

Knowledge of mother-to-child transmission of HIV by pregnant women in Maputo City, Mozambique

Rosa M. Manjate^{1,2,3}, Osvaldo F.A. Loquiha⁴, Acácio J.D.E. Sabonete⁵, Khátia R. Munguambe⁶, Julie Cliff⁷, Olivier Degomme¹, Marleen Temmerman^{1,8}, Mohsin Sidat⁷

¹Ghent University, Ghent, Belgium

²Eduardo Mondlane University, Maputo, Mozambique

³Ministry of Health, Mozambique

⁴Department of Mathematics and Informatics, Faculty of Sciences, Eduardo Mondlane University, Maputo, Mozambique

⁵National Institute of Health – Ministry of Health, Mozambique

⁶Department of Community Health, Faculty of Medicine, Eduardo Mondlane University, Maputo, Mozambique

⁷Faculty of Medicine, Eduardo Mondlane University, Maputo, Mozambique

⁸Aga Khan University Hospital, Nairobi, Kenya

Abstract

Introduction: Good knowledge of prevention of mother-to-child transmission (PMTCT) can improve mothers' behavior in seeking care. This study aimed to assess knowledge on PMTCT, human immunodeficiency virus (HIV), and acquired immunodeficiency syndrome (AIDS) at three public antenatal clinics in Maputo City.

Material and methods: Between December 2013 and November 2014, an antenatal care (ANC)/PMTCT cross-sectional exit survey among pregnant women was conveniently conducted. Face-to-face interviews, adjusted odds ratios, and 95% confidence intervals were applied.

Results: In total, 420 pregnant women were enrolled into the study, and 72.7% had high PMTCT knowledge, 72% knew mother-to-child transmission (MTCT) can occur in pregnancy, 76.4% through breastfeeding, 82.9% in labor, and 92.7% knew drugs to reduce MTCT. Similarly, 83.4% had high HIV prevention knowledge. PMTCT knowledge was more likely to increase with age (AOR = 3.83; 95% CI: 1.36-10.81) and education (AOR = 2.16; 95% CI: 1.15-4.08). HIV prevention knowledge was likely to increase with education (AOR = 4.71; 95% CI: 1.54-14.36), being married (AOR = 2.66; 95% CI: 1.30-5.43), and through condom use (AOR = 2.16; 95% CI: 1.13-4.14).

Conclusions: Most pregnant women had high PMTCT and HIV prevention knowledge. The youngest, single, and illiterate women have challenges to access information. PMTCT education in verbal mother tongue is required due to limited literacy. Male partner involvement should be strongly supported.

HIV AIDS Rev 2020; 19, 2: 106-115

DOI: <https://doi.org/10.5114/hivar.2020.96507>

Key words: knowledge, pregnant women, HIV/AIDS, Mozambique, MTCT.

Address for correspondence: Dr. Rosa M. Manjate, Ghent University, Eduardo Mondlane University and Ministry of Health, e-mail: marlene.cuco@gmail.com

Article history:
Received: 08.04.2019
Received in revised form: 06.06.2019
Accepted: 07.07.2019
Available online: 19.06.2020

International Journal
of HIV-Related Problems

**HIV & AIDS
Review**

Introduction

Human immunodeficiency virus (HIV)/acquired immune deficiency syndrome (AIDS) epidemic continues to be a challenge for pregnant women and their children, particularly in sub-Saharan Africa (SSA) [1, 2]. In 2017, worldwide, there were 36.9 million of people living with HIV, with 1.4 million pregnant women among them [3] and 1.8 million children under 15 years [4]. Overall, the number of new HIV infections in children decreased by 35% from 2010 to 2017. Nevertheless, in 2017, approximately 70% of pregnant women and 90% of 110,000 newly HIV-infected children were in the African region [3, 5]. Over 90% of HIV infections in children occur through mother-to-child transmission (MTCT) [3]. In the absence of any interventions, MTCT contributes with 15% to 45% of child acquired HIV infection, with the lowest risk in developed countries and the highest in developing countries [6]. The chance of HIV MTCT is estimated to be 10% during pregnancy, 15% during delivery, and 20% through breastfeeding [3, 7].

Mozambique is a South African country (SAA), which is greatly affected by HIV/AIDS. In 2015, the Mozambican Malaria, HIV/AIDS, and Immunization Indicator Survey (EMASIDA, 2015) found that adult HIV prevalence was 13.2%. Among 2.1 million Mozambicans living with HIV/AIDS, 60% were women [8], and HIV/AIDS prevalence among pregnant women was estimated at 15.8%, varying between 1.1% and 34% at ANC sites [9, 10]. According to national policy, prevention of mother-to-child transmission (PMTCT) is integrated with antenatal care (ANC) [11]. Currently, over 90% of pregnant women have access to PMTCT interventions. However, the MTCT rate was estimated at 17% in 2013 and 14% in 2017 [12], and new pediatric HIV infections decreased only by 42% from 2010 to 2017 [13], a slower decline than that observed in other countries [5, 13].

To support countries greatly affected by HIV/AIDS, the World Health Organization (WHO) strategy of virtual elimination of pediatric HIV infection recommended primary prevention of HIV infection among women of reproductive age, unintended pregnancies among women living with HIV/AIDS, PMTCT, provision of care, and support to mothers living with HIV/AIDS, their children, and families [14]. In 2016, in an effort to significantly curb HIV/AIDS infections, the Mozambique government, along with others world leaders, committed to the implementation of the UNAIDS 2014 fast-track strategy to ensure that 90% of pregnant women know their HIV status, 90% have an access to ART, 90% of those under treatment have viral suppression, zero new HIV infections among children, and zero stigma by 2020 [2]. These interventions have resulted in a reduction of MTCT to less than 5% of pregnancies, predominantly in middle- and high-income countries [3].

