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Socioeconomic and sociodemographic differentials in pregnant women's knowledge on prevention of mother-to-child HIV transmission in Kenya: A cross-sectional study from 2008-09 KDHS

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Abstract

Background: Human immunodeficiency virus (HIV) is a global public health issue. One way of transmission is through mother-to-child transmission (MTCT). There are ways to prevent this and one option is to give the mother special drugs during pregnancy, delivery or afterwards. Socioeconomic and sociodemographic factors can potentially affect the knowledge women have about prevention of mother-to-child transmission (PMTCT).

Objective: The aim of this secondary analysis was to explore which socioeconomic and sociodemographic factors are associated with pregnant women's knowledge about PMTCT.

Methods: Secondary data obtained from Kenyan Demographic and Health Surveys from 2008-09 were used, n=524. Variables investigated were marital status, education level, HIV status, religion, type of residence, occupation and wealth quintile and their association to the outcome, knowledge about prevention of mother-to-child transmission. They were tested by means of logistic regression analysis.

Results: Results showed that higher level of education and belonging to a higher level of wealth quintile were significantly associated with having knowledge about PMTCT. All categories for education showed a significant difference in the adjusted model I and for wealth quintile, only richer and richest category showed a significant difference, also in the adjusted model I. Over all, 74% did have knowledge about PMTCT.

Conclusion: There are socioeconomic differentials in knowledge about PMTCT. Knowing which women have the least knowledge about PMTCT makes it is easier to know which women to target to be able to increase the knowledge among the population with high prevalence of HIV in low- and middle income countries.

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Abbreviations

Acquired immune deficiency syndrome	AIDS
Antenatal care	ANC
Antiretroviral drugs	ARV
Antiretroviral therapy	ART
Community Health Worker	CHW
Demographic and Health Surveys	DHS
Human immunodeficiency virus	HIV
Interagency Task Team	IATT
Joint United Nations Programme on HIV/AIDS	UNAIDS
Kenyan Demographic and Health Surveys	KDHS
Kenya National Bureau of Statistics	KNBS
Millennium development goal	MDG
Ministry of Health and Sanitation, the Kenya Medical Research Institute	KEMRI
Mother-to-child transmission	MTCT
National AIDS Control Council	NACC
National AIDS/STD Control Programme	NASCOP
National Coordinating Agency for Population and Development	NCAPD
Prevention of mother-to-child transmission	PMTCT
Socioeconomic status	SES
United Nations Children's Fund	UNICEF
Voluntary Counseling and Testing	VCT
World Health Organization	WHO

1. Background

1.1. Millennium development goals

In 2000, the United Nations declared 8 Millennium Development Goals (MDGs) to be achieved globally when reaching the year 2015 (1). Millennium Development Goal 6 is focusing on combat Human immunodeficiency virus (HIV) and acquired immunodeficiency syndrome (AIDS), malaria and other diseases (1). There were 2 main goals within the MDG 6; first, to have stopped and begun to reverse the transmission of HIV/AIDS, and second, to achieve universal access to HIV treatment among people in need by the year 2010 (1). This MDG 6 emerged from the success in high-income countries, where the combined antiretroviral therapy (ART) was contributing to reductions in mother-to-child transmission (MTCT) of HIV and mortality due to HIV (2). In 2013, 26 countries reported success in halving the number of new HIV infections since 2001, though the targets for MDG 6 are not yet being achieved (2). Among children, the number of new infections of HIV has declined since it had its peak in the year 2002 (3). It has fallen by 58%, though despite this large decrease, the mortality among children due to HIV has not declined more than 40% (3). This is due to the coverage of antiretroviral therapy being larger among adults compared to children (3).

1.2. Global burden of HIV

HIV is a global public health issue (10). More than 39 million people have died due to HIV so far and in 2013, approximately 1.5 million people died around the world due to HIV-related causes (10). At the end of 2013 there were approximately 35 million people infected with the virus and during that same year, 2.1 million people became newly infected worldwide and about 32.6 million people are living with HIV in low- and middle-income countries (10). The most affected region today is Sub-Saharan Africa. There were 24.7 million cases of HIV infections in 2013 in Sub-Saharan Africa only (10) and Sub-Saharan Africa is also the part of the world that accounts for nearly 70% of all new HIV infections (10).

The HIV pandemic has had withering consequences especially on children and children in Sub-Saharan Africa in particular (12). One explanation for this is that the progression of HIV is more rapid in children than adults (13). Without treatment, over

50% of the children dies within 2 years of age (13). Even children not infected with HIV can suffer from the disease (14). When one of the parents, or even both of the parents, are infected with the virus and goes untreated, they risk dying and leaving their child to orphan hood (14).

The transmission of HIV occurs via exchange of body fluids from infected people, for example blood, breast milk and other secretions (10). Diagnosing of HIV usually consists of blood testing and the detection of presence or absence of HIV antibodies (10). Treatment for HIV exists consisting of antiretroviral drugs (ARV) (10). Hence, HIV became a long-term chronic disease from being a fatal infection that could progress rapidly (10). Globally, in 2013, 12.9 million people living with HIV were at the time receiving ART (10). Of those 12.9 million people, 11.7 million people were living in low- and middle-income countries (10). Though this number might seem large, only 36% of people infected are receiving ART in low- and middle-income countries (10).

1.3. HIV in Kenya

The number of people with HIV infection in Kenya is estimated at 1.6 million in 2012 and the number of people living with the virus among adults aged 15 years and up is estimated at 1.4 million. In 2000, the HIV incidence rate among the adult population was <1% and was estimated at even lower percentage in 2013 (15,16). HIV in women aged 15 and up were approximately 820,000 in 2012 and children with an HIV infection aged 0 to 14 were 200,000 (15). The prevalence of HIV is higher among women at 8% compared to HIV prevalence among men at 6%. A decline in HIV incidence has occurred in Kenya since the year 2000 and a plausible explanation might be the scale up of treatment and prevention programmes (16).

