Data analysis

All questionnaires were entered onto Excel spreadsheet and checked for accuracy and completeness. The data were then exported to the Statistical Package for Social Sciences (SPSS) version 19 for analysis. With regard to knowledge of PMTCT and PMTCT practices during breastfeeding, we first provided a summary of the number of correct responses by participants, and later ~~we~~ categorized ~~participants'~~ the responses as ~~representing~~ either "high" knowledge when a respondent ~~gave correct~~ responded correctly ~~ses~~ to all of the questions, or ~~; otherwise we categorized the respondent's as having~~ "low" knowledge when a participant responded incorrectly to one or more of the questions. ~~–~~Descriptive statistics were used to describe and summarize other variables such as socio-demographic characteristics of respondents, clinical information,

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knowledge of ~~about~~ PMTCT, and the important person in decision-making on infant feeding choices.[15] Pearson Chi-Square or Fisher's Exact Test was used to compare results between groups. Multiple logistic regression analyses were also employed to control for possible confounding factors and to assess the separate effects of the study variables. Odds ratios (OR) with 95% confidence intervals (95% CI) were computed to assess factors associated with the choice of breastfeeding, knowledge of PMTCT and PMTCT practices related to breastfeeding. A two-tailed probability level of $p < 0.05$ was chosen as the level of statistical significance.

RESULTS

Characteristics of respondents

Of a total of 102 women from the infectious disease control clinics (IDCCs) who were eligible for inclusion in the study, 96 volunteered to participate, yielding a response rate of 94.1%. The demographic characteristics of participants, including age, marital status, education, employment status and parity are shown in Table 1. ~~The mean age of the respondents was 24.2 years (SD 0.96) with a range of 22 to 42 years.~~ Respondents aged 21-25 years constituted the majority (43.8%; n=42). With regard to marital status, a majority (92.7%, n=89) ~~42.7% (n=41)~~ of the respondents identified themselves as single~~,~~ ~~4.2% (n=4) as married, and 50% (n=48) as~~ or co-habiting. ~~Thirty percent (n=29) of the respondents completed junior secondary school education; 28.1% (n=27) completed senior secondary school education while~~ O~~o~~nly 7.3% (n=7) had university-level

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education. Regarding employment status of the respondents, 39.6% (n=38) were unemployed during the study period~~; 38.5% (n=37) were employed by the private sector while 8.3% (n=8) were government employees~~. About half of the study participants (53.1%; n=51) had 1-2 children; and 34.4% (n=33) were pregnant for the first time~~, and 10.4% (n=10) had 2-4 children~~.

All respondents were taking some form of HAART regimen at the time of the study~~interview~~. Table 1 shows that a majority of the respondents (85.4%; n=82) indicated that they received Atripla as their HAART regimen while 6.3% (n=6) received a combination of Combivir and Nevirapine (CBV+NVP). As shown in Table 1, nearly half of the respondents (55.2%; n=53) identified their husbands/partners as the most influential individual with regard to their choice of infant feeding method.~~; whereas 33.3% (n=32) of respondents indicated their mothers had the greatest outside influence on their infant feeding choices.~~ Only 66 of the ~~A total of 66~~ respondents (70.2%) indicated that they were counseled on infant feeding options recommended for ~~HIV-infected~~HIV infected women. ~~; 29.8% (n=28) of respondents did not receive such counseling.~~

As for KAP related to breastfeeding among the respondents, 56.3% of respondents believed that an infant of an ~~HIV-infected~~HIV infected mother could become infected with HIV when breastfed, and 88.4% were concerned about ~~feared~~ AIDS stigma~~tization~~ related to HIV and infant feeding choices. Only about half of the ~~HIV-infected~~respondents ~~HIV-infected~~ women had high knowledge about PMTCT and

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PMTCT-related practices related to ~~during~~ breastfeeding. Less than one in five (19.8%) ~~HIV infected~~HIV infected ~~women~~ made the decision to exclusively breastfeed their babies (Table 1).