In some resource constrained SSA countries, obstacles to successful prevention of MTCT/PMTCT prevail. In a study comparing demographic and health survey databases from Mozambique, Uganda, Congo, and Nigeria, Mozambique was placed second, with 69.4% of pregnant women tested

for HIV in ANCs compared to 81.5% in Nigeria. Overall, PMTCT uptake was lower among less educated women and those with limited knowledge of HIV [15]. Similarly, a South African study found that adolescence, lower education, and late first ANC visits were associated with high PMTCT dropout [16]. The 2017 Mozambican census revealed that 46.3% of girls between 15 and 25 years old were unable to read and write in any language [17], and almost half of girls are first time pregnant before 20 years old [8]. The Mozambique's PMTCT strategy includes HIV awareness and education, universal access to combined anti-retroviral therapy (cART), institutional birth, and exclusive breastfeeding [12]. The EMASIDA 2015 study observed that in Maputo City, only 61.2% of women knew that MTCT can occur through breastfeeding and were aware of special drugs taken by pregnant woman to reduce the risk of HIV in MTCT. Sixty-eight percent of women knew that limiting sexual relationships to a single non-infected partner and using condoms with occasional sex partners reduce the risk of HIV infection [8].

Knowledge of prevention of mother-to-child transmission of HIV infection (PMTCT) can improve mother's behavior in seeking PMTCT services [18]. Mozambique PMTCT knowledge data in pregnancy is still limited. This study aimed to assess the knowledge about PMTCT and HIV, and related factors in pregnant women at public antenatal clinics in the capital of Mozambique. These study findings will provide useful information for policy makers and healthcare providers to continually improve ANC/ PMTCT uptake in pregnant women.

Material and methods

Study design, population, and study settings

This survey is a part of a larger study intended to measure adherence to cART for PMTCT. It was an exit health-center-based cross-sectional study involving pregnant women attending ANC/PMTCT, carried out from December 2013 to November 2014 in Mavalane health zone, Maputo City. Public primary healthcare in Maputo City has 16 health centers divided into three health zones, according to the referral general hospitals namely Mavalane, Jose Macamo, and Chamanculo. Mavalane health zone is the largest area, comprised of eight public health centers, which provide roughly 50% of ANC/ PMTCT care in Maputo City. In 2014, Mavalane health zone included 40% (980,000) of the Maputo City population and 50% (61,289) of expected pregnancies [19]. The overall HIV prevalence among pregnant women in the southern region of Mozambique where Maputo City is located was estimated at 24% [9].

Questionnaire design

The questionnaire was specifically developed for this study in Portuguese, the official language of Mozambique. Questions were taken from the national survey of prevalence, behavioral risks, and information on HIV and AIDS in Mo-

zambique [20] and completed with few specific questions. Questions intended to assess mother-to-child transmission of HIV routes and prevention knowledge, HIV/AIDS prevention knowledge and related factors such as age, education, marital status, ant-natal attendance, sexual behavior, and practices. Three health technicians supervised by the principal investigator collected the data. Prior to the study, two interactive sessions including study subject's privacy, confidentiality, informed consent, questionnaire contents, interviews procedures, data collection, and quality control were carried out with all interviewers. A pilot test was done among 32 pregnant women attending ANC/PMTCT in Malhangalene and Polana Cimento health centers, also located at Mavalane health zone. Results from the pilot testing were used to improve question clarity, understanding, and consistency, with minor changes made after the pilot test.

Sample size estimation

The sample size was calculated based on a single proportion formula assuming that 50% of pregnant women would have a high knowledge of PMTCT of HIV, with 5% of precision, 95% of confidence, and 10% of margin of no response.

Sampling procedures

From eight operating public health centers in Mavalane health zone, we conveniently selected three, namely Mavalane (MHC), Primeiro de Maio (PMHC), and Primeiro de Junho (PJHC) health centers due to longstanding integrated ANC/PMTCT services. Sample size was proportionally allocated taking into account the total number of pregnant women who attended ANC/PMTCT services in the year previous to the study in each health center to accomplish the total sample required. For study enrolment, pregnant women were approached on their exit from ANC/PMTCT services, informed about the study, and assessed for eligibility. Pregnant women who met the inclusion criteria, namely aged 18 years and older and six months pregnant, were invited to participate. The total of 423 pregnant women were selected from PMHC (60%, 254), MHC (25%, 106), and PJHC (15%, 63). At health centers, all pregnant women benefit from free integrated ANC/PMTCT package, including ANC/PMTCT education essentially provided at ANC service, mostly delivered by mother and child health nurses (MCH), with assistance of lay counsellors, using a mixture of Portuguese and local languages. Some HIV/AIDS information is also provided through mass media.

Operational definitions

PMTCT knowledge and HIV prevention knowledge

MTCT awareness was assessed as whether pregnant women had ever heard about MTCT of HIV. The level of PMTCT knowledge and level of HIV prevention knowledge were

defined as two composite outcomes assessed through a set of items or questions regarding MTCT and HIV/AIDS. For PMTCT knowledge, a discrete score was obtained adding up the responses (1 for correct answer and 0 otherwise) for awareness of PMTCT of HIV during pregnancy, delivery and through breastfeeding, and the use of drugs to reduce the risk of PMTCT of HIV. The sum of scores for PMTCT knowledge ranged from 0 to 4, accordingly to correct answers. The level of PMTCT knowledge was defined by categorizing the scores as (0 to 1) expressing low, (2) moderate, and (3 to 4) high knowledge on PMTCT.