The HIV epidemic in Kenya is referred to being generalized most of the time (17). This means that the virus affects everyone in the society equally i.e. everyone has the same risk of HIV acquisition (17). However, studies have identified in recent years that certain groups in the society are more prone to acquiring the virus (17). These groups are men who have sex with men as previously mentioned, female sex workers, people who inject drugs and women (17). For men who have sex with men, the

prevalence of HIV is almost 3 times more than rest of the population (18). The group with the highest prevalence of HIV in Kenya is female sex workers (19).

1.4. Infection pathway for HIV

The incubation time for HIV is long and for some people, symptoms do not arise immediately, it can take years before symptoms appear (11). It takes about three months for the virus load in the blood to be detectable with common HIV tests (11). The infection often starts with an acute infection, a primary infection, though not everyone experience this (11). The acute infection is associated with for example fever, muscle ache and fatigue. The symptoms are not specific for HIV, but can be confused with other infectious diseases. These primary symptoms will heal spontaneously (11). HIV mainly infects CD4+ T-cells, white blood cells that belongs to the specific immune system (11). Other cells can also be infected, though to measure how far the infection has come, CD4+ T-cell count is standard (11). If untreated, almost all HIV infections progressively deplete the number of CD4+ cells (11). When the virus has destroyed most of the CD4+ cells in the body, the immune system fails to combat other common infectious diseases as well (11). As the infection has reached this state, the disease has evolved to become AIDS. Eventually, an untreated HIV infection will lead to death (11). AIDS can take up to 15 years to develop, depending on the individual. AIDS can also develop after only 2 years. The definition of AIDS according to the World Health Organization is the development of infections such as tuberculosis and meningitis, certain cancers or other clinical manifestations that are considered severe (10).

1.5. Mother-to-child transmission of HIV

In 1998, the Interagency Task Team (IATT) on the prevention of MTCT of HIV was established (20). In 2001, they changed their name to the Interagency Task Team on Prevention of HIV Transmission in Pregnant Women, Mothers and their Children (20). The agency is co-chaired by WHO and the United Nations Children's Fund (UNICEF) and it is a group of 28 multilateral, governmental and non-governmental organizations (20). Their task is to strengthening global, regional and national programs and partnerships that address the issue of the survival of pregnant women, children and mothers living with HIV (20). In 2003, this goal was expanded when a

comprehensive strategic approach was adopted by the United Nations, in terms of the prevention of HIV infection in infants and young children (20). Their goals are now consisting of 4 components: 1) primary prevention of HIV infection among women of childbearing age; 2) preventing unintended pregnancies among women living with HIV; 3) preventing HIV transmission from a woman living with HIV to her child; 4) providing appropriate treatment, care and support to mothers living with HIV and their children and families (20).

Around 400,000 children under the age of 15 acquired HIV in 2009 and this was mainly due to MTCT (21). According to the Joint United Nations Programme on HIV/AIDS (UNAIDS), in 2012 there were approximately 260,000 children newly infected with HIV (22). Most of these infections occurred in Sub-Saharan Africa (22). This decrease was a result of scaled up HIV-prevention services that decreased the transmission by 35% (22). There are several ways for HIV to infect a child if the mother has acquired the virus. The transmission can occur during pregnancy, labor, delivery or breastfeeding. This is called MTCT and in the absence of any type of prevention intervention, the likelihood of transmission rates range between 15-45% according to The World Health Organization (WHO). The rate can be reduced to approximately 5% in the presence of a prevention strategy, called prevention of mother-to-child transmission (PMTCT) (22,23).

Global efforts in the past decade have been driven to prevent mother-to-child transmission due to rapid progress in policy, program implementation and scientific discoveries (24). One prevention strategy that has been in the forefront is the “Option B+” strategy. This strategy is about providing lifelong ART to every HIV positive woman discovered during pregnancy or breastfeeding. Although this strategy was originally developed for countries not having the option to count the white blood cells to help indicate in what stage the HIV infection is, now this option is adopted worldwide (24). There are also other prevention strategies besides biomedical approaches that includes for example caesarean sections and avoid breastfeeding, though this is in countries where formula is safe and harmless for the child (25). The most effective way to prevent MTCT is to prevent infection in women (26). Other common preventive measures to take to avoid being infected by HIV from the beginning are male and female condoms, voluntary medical male circumcision,

antiretroviral therapy for prevention, voluntary counseling and testing (VCT) and harm reduction for injecting drug users (10).

1.6. Socioeconomic and sociodemographic factors

Socioeconomic factors are the combination of social and economic realities and experiences that shapes a person's attitudes, personality and lifestyle (53). Examples of socioeconomic factors are education, occupation, place of residence, ethnicity and religion. Education is an important socioeconomic factor and can contribute to social growth and shapes people's perspectives (36). Education can also have an impact on decision-making power within families and contribute to quality-of-life issues. Occupation and income affects one's socioeconomic status as different careers places people in different levels of income brackets and also contributes to different social status in the society. Place of residence can easily reflect people's income due to neighborhoods often grouping people with similar income or background. Culture and ethnicity also have an impact on people's views and attitudes as different religions and ethnicities have different values and traditions (54). Sociodemographic factors are social and demographic factors combined, such as age, sex and marital status. Socioeconomic and sociodemographic factors can affect each other and be interlinked. Low socioeconomic status (SES) has been shown to be associated with HIV acquisition (55,56).

1.7. Risk factors for HIV acquisition

Socioeconomic factors such as poverty are known to be a causal factor for acquiring HIV (4). One example is the fact that lower economic status of women deprive their ability to negotiate about safe sex and poverty are also increasing the risk that women need to provide sex for money (4,5). This points to women's lack of autonomy in the society. A study conducted in a slum area in Kenya found that poverty is in fact a contributor to increased sexual risk behavior (6). Furthermore, poverty can also increase the risk of having extramarital sexual partners and also multiple sexual partners in general (7). Poverty does not only have a play in the socioeconomic risk factor for acquiring HIV, poverty also increases biological susceptibility to HIV acquisition, as for all infectious diseases. Conditions due to poverty such as malnutrition and lack of accessibility to health service increase the risk of infectious

diseases, such as HIV; this is due to the injustice of inequity. Poverty increases the risk of people not being able to pay for care or access it in terms of distance for example, if they do not have a way of transport themselves to a health facility. Also, people living in poverty might not have the financial opportunities to purchase condoms and practice safe sex (8). These are a few examples of the fact that inequalities can harm people's health. Other studies have shown that men who have sex with men are a high-risk group for the acquisition of HIV (9). Men who have sex with men who had disclosed their sexual orientation to a health care worker were associated with them being denied health care. Participants also reported being afraid to seek health care due to their sexual orientation (9). Other sexually transmitted infections are also considered risk factors for the acquisition of the virus, such as chlamydia, syphilis, herpes, gonorrhea and bacterial vaginosis. For injecting drug users, sharing needles with an HIV-infected person is a risk. Receiving blood via blood transfusions from a person infected with HIV is an extremely high risk of HIV acquisition. Unprotected vaginal and anal sex are also risk factors, though the risk of acquisition is not 100% (10).