Knowledge and practices related to breastfeeding among ~~HIV infected~~HIV infected pregnant women

Data on knowledge and choice of breastfeeding method are presented in Table 2. Pearson Chi-Square (or Fisher's Exact Test) was used to determine associations between categorical data. ~~Results indicated that choice of breastfeeding differed markedly among the respondents. Participants who received Atripla (FTC+TDF+EFV) and PMTCT counseling in the antenatal period were more likely to choose exclusive breastfeeding (P<0.01). .~~

Multiple logistic regression analysis was used to assess factors associated with knowledge and choice of infant feeding method. Results indicated that receiving infant feeding counseling as part of the PTMCT program was significantly associated with the decision to exclusively breastfeed (OR[95%CI]: 5.38 [1.83, 15.81]). Receiving infant infant feeding counseling as part of the PMTCT program was also, significantly associated with high knowledge of PMTCT practices related to breastfeeding (OR[95%CI]: 5.91[1.06, 34.31]). Women who did not express concern about AIDS ~~did not expressed perceptions of self (internalized) AIDS-related~~ stigma had significantly higher knowledge of PMTCT practices related to infant feeding (OR [95%CI]: 5.91[1.69,

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15.56]). Knowledge of PMTCT practices related to breastfeeding was negatively associated with the belief that breastfeeding could transmit HIV to baby (OR[95%CI]: 9.73 [3.37, 28. 08]).

DISCUSSION

The basic ethical principle of 'informed choice' requires that ~~HIV positive~~HIV positive women are provided with adequate information about their infant feeding options in the context of prevention of mother to child transmission of HIV.[17] This study observed that only about half of the ~~HIV infected~~HIV infected women had knowledge of PMTCT and PMTCT practices related to breastfeeding. This finding is similar to that demonstrated by Hailu[18] who found that only 30.5% of women in Jimma, Ethiopia had sufficient knowledge of infant feeding options recommended for ~~HIV positive~~HIV positive women. [18] Results revealed that counselling on infant feeding provided as part of the PMTCT program was significantly associated with knowledge of PMTCT practices related to breastfeeding [OR(95%CI): 5.91(1.06, 34.31)]. Although the Botswana National PMTCT guideline recommends that all pregnant women be counseled on infant feeding choices, ~~in the present study~~ only 70% of the respondents indicated that they received such counseling~~service during ANC~~. This suggests that gaps exist within the PMTCT program guidelines and actual practice. ~~hence giving rise to missed opportunities. Developing a checklist of topics to be discussed with all pregnant women during every ANC visit might be an effective strategy to address this gap.~~

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The Botswana Government had promoted exclusive formula feeding by ~~HIV-infected~~HIV infected women for many years but presently allows these women to make informed infant feeding choices.[3] However, informed decision-making can only take place when the women are provided with individualized, unbiased and accurate information about infant feeding options, and when this information is presented in a way that is compatible with women's beliefs and at an appropriate health literacy level.[17,19] This underscores the need for training and re-training of maternal and child health workers in the rational, principles, and methods of infant feeding counseling in the context HIV infection, based on WHO and national guidelines on infant feeding in the context of HIV.[3,9]~~refs~~ Similarly, providing every pregnant woman with a brief guidance manual on infant feeding in the context of HIV infection written in the local language, and with appropriate pictorial explanations might help to ensure that all deserving mothers have access to uniform standard information based upon which they can make informed choices about infant feeding.

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The Botswana Family Health Survey showed that only 20% of mothers breastfed exclusively for the first six months.[20] -Similarly, our study found that less than 1 in 5 (19.8%) ~~HIV-infected~~HIV infected mothers chose to exclusively breastfeed. This finding is in agreement with those of Tomasoni et al[21] and Hailu[18] who found similar low rates of EBF among ~~HIV-positive~~HIV positive mothers (46% and 13.4% respectively).

Previous studies have explored factors associated with choice of breastfeeding among ~~HIV-infected~~HIV infected women. The ~~A~~ study by Hailu[18] found that ~~the~~ infant feeding

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choices made by lactating mothers in Ethiopia were significantly associated with their age~~s~~, while a South African study reported that sociocultural factors (including social stigma of HIV/AIDS, maternal age and family influences on feeding practices, economic circumstances, beliefs about HIV transmission through breast milk and beliefs about the quality of breast milk compared to formula) influenced the decision to exclusively breastfeed. As demonstrated in our study, counseling on infant feeding during antenatal visits was an important predictor of infant feeding choices ~~(OR[95%CI]: 5.38 (1.83, 15.81)).~~ .