HIV prevention knowledge

HIV awareness was assessed as whether pregnant women had ever heard about HIV. For HIV prevention knowledge, a discrete score was obtained summing the binary codes (0 and 1) for awareness of protective factors against HIV infection (having a single negative sexual partner, condom use with occasional sexual partners, and sexual abstinence), with rejecting myths regarding risk factors for HIV infection (such as mosquito bites and eating together with HIV-infected people). The level of HIV prevention knowledge was categorized with values ranging from 1 (low) to 5 (high knowledge) of correct answers, and further grouped as (1 and 2) expressing low, (3) moderate, and (4 and 5) high knowledge. This choice of cut-off values for both PMTCT and HIV knowledge was preferred not only because it results in a symmetric definition of level of knowledge, but also because it reduces data sparsely.

Data collection

At ANC/PMTCT exit, face-to-face interviews were carried out to all selected pregnant women who met the inclusion criteria. Data collection was done using a pretested structured questionnaire comprised of 30 questions. The questionnaire was administered in a private room using either Portuguese or whenever necessary, direct translation to Changana, the most spoken native language in Maputo City. Time spent for completion varied, but on average, it was forty-five minutes.

Data analysis

The data was entered into Epi info version 3.5.5, cleaned and analyzed in SAS/STAT PROC NLMIXED (version 9.4). Two-way contingency tables were used to summarize the data with the Cochran-Mantel-Haenszel test applied to investigate associations between levels of PMTCT and HIV/AIDS knowledge and pregnant woman's socio-demographic characteristics. The bivariate Dale model was used to estimate the joint distribution of levels of MTCT and HIV/AIDS knowledge, while adjusting for effects of covariates [20]. For this model, parameter estimates were expressed in odds ratios and interpreted using ordinal logistic regression models. The model estimation was done in SAS/STAT PROC NLMIXED (version 9.4), using a macro developed by McMillan and Hanson [21]. For inference, *p*-values, and confidence intervals (CI) were calculated for adjusted odds ratios, with significance level set at 5%.

The dependence between the outcomes was modelled using the global cross-ratio (GCR), an association measure for contingency tables, for outcomes with 3 or more ordered levels.

Ethical clearance

Ethical approval was obtained from the Mozambican National Bioethics Committee (Reference no: 357/CNB/12; IRB 00002657). Administrative permit was obtained from the Maputo City Health Directorate and from each health center participating in the study. Oral informed consent was obtained from each enrolled pregnant woman after clear explanation of the study aim and the right to withdraw at any stage, with no negative consequences. Data confidentiality was ensured. All collected data was kept anonymous with access restricted to the research team. Findings were presented as aggregate data with no identifiers.

Results

Table 1 summarizes socio-demographic features of 420 pregnant women enrolled in the study. The response rate was 99.2%. The majority of pregnant women (72.3%) were married or in marital union, 64% were under 30 years old, with half between 18 and 24 years old, 54.5% had either primary or no education with limited Portuguese speaking, reading, and writing capabilities, and 46.2% were unaware of their HIV sero-status.

Table 2 shows the frequency of distribution of mother-to-child transmission, with HIV routes and HIV prevention knowledge. The majority of pregnant women (80.4%) were aware of MTCT, and almost 75% knew MTCT of HIV can occur during pregnancy, in labor, and through breastfeeding. All pregnant women (100%) were aware of HIV, and over 90% knew the three safe sexual practices to reduce HIV infection. Moreover, 82.1% correctly disagreed that HIV infection can be transmitted through mosquito bites and 97.5% by sharing food with someone who has HIV.

Table 3 illustrates the results of cross tabulation of PMTCT level and HIV prevention knowledge. Among pregnant women who participated in the study, 72.7% had high PMTCT knowledge, meaning that they knew all three MTCT of HIV transmission routes and drugs to prevent it, and 83.4% had high HIV prevention knowledge, meaning that they knew three sexual prevention means and rejected the two most common misconceptions. Only 62.3% had both high PMTCT and high HIV prevention knowledge.

Table 4 describes a two-way tabulation of socio-demographic characteristics associated with PMTCT and HIV prevention knowledge. PMTCT knowledge was more likely to increase with age ($p = 0.040$), education level ($p = 0.035$), condom use in the last sexual intercourse ($p = 0.048$), and HIV sero-status ($p = 0.015$). The level of HIV prevention knowledge was likely to increase with educational level ($p = 0.002$), marital status ($p = 0.004$), antenatal visits ($p = 0.004$), private counselling session ($p = 0.044$), dis-

cussed HIV status with partner ($p = 0.001$), and condom use in the last sexual intercourse ($p = 0.006$).

Table 5 represents results of the bivariate Dale model. The odds of high PMTCT knowledge for pregnant women aged 35 years or more was almost four times that of women between 18-24 years old (AOR = 3.8; 95% CI: 1.36-10.81). The odds of high PMTCT knowledge for women with secondary or higher education was also almost three times that of women with no education (AOR = 2.8; 95% CI: 1.14-7.08). Regarding HIV prevention, the odds of high knowledge for women with secondary or higher education was almost five times that of women with no education (AOR = 4.71; 95% CI: 1.54-14.36). Also, the odds of having high HIV prevention knowledge among married women or living with a partner was almost three times that of a single, widow, or divorced women (AOR = 2.66; 95% CI: 1.30-5.43). A similar trend was observed between women who reported condom use and those who did not (AOR = 2.16; 95% CI: 1.13-14).