1.8. Voluntary counseling and testing for HIV

One barrier to antenatal care and delivering at a health facility is the HIV testing. HIV testing is essential to the control of HIV. Knowledge about serostatus of one's partner promotes safer sexual practices in many different populations (27–30). Another critical factor in the prevention, treatment and care of HIV is Voluntary Counseling and Testing (VCT). Different ways of implementing VCT exists, for example mobile-clinic and home-based testing (29). Studies have shown that VCT can effectively change behavior among people infected with HIV, though these evidences were not from low-income countries where most new HIV infections occur (10,31). A systematic review and meta-analysis were conducted by Denison et al. in 2008 (32) evaluating voluntary counseling and testing from low- and middle-income countries. There were 7 studies included and results demonstrated that even in low- and middle-income countries sexual risk behavior can be reduced by a voluntary counseling and testing strategy (32). In a study conducted in Uganda, socioeconomic and sociodemographic factors were statistically significant associated with accepting or declining voluntary counseling and testing (33). Marital status was significantly

associated with accepting VCT as were education. The chance of accepting VCT was significantly lower among participants with primary education compared to those with no formal education. In terms of marital status, those who were currently married or previously married were more likely to accept VCT compared to those who have never been married (33). VCT acceptance was not associated with age or gender (33).

1.9. Uptake of prevention of mother-to-child transmission of HIV

Although there are effective prevention interventions, there are barriers to optimal uptake of PMTCT services existing at both health facility level and community level (34,35). Optimal use of ARVs by the mother reduces the risk of transmitting HIV to the child (36). Though women who do not deliver at health facilities are less likely to use ARVs during delivery even though this is a critical period and large proportion of HIV infections acquired perinatally occur during delivery (37–39). Also, women who do not deliver at health facilities have increased risks of prolonged labor and rupture of membranes, two things associated with an increased risk of HIV transmission to the child (40,41). According to the 2008 Kenya Demographic and Health Survey (KDHS), only 43% of the women delivered at a health facility in Kenya (42). In one study conducted by Kinuthia et al. results showed that women delivering at a health facility had a higher level of education, belonged to a higher level of SES, were more likely to be aware of their partner's HIV status, initiated antenatal care (ANC) earlier and used ARVs, compared to women not delivering at a health facility (43). The same study showed that barriers for delivering at a health facility among HIV-infected women are distance to facility, cost and harsh treatment at the facility (43). Number of women delivering at health facilities in Kenya remains low and this contributes to challenges in reducing HIV transmission between mother and child (43). In another study conducted by Kinuthia et al. results showed that mothers who did not get tested for HIV during ANC were more likely to have lower SES and they were also more likely to have less than secondary education (38). A cross-sectional study conducted in Uganda found that willingness to test for HIV were higher among women who had an educational level beyond 7 years of primary school compared to women who did not complete primary school. Mothers who could read and write were also more willing to be tested. Women with knowledge about the fact that there are rapid HIV test were also more willing to be tested compared to those who did not know that

(34). Results also showed that the strongest predictor associated with willingness to test was if the women thought her husband would approve of the test (34). Results from another study doing qualitative research on barriers to antenatal care and delivering at health facilities concluded that four barriers were present among the respondent's, which were women. The first barrier was the attitudes of clinic staff, the second barrier was long clinic waiting times. The third and fourth barriers were HIV testing and cost (44). In a study conducted in China, it was proven that prevention of mother-to-child transmission programmes have in fact reduced HIV between mother and child (48). Though this study points to one other important aspect of these types of programmes, i.e. the continuum of care after delivery. It is important to continue the care of HIV infected mothers to achieve full potentials of these programs (48).

1.10. Uptake of prevention of mother-to-child transmission of HIV in Kenya

In a study by Kohler et al. (49) the rates and correlates of uptake of antenatal care, HIV testing and antiretrovirals were explored. (49). The study was a cross-sectional survey during 2011 among HIV-positive women who had given birth the previous year (49). There were 405 women included in random sampling and the results showed that 94% of women accessed antenatal care and 87% of women were tested for HIV. Being tested were associated with higher socioeconomic status, employment and partner getting tested for HIV (49). There were 247 known HIV-positive women and among those, 216 self-reported being HIV positive. Of those 216 mothers, 82% took prevention of mother-to-child transmission ARVs. Only 54% of women completed the full antenatal course, perinatal course and postpartum course. The use of ARV was associated with having an HIV tested partner and more ANC visits. The use of ARV during delivery was low at 62% and this was only associated with delivering at a health facility. In terms of HIV test for the newborn child, 80% of the mothers had their infant tested for HIV (49).

In another study, the use of PMTCT health services, and maternal services, for all the women disregarding their HIV status (50) were explored. Results demonstrated that HIV positive women that had not disclosed their HIV status to anyone had the lowest attendance at prevention of mother-to-child transmission and maternity health services (50). Only 21% of these mothers gave birth at a health facility. Thirty five

percent of HIV negative mothers accessed PMTCT and maternity services and 49% of women who had revealed their HIV status to people accessed the services (50). Disclosing their HIV status were associated with taking ARV to prevent mother-to-child transmission, especially disclosing to a partner, and these women were also more likely to give birth at a health facility compared to mothers who had not disclosed their HIV status to anyone (50). In a study by Bajunirwe et al. women in rural areas thought they would be better off consulting their husband before taking an HIV test (34). This is another proof that partner's involvement might be important to consider when it comes to increasing uptake of prevention of mother-to-child transmission of HIV.