It is noteworthy that women who did not expressed concern about AIDS stigma ~~perceptions of self (internalized) AIDS stigma~~ had significantly higher knowledge of PMTCT practices related to infant feeding. ~~(OR[95%CI]: 5.91(1.69, 15.56))~~This may be an indication of the barrier that AIDS-related stigma poses against uptake of PMTCT services among HIV infected pregnant women in the study setting. It is known that for social stigma to present a barrier against uptake of services, effected individuals must accept the devaluation and discrediting that accompany the stigma. They must perceive themselves as guilty of moral transgression and accept the blame put on them.

~~Even in situations where a family's response to a HIV infected individual is positive, the fear of stigma and discrimination from the larger society can create a barrier against uptake of available services.~~ It is important for PMTCT programs to address stigma in order to promote service uptake. Since many of the key influences on AIDS-related stigma and discrimination are broad-based and deeply rooted with the structures of

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communities, the most effective interventions would be those with sound theoretical foundations, and that include attention to individual as well as social and structural barriers. In a review of AIDS-related stigma in sub-Saharan Africa, Ehiri et al.[22] presented the case for a multi-level approach that involves action directed at health workers, religious leaders, members of the judicial system, the media, people living with HIV/AIDs, and their family members.[22]

HIV-infected pregnant women are encouraged to exclusively breastfeed their infants for at least 6 months with proper HAART in both high and low-income countries owing to the proven benefits of breastfeeding for both the mother and the infant.[23-24] For example, results of a clinical trial in Kenya indicated that giving breastfeeding women a triple-ARV regimen from late pregnancy to 6 months after birth is a safe, feasible way to reduce MTCT in resource-limited settings.[25] ~~Similarly, one large study of 560 HIV-infected pregnant women in Botswana reported only 2 cases of post-natal transmission of HIV among infants of women who were adherent to ART.[26]~~ A cohort study in India found higher rates of HIV-free survival in breastfed infants, reporting a cumulative 12-month mortality of formula-fed infants of 9.6% versus 0.68% among breastfed infants[26]. Indeed, WHO's recommendation that all mothers who are known to be HIV-infected either on lifelong ART or not, who exclusively breastfeed their infants should do so for 6 months, introduce appropriate complementary foods thereafter and continue breastfeeding for the first 12 months of life is based on a plethora of research that demonstrate the positive effect of exclusive breastfeeding on HIV-free survival of infants born to HIV infected mothers.[refs][27-32] ~~The low rate of HIV transmission found in this~~

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~~study, in addition to the higher HIV-free survival rates in breastfed infants, support PMTCT universal ART for all HIV-infected~~HIV infected ~~pregnant women combined with breastfeeding in an attempt to balance the risk of HIV transmission with risk of infant mortality due to other causes.~~[27]

~~After reviewing results of their study in South Africa, Patel et al~~[28] ~~concluded that the recommendation of EBF for HIV-infected~~HIV infected ~~women should be further strengthened in resource-poor settings for long-term child health.~~[28] ~~Their study demonstrated that EBF, combined with effective maternal/infant ART significantly reduced transmission of HIV to infants through breastfeeding.~~[29]

Evidence shows ~~remains~~ that there is significant benefit of breastfeeding regardless of the setting as it has been shown to result in positive health outcomes for infants, even in countries with reliable water and sanitation systems, where gastrointestinal problems and other infectious diseases are not a concern.~~[303-314]~~ ~~In high-income countries, breastfeeding has been associated with reduced blood pressure and cholesterol levels as well as reduced risk of obesity and diabetes in adulthood.~~[30] ~~From a life course approach, breastfeeding promotion can provide health benefits at the population level.~~[30] ~~A longitudinal study which investigated the health effects of breastfeeding in high-income countries, with particular reference to diarrhea and ear infections, showed that breastfeeding has a protective effect for the outcomes of interest.~~[31] ~~In addition, this study showed a dose-response relationship where the more breast milk the infant received in the first 6 months of life, the less likely the infant is to develop diarrhea and ear infections.~~