Discussion

High levels of knowledge of PMTCT of HIV can improve mother's behavior in seeking care and contribute

Table 1. Socio-demographics characteristics, behavior, and practices of pregnant women at antenatal care (ANC)/prevention of mother-to-child transmission (PMTCT) clinics

Parameter	N = 420 (%)
Age groups	
18-24	132 (31.4)
25-29	137 (32.6)
30-34	112 (26.7)
> 35	39 (9.3)
Education level	
No education	31 (7.4)
Primary	198 (47.1)
Secondary or higher	191 (45.5)
Religion	
Christian/Islam	58 (13.8)
Evangelic	333 (79.3)
None	29 (6.9)
Marital status	
Single/widow/divorced	116 (27.7)
Married/marital union	303 (72.3)
HIV status	
Positive	139 (33.1)
Negative	87 (20.7)
Unknown	194 (46.2)
ANC visits	
≤ 3	357 (85.0)
≥ 4	63 (15.0)

Table 2. HIV/AIDS and prevention of mother-to-child transmission (PMTCT) awareness, and prevention knowledge, among pregnant women at antenatal care (ANC)/PMTCT clinics

Question	N = 420 (%)	Question	N = 420 (%)
Human immunodeficiency virus		A person cannot be infected by sharing food with someone who have HIV	
Have you ever heard about HIV/AIDS?		A person cannot be infected by sharing food with someone who have HIV	
Yes	420 (100)	Yes	10 (2.5)
No	0	No	392 (97.5)
Do you know anyone living with HIV/AIDS?		Limiting sexual relationship to a single not infected partner and condom use occasional partners reduce the risk of getting HIV infection	
Yes	295 (72.5)	Yes	325 (85.5)
No	112 (27.5)	No	37 (8.8)
Pregnant women HIV status		Mother-to-child transmission of HIV	
Positive	139 (33.1)	HIV can be transmitted from mother-to-child	
Negative	87 (20.7)	Yes	351 (80.4)
Unknown	194 (46.2)	No	69 (19.6)
Private counseling session for HIV		HIV can be transmitted from mother-to-child during pregnancy	
Yes	326 (78.9)	Yes	302 (72.0)
No	87 (21.1)	No	118 (28.0)
Discussed HIV status with partner		HIV can be transmitted from mother-to-child during labor	
Yes	335 (81.1)	Yes	348 (82.9)
No	78 (18.9)	No	72 (17.1)
Condom use in the last sexual intercourse		HIV can be transmitted from mother-to-child through breast-feeding	
Yes	268 (68.9)	Yes	322 (76.4)
No	121 (31.1)	No	99 (23.6)
It is possible to reduce the risk of getting HIV infection by limiting sexual relationship to a single not infected partner?		The risk of MTCT can be reduced if mother take special medicines during pregnancy	
Yes	38 (93.9)	Yes	415 (92.7)
No	21 (6.1)	No	5 (2.3)
It is possible to reduce the risk of getting HIV infection by using condom whenever have occasional sex?		HIV can be transmitted from mother-to-child through breast-feeding and the risk reduced by special medicines taken in pregnancy	
Yes	387 (96.0)	Yes	324 (77.1)
No	16 (4.0)	No	88 (21.0)
It is possible to reduce the risk of getting HIV infection through sexual abstinence?			
Yes	178 (90.0)		
No	21 (10.0)		
HIV infection cannot be transmitted through mosquito bite			
Yes	59 (14.6)		
No	345 (82.1)		

Table 3. Cross tabulation of level of prevention of mother-to-child transmission (PMTCT) and HIV prevention knowledge in pregnant women at antenatal care (ANC)/PMTCT clinics

		HIV prevention knowledge			
		Low (%)	Moderate (%)	High (%)	Total (%)
PMTCT knowledge	Low (%)	1 (0.27)	17 (4.55)	47 (12.57)	65 (17.38)
	Moderate (%)	2 (0.53)	3 (0.80)	32 (8.56)	37 (9.89)
	High (%)	5 (1.34)	34 (9.09)	233 (62.30)	272 (72.73)
	Total (%)	8 (2.14)	54 (14.44)	312 (83.42)	374 (100.00)

Table 4. Socio-demographics characteristics associated with prevention of mother-to-child transmission (PMTCT) and HIV/AIDS knowledge among pregnant women at antenatal care (ANC)/PMTCT clinics