Mushamiri et al. (51) tested the impact on mobile phones in the health system in terms of antenatal care and prevention of mother to child transmission services in Kenya (51). The community health workers (CHW) were in agreement that using mobile phones instead of paper-based as a form of tracking women were preferable and helped them efficiently track the women who are pregnant (51). Tracking women through mobile phones also increased the chances of women going to 6 follow-ups post-delivery. More women who used the mobile phones accessed mother-to-child transmission services compared to women who did not use mobile phones (51).

1.11. Knowledge about mother-to-child HIV transmission and prevention

In one study (52), the knowledge about the fact that HIV can be transmitted between mother and child seems to be widespread, though only approximately half of participants knew that HIV is not always transmitted between mother and child. Though most women had knowledge about that HIV can be transmitted during different stages, such as pregnancy, delivery and breastfeeding. HIV awareness and PMTCT in general seems to be high (45,52–54). Studies have explored the knowledge and attitudes about PMTCT among women and one study found that there was an association between seeking PMTCT services for the first time and never having sought reproductive health services such as family planning and abortion care (55). UNICEF showed that PMTCT services are dependent on strong infrastructure and health care systems (56). One study implemented a PMTCT program offering women testing for not only HIV but also syphilis and hepatitis B and this contributed

to MTCT of HIV decline from 8.1% in 2009 to 6.7% in 2013 (57). Sociodemographic and socioeconomic factors has been proven to influence the knowledge about PMTCT and ART (52). The above literature review can be summarized by the concept map below.

1.12. Concept map

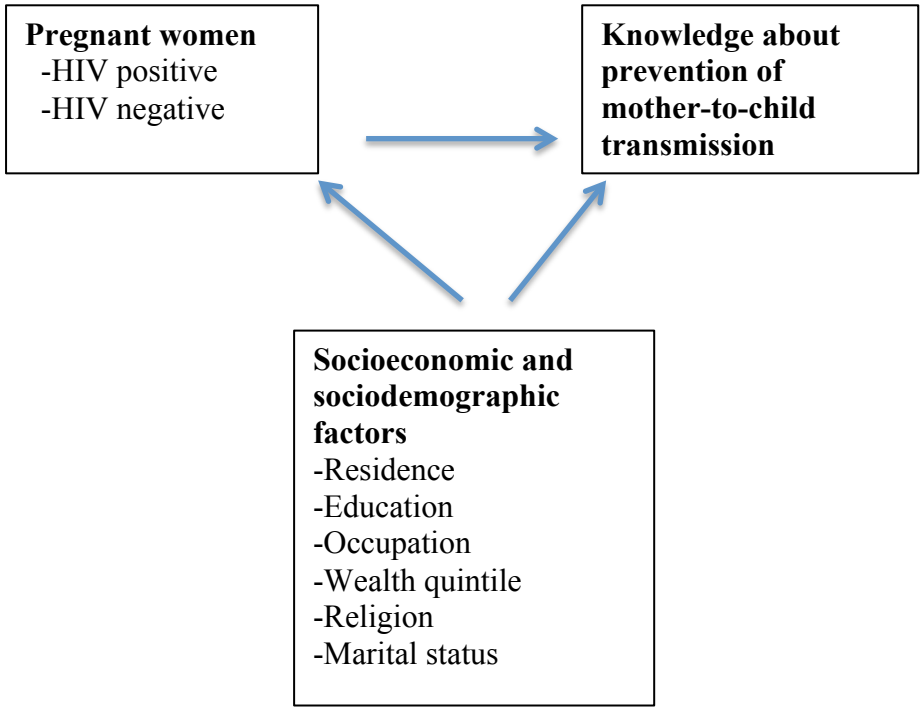

Fig. 1 Concept map guiding this secondary analysis.

1.13. Rationale of the study

Even though HIV is a global issue today, most of the people living with HIV are living in low- and middle-income countries and Sub-Saharan Africa is the most affected region. In Kenya, the prevalence of HIV is higher among women than men and therefore this secondary analysis is relevant to perform on data from Kenya on women. There is a wide spread knowledge about the fact that children can acquire HIV from their mother during pregnancy, delivery or breastfeeding also called mother-to-child transmission (MTCT) (58). There is also knowledge about the fact that there are preventive strategies to reduce HIV transmission between mother and child called prevention of mother-to-child transmission (PMTCT) (52). Therefore it is

important to discover if that knowledge about PMTCT among women is associated with socioeconomic/sociodemographic factors. Pregnant women are highly affected by this issue and therefore they are the target group in this secondary analysis. To gain knowledge in which factors might affect their knowledge makes it is easier to know which women to target when trying to decrease the risk of mother-to-child transmission of HIV. Due to the fact that low SES is associated with HIV (4), it is interesting to see if socioeconomic and sociodemographic factors are associated with the knowledge about prevention of mother-to-child transmission. There are also a limiting amount of studies addressing this particular issue with the pregnant mothers.

1.14. Objective

The objective of this secondary analysis is to explore which socioeconomic and sociodemographic factors are associated with pregnant women's knowledge about the fact that mother taking special drugs during pregnancy could reduce the risk of mother-to-child transmission also called prevention of mother-to-child transmission. Secondary analysis will be performed on 2008-09 Kenyan Demographic and Health Survey data. Included are both HIV-infected and HIV-uninfected mothers.

1.15. Research question

The research question to be answered in this secondary analysis is: Which socioeconomic and sociodemographic differentials are associated with pregnant women's knowledge on prevention of mother-to-child HIV transmission?

2. Methods

2.1. Study design

Secondary data from 2008-09 Kenya Demographic and Health Surveys (KDHS) was used (42). The Demographic and Health Surveys (DHS) study is a cross sectional study and data from 2008-09 KDHS was collected through interviewing eligible women and men using structured questionnaires (42). This survey interviewed 9,057 eligible households, 8,444 eligible women aged 15-49 years and 3,465 eligible men aged 15-54 years (42).

Three different types of questionnaires were used to obtain data in the survey: women's questionnaires, men's questionnaires and household's questionnaires (42). The questionnaires were based on model questionnaires developed by Measure DHS programme and only partly tailored to address issues in Kenya (42). In this study, data is used from Women's dataset due to the fact that this secondary analysis will only address pregnant women (42).