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~~Infant feeding counseling is vital for all mothers irrespective of their socioeconomic and HIV status. The WHO recommends that HIV-positiveHIV positive mothers be counseled on infant feeding options and be supported in whichever method they choose.[9] The Government of Botswana recommends that all pregnant women are provided with infant feeding information and counseling during antenatal care (ANC) regardless of their HIV status in order to ensure that they are supported in making informed infant feeding choices.[3] Unfortunately, results of this study show that nearly 30% of HIV-positiveHIV positive pregnant women indicated that they did not receive this service. Given the demonstrated positive relationship between counseling during ANC and knowledge of PMTCT practices related to breastfeeding as well as the women's decision to breastfeed, infant feeding counseling in the context of HIV needs to be strengthened in order to improve informed breastfeeding choices by HIV-positiveHIV positive mothers in Botswana.~~

A majority of the women in this study (80.2%) opted to formula feed their babies. This could be explained by the fact that many health care workers commonly prescribe or encourage formula feeding despite the availability of evidence supporting EBF where formula feeding is not acceptable, feasible, affordable, sustainable and safe (AFASS). Doherty et ~~al[32] conducted~~ al[34] conducted a series of qualitative interviews of a prospective cohort of 650 ~~HIV-positive~~HIV positive mothers in South Africa and considered the influence of healthcare workers on infant feeding choices. The study concluded that health workers possess significant influence over ~~HIV-infected~~HIV infected women's

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initial infant feeding choices. Doherty et al.[32-34] stated that some women expressed feeling pressured or 'forced' by their provider to choose a particular feeding method as a result of their HIV status. Available evidence shows that women who received formula company-produced infant feeding materials from their health providers at their first prenatal visit were more likely than those who did not receive these materials to stop breastfeeding before hospital discharge and before 2 weeks postpartum. Those who were uncertain about their decision to breastfeed, or with a plan to breastfeed for 12 weeks or less, and who received the commercial materials from their health providers also had notably lower rates of exclusive breastfeeding and overall ~~duration~~[33]duration.[35]

Thus, understanding ethical considerations and providing unbiased information about infant feeding options at the provider level has the potential to improve outcomes of PMTCT services in Botswana and similar low and middle income countries where mother-to-child transmission of HIV is a public health challenge.

Strengths and limitations

Given the small size for this study, r~~R~~esults ~~of this study~~ provide only a snapshot assessment of the effectiveness of implementation of the Botswana PMTCT guidelines of 2011, which ~~that~~ provide ~~HIV infected~~HIV infected pregnant women the opportunity to make informed infant feeding choices. ~~The cross sectional design used in this study limited the ability to demonstrate causality. The reported knowledge, attitudes, infant feeding choices or the personal characteristics of respondents who agreed to participate in~~

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~~the study, could have been different from those of participants who declined to participate.~~ It is important to note that o~~O~~nly ~~HIV infected~~HIV infected pregnant women who attended the four study ~~participating~~ IDCCs during the period of the study period were recruited~~articipated in the study~~. Those that attended non-participating IDCCs were not interviewed. These patients might have had different KAP regarding infant feeding choices from those who were interviewed. Therefore, findings from this study cannot be generalized to all ~~HIV infected~~HIV infected pregnant women in the Botswana National PMTCT program. ~~This study had a low sample size, and was likely insufficiently powered to detect associations.~~

Implications

~~The findings of this study have implications for further research, public health policy and practice.~~ Pediatric AIDS remains a major contributor to child mortality in resource poor countries; thus, interventions that seek to significantly reduce mother-to-child transmission of HIV have the potential to contribute towards ~~the~~ achievement of the Millennium Development Goal of reducing child mortality by two thirds by 2015 from the 1990 level.

~~Exclusive breast feeding has traditionally been promoted as an important intervention to prevent child morbidity and mortality in low income countries. In addition to the nutritional value of breast milk for infants during their first months of life, dependence on breast milk reduces their exposures to food-borne pathogens, and also protects them against diarrhea through the anti-infective properties of breast milk. With the emergence of evidence linking breast feeding with mother to child transmission of HIV, many women are conflicted on the issue of whether or not to breast-fed their babies.~~ The finding~~s~~ that a majority of the participants do not receive the recommended counseling on

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infant feeding underscores the need for PMTCH programs in low income countries to take proper care to understand global and national recommendations on infant feeding in the context of HIV, and to find appropriate ways to communicate research evidence to HIV infected women so they can make informed choices regarding infant feeding option.