Parameter	PMTCT knowledge					HIV/AIDS knowledge				
	Low (%)	Moderate (%)	High (%)	Total (%)	p-value	Low (%)	Moderate (%)	High (%)	Total (%)	p-value
Age groups										
18-24	24 (6.14)	17 (4.35)	78 (19.95)	119 (30.43)	0.0408	3 (0.79)	15 (3.93)	98 (25.65)	116 (30.37)	0.9967
25-29	22 (5.63)	10 (2.56)	97 (24.81)	129 (32.99)		3 (0.79)	21 (5.50)	102 (26.70)	126 (32.98)	
30-34	17 (4.35)	10 (2.56)	79 (20.20)	106 (27.11)		0 (0.0)	14 (3.66)	91 (23.82)	105 (27.49)	
> 35	3 (0.77)	3 (0.77)	31 (7.93)	37 (9.46)		2 (0.52)	5 (1.31)	28 (7.33)	35 (9.16)	
Education level										
No education	9 (2.30)	2 (0.51)	19 (4.86)	30 (7.67)	0.0355	1 (0.26)	7 (1.83)	23 (6.02)	31 (8.12)	0.002
Primary	34 (8.70)	20 (5.12)	132 (33.76)	186 (47.57)		5 (1.31)	34 (8.90)	143 (37.43)	182 (47.64)	
Secondary or higher	23 (5.88)	18 (4.60)	134 (34.27)	175 (44.76)		2 (0.52)	14 (3.66)	153 (40.05)	169 (44.24)	
Religion										
Christian/Islam	9 (2.30)	5 (1.28)	41 (10.49)	55 (14.07)	0.8359	1 (0.26)	8 (2.09)	45 (11.78)	54 (14.14)	0.259
Evangelic	52 (13.30)	32 (8.18)	223 (57.03)	307 (78.52)		5 (1.31)	41 (10.73)	254 (66.49)	300 (78.53)	
None	5 (1.28)	3 (0.77)	21 (5.37)	29 (7.42)		2 (0.52)	6 (1.57)	20 (5.24)	28 (7.33)	
Marital status										
Single/widow/ divorced	14 (3.59)	14 (3.59)	79 (20.26)	107 (27.44)	0.2931	3 (0.79)	24 (6.28)	73 (19.11)	100 (26.18)	0.0042
Married/marital union	52 (13.33)	26 (6.67)	205 (52.56)	283 (72.56)		5 (1.31)	31 (8.12)	246 (64.40)	282 (73.82)	
ANC visits										
≤ 3	61 (15.60)	34 (8.70)	240 (61.38)	335 (85.68)	0.2273	4 (1.05)	51 (13.35)	274 (71.73)	329 (86.13)	0.0047
≥ 4	5 (1.28)	6 (1.53)	45 (11.51)	56 (14.32)		4 (1.05)	4 (1.05)	45 (11.78)	53 (13.87)	
Private counseling session										
No	8 (2.05)	9 (2.31)	57 (14.62)	74 (18.97)	0.3016	4 (1.06)	7 (1.85)	62 (16.36)	73 (19.26)	0.0442
Yes	57 (14.62)	31 (7.95)	228 (58.46)	316 (81.03)		4 (1.06)	47 (12.40)	255 (67.28)	306 (80.74)	
Discussed HIV status with partner										
No	14 (3.62)	8 (2.07)	53 (13.70)	75 (19.38)	0.9048	3 (0.79)	18 (4.75)	53 (13.98)	74 (19.53)	0.0098
Yes	52 (13.44)	32 (8.27)	228 (58.91)	312 (80.62)		5 (1.32)	37 (9.76)	263 (69.39)	305 (80.47)	
Condom use last sexual intercourse										
No	28 (7.65)	10 (2.73)	77 (21.04)	115 (31.42)	0.0487	5 (1.40)	23 (6.42)	84 (23.46)	112 (31.28)	0.0063
Yes	35 (9.56)	27 (7.38)	189 (51.64)	251 (68.58)		3 (0.84)	27 (7.54)	216 (60.34)	246 (68.72)	

Table 4. Cont.

Parameter	PMTCT knowledge					HIV/AIDS knowledge				
	Low (%)	Moderate (%)	High (%)	Total (%)	p-value	Low (%)	Moderate (%)	High (%)	Total (%)	p-value
Know people living with HIV/AIDS										
No	51 (13.28)	24 (6.25)	206 (53.65)	281 (73.18)	0.1041	7 (1.86)	40 (10.64)	224 (59.57)	271 (72.07)	0.567
Yes	14 (3.65)	16 (4.17)	73 (19.01)	103 (26.82)		1 (0.27)	14 (3.72)	90 (23.94)	105 (27.93)	
HIV status										
Positive	15 (3.84)	7 (1.79)	57 (14.58)	79 (20.20)	0.0158	2 (0.52)	12 (3.14)	116 (30.37)	130 (34.03)	0.1118
Negative	11 (2.81)	18 (4.60)	104 (26.60)	133 (34.02)		2 (0.52)	9 (2.36)	67 (17.54)	78 (20.42)	
Unknown	40 (10.23)	15 (3.84)	124 (31.71)	179 (45.78)		4 (1.05)	34 (8.90)	136 (35.60)	174 (45.55)	

to a decrease in the rate of mother-to-child transmission of HIV [22]. This study assessed PMTCT and HIV prevention knowledge as well as related factors among pregnant women at ANC/PMTCT exit.

The majority of pregnant women (72.7%) had a high level of PMTCT knowledge. This was consistent with a hospital-based cross-sectional survey carried out in Kathmandu (Nepal), where 84.4% of pregnant women knew all three MTCT transmission routes, although knowledge of drugs to prevent it was relatively low [23]. However, the level of PMTCT knowledge found in our study was higher than in two Ethiopian institutional-based surveys in Assosa town (57.5%) [24] and East Gojjam (52%) [25], and 48% at Kiisi referral hospital in Kenya [26]. In our study, we also observed that 77.1% of pregnant women knew that MTCT can occur through breastfeeding and the existence of drugs to prevent it, compared to 61.2% who answered correctly in the Mozambican Malaria, HIV/AIDS, and Immunization Indicator Survey (IMASIDA, 2015) [8].