2.2. Study setting

The survey was conducted in Kenya, which is located in Southeastern Africa (42). The country lies on the equator and boarded by Tanzania to the south, Uganda and Lake Victoria to the west, Sudan to the northwest, Ethiopia to the north, Somalia to the northeast and Indian Ocean to the east (42). It has a total area of 582,646 square kilometers and Kenya is divided into 8 provinces and 158 districts (42). Only 20% of the land area is arable (42) and approximately 80% of the land area is semiarid or arid (42). Kenya is divided into 8 provinces and 158 districts and has many different features including for example Mount Kenya, the second highest mountain in Africa, Great Rift Valley, running from north to south and Lake Victoria, the largest lake with freshwater on the continent (42). Kenya falls into two regions, lowlands and highlands. Temperatures and rainfalls are influenced by proximity to the ocean or lakes and by altitude (42). Along the coast, the climate is tropical (42). There are 4 seasons during one year; a dry period from January to March, rainy season from March to May, dry spell from May to October and short rains between October and December (42).

The number of people living in Kenya is estimated at almost 46,000,000 in 2014 (59). Due to the fact that Kenya has a high fertility rate at 4.6 children per women in 2009 and a decline in mortality, the country has a relatively young population (42). Kenya has approximately 70 different ethnic groups (60). The 5 largest ethnic groups in the country are Kikuyu, Luo, Luhya, Kamba and Kalenjin (60). They all range in size, for example the ethnic group Kikuyu includes about 7 million people and the ethnic group El Molo consists of about 500 people (60). Kikuyu is the largest ethnic group in Kenya, though it makes up not more than 20% of the total population. The Kikuyu

group is representative in public life, business, government and the professions. People belonging to the Lou group are mainly artisans and traders. The Kamba group represents many people in law enforcement and defense. The Kalenjin group are to a large extent farmers (60).

The KDHS 2008-09 is a population and health survey conducted in Kenya every 5 years. It was designed to provide data on the health situation and population and also used as a follow up to previous KDHS in 1989, 1993, 1998 and 2003 (42).

Fig. 2 Map of Kenya by province.

2.3. Study population

A total of 400 clusters were chosen from a national master sample frame (42). Because the survey is household based, the sample was therefore drawn from the population in the households (42). Participants in the DHS study are women aged 15-49 years (42). All women between the ages 15-49 years were eligible if they were either usual residents or visitors present in the households that were going to be sampled the night before the survey (42).

The household questionnaires were administrated first to collect basic background information on each person in the household to be able to identify eligible men and women for the individual interviews. All eligible women and men that were interviewed were also asked to give drops of blood for HIV testing (42).

A sample of 10,000 households was drawn and considered representative on the national level. A total of 9,057 households were found eligible and participated. 8,444 eligible women and 3,465 eligible men were in the end interviewed from the households. There were 622 pregnant women in the study and 524 women of these gave blood for HIV testing and in this secondary analysis, they were the unit of analysis (42). See figure 3 for flowchart of sample distribution.

2.4. Sample size

A sample of 10,000 households were drawn and considered representative on the national level (42). This sample would allow for separate estimates for key indicators for the 8 provinces and also for rural and urban areas separately (42). Sparse population in North East province contributed to fewer clusters and households being surveyed in that area (42). To get enough cases for analysis in the DHS study, an attempt to oversample urban areas was done. Different sampling proportions contribute to this KDHS sample not being self-weighing at the national level (42).

2.5. Data collection

Data collection for this survey from 2008-09 Kenyan Demographic and Health Survey took place over a three-month period, from 13 November 2008 to late February 2009. The survey was conducted by 23 survey teams (42). The teams

consisted of one supervisor, four female interviewers, one field editor, one male interviewer, two health workers, one driver and two people handling Voluntary Counseling and Testing (42). Interviews were performed using structured questionnaires and in the one-half of the households that was selected for the man's survey, men and women being interviewed were also asked to provide drops of blood voluntarily for HIV testing. Two health workers were assigned to each of the survey teams to collect the blood (42).

2.6. Variables

2.6.1. Outcome variable

Pregnant women's knowledge about prevention of mother-to-child transmission. This variable is chosen to be the outcome variable. The question asked in the women's structured questionnaire is "Are there any special drugs that a doctor or a nurse can give to a woman infected with the AIDS virus to reduce the risk of transmission to the baby?" The options are yes=1, no=2, don't know (DK)=8. In this secondary analysis, all the "don't know" answers were coded as "no".

2.6.2. Exposure variable

HIV status. This variable is seen as an exposure variable. The participants were asked to give some blood so HIV testing could be performed. The results showed either HIV positive or HIV negative.

2.6.3. Predictor variables

Residence. This variable is *De jure* type of place of usual residence and the potential answers are rural residence, urban residence, abroad or not *De jure* resident. *De jure* is the place of residence where the respondent is legally living.

Education. This variable provides the highest level of education attended. This is a standardized variable providing level of education in the following categories: no education, primary, secondary, and higher.

Occupation. The variable gives information about whether the respondent is currently working. The options are no=0 and yes=1.

Wealth quintile. This variable is wealth index and is a background characteristic for the long-term standard of living of the household. It is based on the household's ownership of consumer goods, type of drinking water source, dwelling characteristics, toilet facilities and also other characteristics reflecting the socioeconomic status of the household. The assets where assigned a weight, a factor score, that was generated through principal component analysis. The asset scores were then standardized in relation to a normal standard distribution with a standard deviation from 1 and a mean of 0 (61). Every household was assigned a score for each asset and then the score were summarized for each household and the individuals in the households were ranked according to the total score of the household. The results were divided into 5 quintiles; lowest=poorest, second=poorer, middle=middle, fourth=richer, highest=richest.

Marital status. Current marital status of the respondent. The options are; never married, married or living together, not living together, divorced or widowed. The divorced category and the widowed category were collapsed due to the divorced category being empty.

Religion. This variable gives information about the respondent's religion. The answers to choose from, and the codings are; roman catholic=1, protestant/other christian=2, muslim=3, no religion=4 and other=6.