The finding that a majority of the respondents in this study (92.7%, n=89) 42.7% (n=41) of the respondents identified themselves as either single or co-habiting calls for a need to generally target this population group with interventions to reduce HIV infection through reduction of risky sexual behaviors.

~~Secondly findings from the research study will contribute towards the achievement of the Millennium Development Goals number 4 and 5 of reducing child mortality by two-thirds and decreasing maternal mortality rates by three-quarters by 2015.~~Further research using qualitative or mixed method approaches are need to ~~For further research, firstly, more in-depth qualitative research is needed to better~~ explore enablers and barriers in provision of infant feeding counseling recommended for all HIV infected pregnant women. Efforts should be made to understand health workers' challenges in implementing this recommendation, and the reasons why some HIV infected women do not receive infant feeding counseling need to be explored. ~~KAP regarding infant feeding choices among HIV-infected pregnant women in Gaborone, Botswana.~~ ~~Secondly findings from the research study will contribute towards the achievement of the Millennium Development Goals number 4 and 5 of reducing child mortality by two-thirds and decreasing maternal mortality rates by three-quarters by 2015.~~ ~~Secondly~~Thirdly, To gather generalizable information that can be used to improve the quality of Botswana's PMTCT program, it would be beneficial to ~~this study should be~~ replicate this study ~~d~~ at other IDCC sites as well as ANC clinics ~~to warrant generalization of results to HIV-infected pregnant women elsewhere~~ in the country. ~~Botswana. With regard to policy and practice, t~~To effectively improve EBF rates amongst ~~HIV-infected~~HIV infected women, policy makers must make concerted efforts to advocate, promote, and sustain the universal HAART program for pregnant women, and strengthen ANC services. The Botswana Ministry of Health should provide adequate training of healthcare workers on

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infant feeding counseling for HIV infected women to ensure that they are in a good position to provide unbiased and balanced infant feeding counseling to their clients.

Author affiliations

[1]School of Population, Community & Behavioural Sciences, University of Liverpool Liverpool L69 3BX, United Kingdom

[2]Botswana-Harvard School of Public Health, AIDS Institute Partnership, Gaborone, Botswana

[3]Department of Social Medicine & Health Service Management, Third Military Medical University, Chongqing, China

[4]Division of Health Promotion Sciences/Global health Institute, Mel & Enid Zuckerman College of Public Health, University of Arizona, Tucson, Arizona, USA

Contributors: JN participated in the design of the study and collected data~~,~~ (interviews of respondents). She also prepared the first draft of the manuscript. ~~and drafting of the manuscript.~~ NN conducted literature review, and edited drafts of the manuscript. YL conducted data analysis and participated in the drafting of the manuscript. CM conducted

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literature review and participated in the drafting of the manuscript. JE guided and supervised the conceptualization and the design of the study, provided oversight of quality control of the research implementation, and edited drafts of the manuscript.

Competing interests: None.

Ethics approval: Approval for this study was obtained from the Ethics Committee of the University of Liverpool, Liverpool, England and from the Botswana Ministry of Health through the Health Research and Development Committee (HRDC).

Data sharing statement No additional data are available.

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Table 1: Characteristics of Participants (N=96)

Characteristics		No.	%
Age group (years)	21-25	42	43.8
	26-30	30	31.3
	31-35	18	18.8
	36-40	5	5.2
	41-45	1	1
Marital status	Single	41	42.7
	Married	4	4.2
	Cohabiting	48	50.0
	Separated	3	3.1
Educational level	Primary school	15	15.6
	Junior secondary	29	30.2
	Junior secondary with additional training	8	8.3
	Senior secondary	27	28.1
	College or vocational training	10	10.4
	University	7	7.3
Employment status	Unemployed	38	39.6
	Government employee	8	8.3
	Private Employee	37	38.5
	Self-employed	7	7.3
	Volunteer	2	2.1
	Student	4	4.2
Parity	1-2	51	53.1
	3-4	10	10.4
	5 or more	2	2.1
	None	33	34.4
HAART Regimen received	Atripla (FTC+TDF+EFV)	81	84.4
	CBV+NVP	6	6.3
	CBV+Kaletra	5	5.2
	TDF+FTC+Kaletra		
	Others	4	4.2