Similarly, the majority of pregnant women (83.4%) had a high HIV prevention knowledge. This result was also in line with a Nepali findings [23]. Furthermore, 85.5% of pregnant women knew that limiting sexual life to a single not infected with HIV partner and condom use with occasional partners, can reduce the risk of HIV infection, as compared to 68% found in IMASIDA, 2015 [8] and 63.8% observed at community-based cross-sectional survey in Northeast Ethiopia in Meket [18]. The difference between our findings and IMASIDA, 2015 was expected, since our results were generated from ANC/ PMTCT-based survey, and pregnant women are more likely to have PMTCT and HIV information exposure at ANC clinics [18], while IMASIDA was country-wide population-based survey, covering both pregnant and not pregnant women in rural and urban settings [8].

Consistent with previous results [18, 25], pregnant women with secondary or higher education levels were almost three times (AOR = 2.8; 95% CI: 1.14-7.08) more likely to

have PMTCT knowledge. Similarly, more educated pregnant women were almost five times (AOR = 4.71; 95% CI: 1.54-14.36) more likely to have high HIV prevention knowledge than their less formally educated counterparts. However, 54.5% of pregnant women in our sample had either primary level or no formal education. In Maputo City, ANC/ PMTCT/HIV information, both oral and written, is mostly provided in Portuguese, potentially limiting illiterate pregnant women's ability to speak, read, understand, and follow ANC/PMTCT recommendations [27, 28]. Consequently, the higher PMTCT and HIV prevention knowledge could be greatly related to high HIV/AIDS exposure, as 33% of pregnant women were HIV-positive and 72.5% knew someone suffering from AIDS.

Although there are slight differences in estimated levels of PMTCT and HIV prevention knowledge, the majority of discussed studies [24, 29, 30] and our study results underscore the importance of education for women and girls to understand PMTCT and HIV prevention information to fully benefit from health services. As in other settings [18] and in line with education policy in Mozambique, increasing girls' schooling should continue to be amongst priorities. In the case of Mozambique, verbal mother tongue should be used for illiterate women at ANC/ PMTCT to ensure all women benefit from MTCT and HIV/AIDS information and care.

Our findings also revealed that older pregnant women were more likely to have higher PMTCT knowledge (AOR = 3.8; 95% CI: 1.36-10.81). As described in a similar Kenyan survey [26], the fear of HIV disclosure and societal judgment surrounding early pregnancies may have restricted access to PMTCT information for younger women in our study. In addition, older women were more likely to have had previous ANC visits and PMTCT information exposure in earlier pregnancies. Finally, current older pregnant women were more likely to have been exposed to information, since they were younger in the onset of HIV

Table 5. Adjusted odds ratio and 95% CI for factors related to prevention of mother-to-child transmission (PMTCT) and HIV prevention knowledge in pregnant women at antenatal care (ANC)/PMTCT clinics

Parameter	PMTCT knowledge				HIV prevention knowledge			
	O.R.	95% CI		p-value	O.R.	95% CI		p-value
		Lower	Upper			Lower	Upper	
Age group (years)								
18-24	1.00				1.00			
25-29	1.95	1.07	3.56	0.031	1.19	0.55	2.57	0.660
30-34	2.29	1.17	4.50	0.017	1.66	0.69	4.00	0.263
> 35	3.83	1.36	10.81	0.011	1.04	0.35	3.08	0.948
Education								
No education	1.00				1.00			
Primary	1.40	0.59	3.30	0.448	1.24	0.47	3.30	0.666
Secondary or higher	2.84	1.14	7.08	0.025	4.71	1.54	14.36	0.007
Religion								
Christian/Islam	1.00				1.00			
Evangelical	1.03	0.51	2.06	0.939	1.19	0.49	2.88	0.708
None	1.40	0.44	4.51	0.568	0.84	0.22	3.29	0.808
Marital status								
Single/widow/divorced	1.00				1.00			
Married/marital union	0.76	0.41	1.39	0.371	2.66	1.30	5.43	0.008
ANC visits								
≤ 3								
≥ 4	1.73	0.77	3.89	0.186	0.86	0.34	2.15	0.746
Private counseling session								
No	1.00				1.00			
Yes	0.49	0.24	1.02	0.056	1.49	0.64	3.49	0.360
Discussed HIV status with partner								
No	1.00				1.00			
Yes	1.05	0.53	2.09	0.885	1.45	0.64	3.31	0.376
Condom use last sexual intercourse								
No	1.00				1.00			
Yes	1.68	0.98	2.87	0.059	2.16	1.13	4.14	0.020
Know people with HIV/AIDS								
No	1.00				1.00			
Yes	0.67	0.38	1.21	0.186	0.98	0.46	2.11	0.960
HIV status								
Positive	1.00				1.00			
Negative	0.69	0.33	1.45	0.333	0.76	0.29	1.97	0.571
Unknown	0.61	0.32	1.16	0.131	1.02	0.44	2.36	0.955
Global cross-ratio model								
Δ	2.03	0.39	10.7	0.403				
δ_1	0.69	0.14	3.27	0.636				

epidemic, when PMTCT and HIV/AIDS prevention information were more widespread in Maputo City than nowadays.

In the same way, pregnant women who were married or living with a partner were more likely to have high HIV knowledge (AOR = 2.66; 95% CI: 1.30-54.43), suggesting

that open discussion of HIV/AIDS issues with partners have a positive effect on women information, as quite often males are more educated and informed than women, although less likely to attend health facility [31-34]. Both findings pose challenges to the public health sector to improve access to PMTCT/HIV information to younger and single women to benefit from PMTCT/HIV interventions.