2.7. Statistical analyses

All statistical analyses were performed using the statistical software R, version 3.1.2 and further the R Commander software, a package in R. Fox, J. (2005). The R Commander: A Basic Statistics Graphical User Interface to R. Journal of Statistical Software, 14(9): 1--42. Descriptive statistics were performed in forms of frequency distributions to get an overview of the dataset and the chosen variables. For three variables, the answers appeared as numbers in the dataset and were recoded into

words to be able to make frequency distributions. These three variables were; the outcome variable, which is knowledge about prevention of mother-to-child transmission, occupation and type of religion. Pearson's Chi-square test was used to examine the association between the predictor variables and the outcome variable in bivariate logistic regression analysis. Significance were set at $p<0.05$ and those variables found to be significant were included in a multiple logistic regression. Two models for multiple logistic regressions were developed. Model I is adjusted for all the variables that appeared significant in the bivariate logistic analysis. These variables are education, wealth quintile and type of residence (see Table 3). Model II is adjusted for all the variables that were intended to be included from the beginning, significant or not in the bivariate logistic analysis (see Table 3). This was due to them being relevant for the topic even though they did not appear significant in the bivariate logistic regression.

When there was a pronounced difference between the crude odds ratios from the bivariate logistic regression and the odds ratios from the multiple logistic regressions, additional tests were performed to investigate which predictor or predictors might have caused this phenomenon and if multicollinearity was present in the analysis. Multicollinearity appears when two or more factors are connected to each other and are affecting one another.

The sampling design needs to be taken into consideration because many standard errors and estimates are calculated different for different sampling strategies. Hence, not accounting for sampling strategy will likely make the standard errors underestimated (62).

3. Ethical considerations

The data used in this study was obtained from Kenyan Demographic and Health Surveys from the years 2008-09. The survey was carried out by the Kenya National Bureau of Statistics (KNBS) in partnership with the National AIDS/STD Control Programme (NASCOP), the National AIDS Control Council (NACC), the Ministry of Health and Sanitation, the Kenya Medical Research Institute (KEMRI), and the National Coordinating Agency for Population and Development (NCAPD). All DHS

data are free to use. A registration process is needed before obtaining the data. General description of the study is needed when applying for the data, such as aim, research question and data analysis. A person reviews the request and when the request is approved, instructions on how to download the data were received with the approval email (42).

3.1. Informed consent

Participants were given an informed consent form to fill out containing information about that the information they provide will be kept confidential and not shown to anyone other than people on the survey team. Participation in the survey was voluntary and they did not have to answer any questions they did not want to answer. They could also stop the interview at any time (42).

3.2. HIV testing

Men and women who were eligible for participation were asked to provide blood for HIV testing. The protocol for the blood collection and analysis was anonymous and based on the anonymous linked protocol which were developed by DHS programme. This was revised and enhanced by NACC and KEMRI. The Scientific and Ethical Review Committee of KEMRI reviewed and approved the study. HIV results could be linked to sociodemographic data in the individual questionnaires due to this linked protocol. If the information could be linked to an individual it was destroyed before linkage. Health workers were recruited from the Ministry of Public Health to prepare the respondents for the blood sample and also obtain informed consent. The health workers explained the procedure, confidentiality of data, and that the results could not be traced back to an individual. If a respondent wanted to know their HIV status, they were informed by the health worker where to obtain VCT services (42).