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Reasons for receiving HAART	PMTCT (Universal HAART)	66	68.8
	Maternal Treatment	30	31.3
Most important person in making decision on infant feeding	My father	3	3.1
	My husband/partner	53	55.2
	My mother	32	33.3
	My Sister	5	5.2
	My Aunt	3	3.1
Received Infant feeding counseling during ANC (N=94)	Yes	66	70.2
	No	28	29.8
Chose to breastfeed	Yes	19	19.8
	No	77	80.2
Believe breastfeeding transmits HIV to baby	Yes	54	56.3
	No	42	43.8
Concerned about HIV stigma	Yes	84	88.4
	No	11	11.6
Knowledge of PMTCT	1 correct response	4	4.2
	2 correct response	17	17.7
	3 correct response	25	26.0
	4 correct response	50	52.1
Knowledge of PMTCT related to breastfeeding	1 correct response	1	1.0
	2 correct response	0	0.00
	3 correct response	2	2.1
	4 correct response	5	5.2
	5 correct response	13	13.5
	6 correct response	26	27.1
	7 correct response	49	51.0

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Table 2: Respondents' knowledge of PMTCT and choice of breastfeeding

Variable	Choice of exclusive breastfeeding		Knowledge about PMTCT		Knowledge about PMTCT practice related to breastfeeding		Breastfeeding transmits HIV to baby	
	Yes No. (%)	No No. (%)	High No. (%)	Low No. (%)	High No. (%)	Low No. (%)	Yes No. (%)	No No. (%)
Age group (years)								
21-25	14(33.3)	28(66.7)	22(52.4)	20(47.6)	25(59.5)	17(40.5)	29(69.0)	13(31.0)
26-30	3(10.0)	27(90.0)	15(50.0)	15(50.0)	16(53.3)	14(46.7)	16(53.3)	14(46.7)
31-35	2(11.1)	16(88.9)	10(55.6)	8(44.4)	6(33.3)	12(66.7)	7(38.9)	11(61.1)
36-40	0(0.0)	5(100.0)	2(40.0)	3(60.0)	1(20.0)	4(80.0)	2(40.0)	3(60.0)
41-45	0(0.0)	1(100.0)	1(100.0)	0(0)	1(100.0)	0(0.0)	0(0.0)	1(100.0)
Marital status								
Single	12(29.3)	29(70.7)	34(82.9)	7(17.1)*	32(78.0)	9(22.0)*	39(95.1)	2(4.9)*
Married	0(0.0)	4(100.0)	3(75.0)	1(25.0)	3(75.0)	1(25.0)	2(50.0)	2(50.0)
Cohabiting	6(12.5)	42(87.5)	12(25.0)	36(75.0)	13(27.1)	35(72.9)	13(27.1)	35(72.9)
Separated	1(33.3)	2(66.7)	1(33.3)	2(66.7)	1(33.3)	2(66.7)	0(0.0)	3(100.0)
Educational level								
Primary school	5(33.3)	10(66.7)	13(86.7)	2(13.3)*	9(60.0)	6(40.0)	13(86.7)	2(13.3)
Junior secondary	6(20.7)	23(79.3)	19(65.5)	10(34.5)	14(48.3)	15(51.7)	16(55.2)	13(44.8)
Junior secondary with additional training	3(37.5)	5(62.5)	3(37.5)	5(62.5)	5(62.5)	3(37.5)	6(75.0)	2(25.0)
Senior secondary	4(14.8)	23(85.2)	11(40.7)	16(59.3)	13(48.1)	14(51.9)	13(48.1)	14(51.9)
College or vocational training	1(10.0)	9(90.0)	0(0.0)	10(100.0)	4(40.0)	6(60.0)	3(30.0)	7(70.0)
University	0(0.0)	7(100.0)	4(57.1)	3(42.9)	4(57.1)	3(42.9)	3(42.9)	4(57.1)
Employment status								
Unemployed	10(26.3)	28(73.7)	23(60.5)	15(39.5)	23(60.5)	15(39.5)	24(63.2)	14(36.8)
Government employee	2(25.0)	6(75.0)	3(37.5)	5(62.5)	3(37.5)	5(62.5)	2(25.0)	6(75.0)
Private Employee	4(10.8)	33(89.2)	15(40.5)	22(59.5)	18(48.6)	19(51.4)	19(51.4)	18(48.6)
Self-employed	2(28.6)	5(71.4)	4(57.1)	3(42.9)	2(28.6)	5(71.4)	5(71.4)	2(28.6)
Volunteer	1(50.0)	1(50.0)	2(100.0)	0(0.0)	1(50.0)	1(50.0)	2(100.0)	0(0.0)
Student	0(0.0)	4(100.0)	3(75.0)	1(25.0)	2(50.0)	2(50.0)	2(50.0)	2(50.0)
Parity								
2-Jan	9(17.6)	42(82.4)	20(39.2)	31(60.8)*	20(39.2)	31(60.8)*	22(43.1)	29(56.9)*
4-Mar	1(10.0)	9(90.0)	9(90.0)	1(10.0)	7(70.0)	3(30.0)	8(80.0)	2(20.0)
5 or more	0(0.0)	2(100.0)	2(100.0)	0(0.0)	0(0.0)	2(100.0)	1(50.0)	1(50.0)