The HIV infection rate of 33% among pregnant women who disclosed their status in our study was higher than Maputo City HIV prevalence estimation of 24% [9], but similar to that found among pregnant women in Manhica District (34%) in Maputo Province [10], where Maputo City and Gaza Province (30%) are located [9]. These very high HIV rates among pregnant women demonstrate the magnitude of HIV/AIDS threat in Mozambique, particularly among women and their children, highlighting the need for more aggressive interventions to dramatically reduce the mother-to-child infection rate currently estimated at 14%, despite over 90% PMTCT services coverage.

On other hand, we found that 46.2% of pregnant women did not know their HIV sero-status. This could be in part due to long waiting time for HIV results, which could take up to 3 months at the time of this study, or a late HIV test uptake, as the majority of pregnant women had less than three ANC consultations. Although our study did not look into this aspect, some previous findings have also shown fear of stigma and discrimination as factors preventing pregnant women from HIV test uptake and sero-status disclosure [26]. Unknown sero-status is amongst the reasons for late PMTCT enrolment and increasing risk of MTCT of HIV. Thus, another specific study is needed to better characterize the reasons of high rates of unknown HIV sero-status and address interventions accordingly.

Furthermore, a positive association is mostly found between high PMTCT knowledge and a higher ANC visits score [19, 20]. However, in our study regardless of high PMTCT knowledge, 85% of pregnant women reported to attend three or fewer ANC visits, suggesting an exposure to PMTCT and HIV information outside ANC/PMTCT. In Mozambique, ANC is the only system for PMTCT to ensure MTCT decrease and pediatric HIV infections reduction. Strategies to increase ANC/PMTCT uptake should be implemented to curb the risk of poor PMTCT outcomes.

Study limitations

This study had some limitations. The health centers as well as participants were conveniently selected. The facilities included and pregnant attendees may not necessarily be similar to non-public healthcare facilities and other public services, such as neighborhood and rural health local services. Therefore, the results of this study may not reflect the reality within the whole of Maputo City and/or of Mozambique and should be contextualized and interpreted with caution. However, women's friendly environment created at the study sites, confidentiality, the use of subjects' mother tongues, and opportunities provided for discussion contrib-

uted to a good relationship between the study subjects and the interviewers, so these results are more likely to accurately represent pregnant woman's opinions.

Conclusions

The majority of pregnant women in this study indicated high PMTCT and HIV prevention knowledge, and low coverage of four or more ANC visits. Older, more highly educated, and married pregnant women had a better PMTCT and HIV prevention knowledge. The youngest, single, and illiterate still face challenges to access ANC, PMTCT, and HIV information. Additional MTCT education is required and should be delivered in an integrated manner within HIV/AIDS strategies to pregnant women, including verbal communication in mother tongue due to limited literacy. Male partner involvement can yield better PMTCT outcomes.

Recommendations

These findings suggest provision of PMTCT and HIV information more effectively to younger, illiterate, and single pregnant women. More ANC visits should also be widely encouraged to contribute to PMTCT uptake. A friendly environment, the use of the mother tongue in an interactive communication allowing pregnant women to pose and discuss questions, seems more valuable in contrast to using Portuguese due to low literacy. Strengthening male partner involvement may be a factor to improved PMTCT outcomes. Finally, our study findings are likely to be useful for policy makers and healthcare providers, as they continually strive to improve MTCT education approaches for better PMTCT results.

Acknowledgments

Authors are grateful to the VRIL-UOS Flemish Inter-university Council Development Cooperation, Ghent University and Eduardo Mondlane University for funding and technical assistance. We particularly acknowledge the valuable contribution of study subjects and health workers from the study sites. Special thanks to Dr Roxan Hoek for her assistance and to Professor Herman Meullman for his guidance and support.

Conflict of interest

The authors declare no conflict of interest with respect to the research, authorship, and/or publication of this article.

References

1. UNAIDS. Joint United Nations Programme on HIV/AIDS. Fast-track strategy to end the AIDS epidemic by 2030. UNAIDS; 2014. Available from: <https://www.unaids.org/en/resources/campaigns/World-AIDS-Day-Report-2014>.
2. UNAIDS. On the fast-track to end AIDS. 2016-2021 Strategy. Geneva: UNAIDS; 2015. Available from: <https://aidsfree.usaid.gov/re>