4. Results

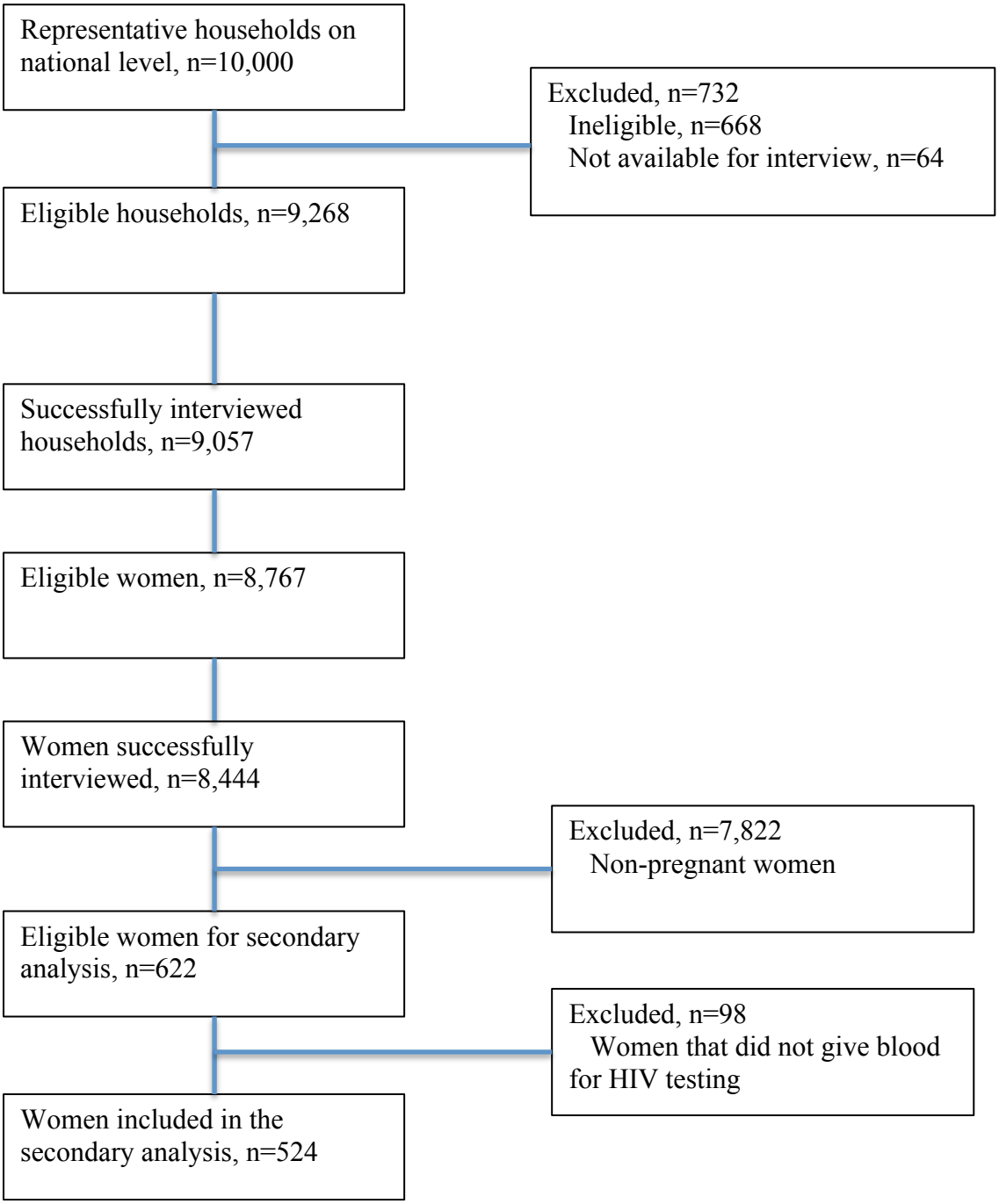

Fig. 3 Flowchart of sample distribution.

4.1. Descriptive statistics

From the total sample of 8,444 women that were eligible from the beginning in the 2008-09 KDHS, 524 women were included in this secondary analysis (see figure 3 for full flowchart of sample distribution) and respondent's background characteristics are presented in Table 1. Included in Table 1. are different characteristics such as HIV status, occupation, marital status, highest level of education, wealth quintile, type of residence, knowledge about PMTCT, ethnicity and type of religion. Presented is also number of participants with percentages and all the missing values. The table shows that most women were HIV negative; only 6% were infected with HIV. The majority of the women had a primary education (57%), lived in rural areas (71%), were married (84%) and belonged to the poorest quintile (30%). In terms of marital status, the category "divorced" was empty and "widowed" was near empty and therefore these two categories were collapsed into one category. In terms of occupation, 48% of participants had any type of occupation and 52 % of participants did not have any type of occupation at the moment. Overall, the majority of women had knowledge about the fact that HIV transmission between mother and child can be prevented by drugs, which is the outcome variable. As much as 74% of all participants did have knowledge about PMTCT. In terms of religion, most participants were protestant/other christian. Overall, most of the participants had any type of religion; only 4% of participants did not belong to any religion. Ethnicity is also showing in the Table 1. As mentioned, there are about 70 ethnic groups in Kenya though only 12 specific ethnic groups are mentioned in Table 1. Embu, Kalenj, Kamba, Kikuyu, Kisii, Luhya, Luo, Masai, Meru, Mijikenda/Swahili, Somali, Taita/Taveta and Other can be seen in Table 1.

Table 1. Baseline characteristics among participants included in this secondary analysis from the 2008-09 Kenyan Demographic and Health Survey. Values are absolute frequencies (n) and relative frequencies (%*). N=524.

Characteristic		Participants	Missing
HIV status	Positive	33 (6)	
	Negative	491 (94)	
Occupation	Yes	253 (48)	1 (0)
	No	270 (52)	
Religion	Muslim	109 (21)	2 (0)
	Protestant/other christian	284 (54)	
	Roman catholic	108 (21)	
	No religion	21 (4)	
Education	No education	113 (22)	
	Primary	297 (57)	
	Secondary	84 (16)	
	Higher	30 (6)	
Residence	Rural	374 (71)	
	Urban	134 (26)	
	Not de jure	16 (3)	
Wealth	Poorest	158 (30)	
quintile	Poorer	82 (16)	
	Middle	90 (17)	
	Richer	77 (15)	
	Richest	117 (22)	
Marital status	Never married	38 (7)	
	Married	440 (84)	
	Living together	27 (5)	
	Widowed	6 (1)	
	Divorced	0 (0)	
	Not living together	13 (2)	
Knowledge	Yes	336 (74)	2 (0)
about	No	115 (25)	
PMTCT			
Ethnicity	Embu	7 (1)	
	Kalenjin	44 (8)	

Kamba	31 (6)
Kikuyu	55 (11)
Kisii	31 (6)
Luhya	90 (17)
Luo	71 (14)
Masai	15 (3)
Meru	10 (2)
Mijikenda/Swahili	51 (10)
Somali	62 (12)
Taita/Taveta	6 (1)
Other	51 (10)

**Percentages may not sum up to 100 due to rounding.*

4.2. Prevalence of knowledge about PMTCT

Absolute frequencies and row percentages are presented from Pearson's Chi-square tests in Table 2. The table includes knowledge about PMTCT, the socioeconomic predictors and p-value for each predictor. Knowledge about PMTCT is the outcome and it was tested against each socioeconomic factor separately. The factors being tested against knowledge about PMTCT are highest level of education, occupation, type of religion, wealth quintile, marital status, type of residence and HIV status of the participant. Four of the predictors had a statistical significant p-value. These predictors are; highest level of education, religion, wealth quintile and type of residence. Three socioeconomic factors did not have a significant p-value and those were occupation, marital status and HIV status. Educational level seems to be associated with knowledge about PMTCT due to the fact that this showed a highly significant p-value. Few respondents with no education had knowledge about PMTCT compared to respondents that has some type of education. Most of the people that had some type of education did in fact have knowledge about PMTCT, 86% did have knowledge about PMTCT with higher education compared to not having an education, where only 29% had knowledge about PMTCT. Hence, there seems to be a trend in having knowledge about PMTCT among educated women. There was a statistical significant difference between different religions in terms of PMTCT knowledge. Wealth quintile had a highly significant p-value. Wealth quintile and knowledge about PMTCT seems to be associated in the way that most of the women in higher wealth quintiles has knowledge compared to women in lower quintiles. In the richest quintile, 90% of women had knowledge about PMTCT and in the poorest wealth quintile, 53% had knowledge about PMTCT. Furthermore, we see a trend in

having knowledge about PMTCT with higher wealth quintile. Most women living in urban areas have knowledge compared to women living in rural areas. The majority of women living in rural areas do not have knowledge about PMTCT.

Table 2. Socioeconomic and sociodemographic characteristics tested against knowledge about PMTCT including Pearson's Chi-square test. Absolute frequencies (n) and row percentages (%*). P-values for each participant characteristic are also presented. N=524.