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None	9(27.3)	24(72.7)	19(57.6)	14(42.4)	22(66.7)	11(33.3)	23(69.7)	10(30.3)
HAART Regimen received								
Atripla (FTC+TDF+EFV)	17(21.0)	64(79.0) *	43(53.1)	38(46.9) *	42(51.9)	39(48.1) *	48(59.3)	33(40.7)
CBV+NVP	1(16.7)	5(83.3)	2(33.3)	4(66.7)	3(50.0)	3(50.0)	1(16.7)	5(83.3)
CBV+Kaletra	1(20.0)	4(80.0)	5(100.0)	0(0.0)	4(80.0)	1(20.0)	4(80.0)	1(20.0)
TDF+FTC+Kaletra								
Others	0(0.0)	4(100.0)	0(0.0)	4(100.0)	0(0.0)	4(100.0)	1(25.0)	3(75.0)
Reasons for receiving HAART								
PMTCT	15(22.7)	51(77.3)	36(54.5)	30(45.5)	36(54.5)	30(45.5)	42(63.6)	24(36.4) *
Maternal Treatment	4(13.3)	26(86.7)	14(46.7)	16(53.3)	13(43.3)	17(56.7)	12(40.0)	18(60.0)
Most important person in making decision on infant feeding								
My father	2(66.7)	1(33.3)	3(100.0)	0(0.0)	1(33.3)	2(66.7)	3(100.0)	0(0.0)
My husband/partner	10(18.9)	43(81.1)	27(50.9)	26(49.1)	25(47.2)	28(52.8)	30(56.6)	23(43.4)
My mother	7(21.9)	25(78.1)	15(46.9)	17(53.1)	19(59.4)	13(40.6)	16(50.0)	16(50.0)
My Sister	0(0.0)	5(100.0)	4(80.0)	1(20.0)	2(40.0)	3(60.0)	4(80.0)	1(20.0)
My Aunt	0(0.0)	3(100.0)	1(33.3)	2(66.7)	2(66.7)	1(33.3)	1(33.3)	2(66.7)
Concerned about AIDS sStigma to HIV infection								
Yes	16(19.0)	68(81.0)	47(56.0)	37(44.0)	47(56.0)	37(44.0)*	51(60.7)	33(39.3) *
No	3(27.3)	8(72.7)	3(27.3)	8(72.7)	2(18.2)	9(81.8)	3(27.3)	8(72.7)
Received infant fFeeding counseling during ANC								
Yes	18(27.3)	48(72.7) *	41(62.1)	25(37.9) *	42(63.6)	24(36.4) *	44(66.7)	22(33.3) *
No	1(3.6)	27(96.4)	8(28.6)	20(71.4)	7(25.0)	21(75.0)	10(35.7)	18(64.3)
Believedfs to breastfeeding transmits HIV to baby								
Yes	14(25.9)	40(74.1)	38(70.4)	16(29.6)*	39(72.2)	15(27.8)*	–	–
No	5(19)	37(77)	12(28.6)	30(71.4)	10(23.8)	32(76.2)	–	–
Knowledge of about PMTCT								
High	13(26.0)	37(74.0)	–	–	–	–	38(76.0)	12(24.0) *
Low	6(13.0)	40(87.0)	–	–	–	–	16(34.8)	30(65.2)
Knowledge about PMTCT related during to breastfeeding								
High	9(18.4)	40(81.6)	–	–	–	–	39(79.6)	10(20.4) *
Low	10(21.3)	37(78.7)	–	–	–	–	15(31.9)	32(68.1)