- sources/prevention.update/editions/january.2016/unaids.2016-2021 strategy for aids free generation.
3. WHO. Mother-to-child transmission of HIV. WHO; 2018. Available from: <https://www.who.int/hiv/topics/mtct/en/>.
 4. UNAIDS. Joint United Nations Programme on HIV/AIDS. Fast-strategy to end HIV/AIDS epidemic in 2030. UNAIDS; 2018. Available from: <https://www.unaids.org/en/resources/campaigns/World-AIDS-Day-Report-2014>.
 5. WHO. Prevention of mother-to-child transmission (PMTCT). Global Health Observatory (GHO) data 2018. Available from: [https://www.who.int/gho/hiv/epidemic_response/PMTCT_text/en/Prevention-of-mother-to-child-transmission-\(PMTCT\)](https://www.who.int/gho/hiv/epidemic_response/PMTCT_text/en/Prevention-of-mother-to-child-transmission-(PMTCT)).
 6. WHO. Mother to child transmission of HIV. WHO; 2011. Available from: <https://www.who.int/hiv/topics/mtct>.
 7. Volmink JA, Marais B. HIV: Mother-to-child transmission. *BMJ Clin Evid* 2008; 2008: 0909.
 8. Ministério da Saúde, Inquérito de Indicadores de Imunização, Malária e HIV/SIDA em Moçambique (IMASIDA). Caverton, Maryland, USA: MISAU, INE e ICFI 2015. Available from: www.dhsprogram.com/pubs/pdf/AIS12/AIS12-SP.pdf.
 9. INS, I.N.d.S., I.N.d.E. INE, and G.T.M.d.C.a.H.S. GTM, Ronda de Vigilância Epidemiológica do HIV e sífilis em Mulheres Grávidas em Moçambique: Principais Resultados; Maputo, Moçambique 2011. Available from: www.misau.gov.mz.
 10. Rupérez M, González R, Maculuvé S, et al. Maternal HIV infection is an important health determinant in non-HIV-infected infants. *AIDS* 2017; 31: 1545-1553.
 11. Ministério da Saúde, Plano Nacional de Eliminação da Transmissão Vertical, Moçambique 2012-2015; 2012.
 12. UNAIDS. *Spectrum* 2.57; 2017.
 13. UNAIDS. UNAIDS data 2018 | UNAIDS. 2018. Available from: <https://www.unaids.org/en/resources/documents/2018/unaids-data-2018>.
 14. UNAIDS. Global Plan towards the Elimination of New HIV infection among Children by 2015 and Keeping Their Mothers Alive, 2011-2015. Geneva: Joint United Nations Programme on HIV/AIDS; 2011.
 15. Gunn JKL, Asaolu IO, Center KE, et al. Antenatal care and uptake of HIV testing among pregnant women in sub-Saharan Africa: a cross-sectional study. *J Int AIDS Soc* 2016; 19: 20605.
 16. Woldeesenbet S, Jackson D, Lombard C, et al. Missed opportunities along the prevention of mother-to-child transmission services cascade in South Africa: uptake, determinants, and attributable risk. *PLoS One* 2015; 10: e0132425.
 17. Instituto Nacional de Estatística. IV Recenseamento Geral da População e Habitação de 2017.
 18. Birhane T, Tessema GA, Alene KA, Dadi AF. Knowledge of pregnant women on mother-to-child transmission of HIV in Meketi district, Northeast Ethiopia. *J Pregnancy* 2015; 2015: 960830.
 19. Instituto Nacional de Estatística. III recenseamento geral da população e habitação, 2007.
 20. Dale JR. Global cross-ratio models for bivariate, discrete, ordered responses. *Biometrics* 1986; 42: 909-917.
 21. McMillan G, Hanson T. SAS macro BDM for fitting the Dale regression model to bivariate ordinal response data. *Journal of Statistical Software* 2005; 14.
 22. USAID. HIV/AIDS Health Profile: Sub-Saharan Africa – USAID; 2012. Available from: https://pdf.usaid.gov/pdf_docs/pdacu659.pdf.
 23. Acharya R, Acharya T, Devkota R. Knowledge regarding prevention of mother to child transmission of HIV/AIDS among antenatal mothers. *Nepal Journal of College of Medical Sciences – Nepal* 2018; 14.
 24. Abteu S, Awoke W, Asrat A. Knowledge of pregnant women on mother-to-child transmission of HIV, its prevention, and associated factors in Assosa town, Northwest Ethiopia. *HIV/AIDS (Auckl)* 2016; 8: 101-107.
 25. Alemu YM, Habtewold DT, Alemu SM. Mother's knowledge on prevention of mother-to-child transmission of HIV, Ethiopia: a cross sectional study. *PLoS One* 2018; 13: e0203043.
 26. Kei MR, Ndwiga T, Okong'o S, Njoroge S. Knowledge and attitude on prevention of mother to child transmission of HIV among pregnant women attending antenatal clinic at Kisii Level Five Hospital in Kisii County, Kenya. *Int J Trop Dis Health* 2015; 6: 44-51.
 27. Ciampa PJ, Skinner SL, Patricio SR, Rothman RL, Vermund SH, Audet CM. Comprehensive knowledge of HIV among women in rural Mozambique: development and validation of the HIV knowledge 27 scale. *PLoS One* 2012; 7: e48676.
 28. Ciampa PJ, Vaz LME, Blevins M, et al. The association among literacy, numeracy, HIV knowledge and health-seeking behavior: a population-based survey of women in rural Mozambique. *PLoS One* 2012; 7: e39391.
 29. Asefa A, Beyene H. Awareness and knowledge on timing of mother-to-child transmission of HIV among antenatal care attending women in Southern Ethiopia: a cross sectional study. *Reprod Health* 2013; 10: 66.
 30. Audet CM, Sidat M, Blevins M, Moon TD, Vergara A, Vermund SH. HIV knowledge and health seeking behavior in Zambézia Province, Mozambique. *SAHARA J* 2012; 9: 41-46.
 31. Bhagwanjee A, Govender K, Reardon C, Johnstone L, George G, Gordon S. Gendered constructions of the impact of HIV and AIDS in the context of the HIV-positive seroconcordant heterosexual relationship. *J Int AIDS Soc* 2013; 16: 18021.
 32. Koo K, Makin JD, Forsyth BW. Where are the men? Targeting male partners in preventing mother-to-child HIV transmission. *AIDS Care* 2013; 25: 43-48.
 33. Byamugisha R, Tumwine JK, Semiyaga N, Tylleskär T. Determinants of male involvement in the prevention of mother-to-child transmission of HIV programme in Eastern Uganda: a cross-sectional survey. *Reprod Health* 2010; 7: 12.
 34. DeGennaro V, Zeitz P. Embracing a family-centred response to the HIV/AIDS epidemic for the elimination of pediatric AIDS. *Glob Public Health* 2009; 4: 386-401.