☼Pearson Chi-Square or Fisher's Exact Test was used to compare results between groups.
*P<0.05

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Table 3: Multi logistic analysis of factors associated with choice of infant feeding options, knowledge of PMTCT, and knowledge of PMTCT practices related to breastfeeding

Variable	Choice of exclusive breastfeeding OR(95%CI)*	High knowledge of PMTCT OR(95%CI)**	High knowledge of PMTCT during breastfeeding OR(95%CI)**	Breastfeeding could transmit HIV to baby*
Marital status				
Single	–	1	–	–
Married	–	34.37 (0.72,46.77)	–	–
Cohabiting	–	8.17 (0.07, 13.00)	–	–
Separated	–	0.75(0.02, 31.77)	–	–
Educational level				
Primary school	–	1	–	–
Junior secondary	–	8.81 (0.63, 21.89)	–	–
Junior secondary with additional training	–	6.24 (0.65, 64.38)	–	–
Senior secondary	–	1.49(0.0.11,20.57)	–	–
College or vocational training	–	1.77 (0.0.19, 15.82)	–	–
University	–	–	–	–
Concerned about HIV s~~S~~tigma ~~to HIV infection~~				
Yes			1	–
No			5.91(1.69, 15.56)	–
Received infant f~~F~~eeding counseling during ANC				
No	1	–	1	–
Yes	5.38 (1.83, 15.81)	–	5.91(1.06, 34.31)	–
Knowledge of ~~about~~ PMTCT related to ~~during~~ breastfeeding				
Yes	–	–	–	1
No	–	–	–	9.73 (3.37, 28. 08)

**Adjusted for age and education.*
*** Adjusted for age*

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STROBE Statement—Checklist of items that should be included in reports of ***cross-sectional studies***

	Item No	Recommendation	Page # in Manuscript
Title and abstract	1	(*a*) Indicate the study's design with a commonly used term in the title or the abstract	1
		(*b*) Provide in the abstract an informative and balanced summary of what was done and what was found	2 & 4
Introduction			
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported	5-6
Objectives	3	State specific objectives, including any pre-specified hypotheses	6-7
Methods			
Study design	4	Present key elements of study design early in the paper	8
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	8
Participants	6	(*a*) Give the eligibility criteria, and the sources and methods of selection of participants	8-9
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	9-10
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group	9-10
Bias	9	Describe any efforts to address potential sources of bias	10
Study size	10	Explain how the study size was arrived at	8-9
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	9-10
Statistical methods	12	(*a*) Describe all statistical methods, including those used to control for confounding	10-11
		(*b*) Describe any methods used to examine subgroups and interactions	10-11
		(*c*) Explain how missing data were addressed	N/A
		(*d*) If applicable, describe analytical methods taking account of sampling strategy	N/A
		(*e*) Describe any sensitivity analyses	N/A

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Results			
Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed	11
		(b) Give reasons for non-participation at each stage	N/A
		(c) Consider use of a flow diagram	
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders	11-12
		(b) Indicate number of participants with missing data for each variable of interest	N/A
Outcome data	15*	Report numbers of outcome events or summary measures	11-12
Main results	16	(*a*) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included	12-13
		(*b*) Report category boundaries when continuous variables were categorized	N/A
		(*c*) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	N/A
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses	N/A
Discussion			
Key results	18	Summarise key results with reference to study objectives	13-17
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias	18
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	18
Generalisability	21	Discuss the generalisability (external validity) of the study results	18-19
Other information			
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	N/A

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*Give information separately for exposed and unexposed groups.

Note: An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at http://www.plosmedicine.org/, Annals of Internal Medicine at http://www.annals.org/, and Epidemiology at http://www.epidem.com/). Information on the STROBE Initiative is available at www.strobe-statement.org.

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