Characteristic	**Knowledge about PMTCT**		***p-value*****
	Yes	No	
Education			<0.001
No education	18 (29)	45 (71)	
Primary	223 (80)	56 (20)	
Secondary	70 (85)	12 (15)	
Higher	25 (86)	4 (14)	
Occupation			0.062
Yes	183 (78)	52 (22)	
No	153 (70)	65 (30)	
Religion			<0.001
Muslim	37 (50)	37 (50)	
Protestant/other christian	206 (79)	54 (21)	
Roman catholic	81 (80)	20 (20)	
No religion	12 (67)	6 (33)	
Wealth quintile			<0.001
Poorest	59 (53)	52 (47)	
Poorer	52 (69)	23 (31)	
Middle	62 (79)	17 (22)	
Richer	61 (81)	14 (19)	
Richest	102 (90)	11 (10)	
Marital status			0.10
Married	279 (74)	99 (26)	
Living together	17 (77)	5 (23)	
Not living together	9 (70)	4 (31)	
Divorced/widowed	5 (83)	1 (17)	
Never married	26 (24)	8 (77)	
Residence			0.001
Rural	219 (70)	94 (30)	
Urban	109 (87)	17 (14)	
Abroad/not dejure	8 (57)	6 (43)	

HIV status			0.086
Positive	23 (89)	3 (12)	
Negative	313 (73)	114 (27)	

**Percentages may not sum up to 100 due to rounding.*

***P-value presented with statistical significance set at p<0.005.*

4.3. Determinants of knowledge about prevention of mother-to-child HIV transmission

Multiple logistic regressions were performed to get crude and adjusted odds ratios with confidence intervals and the results are presented in Table 3. The table includes the characteristics, crude odds ratios from bivariate logistic regression and adjusted odds ratios for model I and model II from multiple logistic regressions. Model I is adjusted for all the characteristics that were significant in the bivariate logistic regression and model II is adjusted for all the characteristics regardless of significance. The characteristics were included even though they were not showing a significant p-value in the bivariate logistic regression because they were found relevant for the topic anyways.

Results showed that education was significant in Chi-square test (see table 2), and all the categories were significant in bivariate logistic regression and multiple logistic regressions (see Table 3). In the bivariate logistic regression analysis, there was an increased chance that the respondent had knowledge about PMTCT with an increased level of education compared to no education. In both the adjusted models, model I adjusted for the significant characteristics and model II adjusted for all characteristics, women with primary or secondary education where much more likely to have knowledge compared to higher education, the reference category being no education. This was not the case in bivariate logistic regression, where there seemed to be an increasing trend of having knowledge about PMTCT with higher level of education.

The results from a Chi-square test for the sociodemographic factor religion showed that there was a significance difference (see Table 2). The crude odds ratio from the bivariate logistic regression, showed that being a Muslim decreased the odds of having knowledge compared to not belonging to any religion, though this did not

show a significant difference. Being a protestant/other christian or roman catholic increased the chances of having knowledge compared to no religion though this did not show a significant difference either. The results from model II, adjusted for all the characteristics, showed that being a roman catholic increased the odds of having knowledge compared to not belonging to any religion, though this did not show a significant difference either (see Table 3).

A Chi-square test performed for wealth quintile showed that there was a significance difference between the different categories (see Table 2). The bivariate logistic regression showed that the chances of having knowledge increased with belonging to higher wealth quintiles compared to the poorest quintile and this showed a significant difference. The results from the adjusted models, showed that in model I, adjusted for the significant characteristics, the richer and richest quintiles had a significant difference and in model II, adjusted for all the characteristics, only the richest quintile showed a significant difference between this wealth quintile and having knowledge about the PMTCT outcome. Even though a significant difference did not show for all the categories, a trend is showing that belonging to a higher wealth quintile can increase the chances of having knowledge about PMTCT (see Table 3).

Results from test being performed for type of residence where the respondent lived against the PMTCT outcome, showed a significant difference in the Chi-square test (see Table 2). When performing bivariate logistic regression, only urban residence showed a significant difference. In bivariate logistic analysis, living in urban areas increased the odds of having knowledge compared to living in rural areas. The same trend were shown in the adjusted models though there were no statistical significant differences in either model I, adjusted for the significant characteristics from bivariate analysis, or model II, adjusted for all the characteristics, as there were in the bivariate analysis. Living abroad or not being a de jure resident seemed to decrease the chances of having knowledge though this was not significant in any analysis (see Table 3).

There were three predictors that did not show a significant difference in any of the tests being performed. For example HIV status did not show a significant difference in any of the tests performed in the analysis. The same non-significant results were shown for occupation and marital status (see Table 2 and 3).

Table 3. Socioeconomic and sociodemographic characteristics tested against the outcome, which is knowledge about PMTCT, presented with odds ratios (OR) and a 95% confidence interval (CI). Categories with OR=1 is considered the reference category. N=524.

Characteristic	Crude OR* (CI 95%)	Adjusted OR I** (CI 95%)	Adjusted OR II*** (CI 95%)
Education			
No education	1	1	1
Primary	9.96 (5.44-18.91)	9.44 (4.87-19.06)	7.80 (3.828- 16.52)
Secondary	14.58 (6.62-34.42)	9.79 (4.12-24.68)	7.58 (3.00-20.22)
Higher	15.63 (5.21-58.96)	7.057 (2.10-28.60)	5.02 (1.40-21.40)
Occupation[a]			
No	1		1
Yes	1.50 (0.98-2.29)		1.31 (0.78-2.18)
Religion[b]			
No religion	1		1
Muslim	0.50 (0.16-1.43)		0.31 (0.08-1.15)
Protestant/other christian	1.91 (0.64-5.15)		0.81 (0.22-2.76)
Roman catholic	2.03 (0.64-5.92)		1.04 (0.26-3.83)
Wealth quintile			
Poorest	1	1	1
Poorer	1.99 (1.08 -3.73)	1.12 (0.56-2.24)	1.06 (0.51-2.18)
Middle	3.21 (1.70 -6.31)	1.59 (0.77-3.34)	1.29 (0.61-2.78)
Richer	3.84 (1.97 -7.88)	2.36 (1.05-5.54)	2.14 (0.93-5.14)
Richest	8.17	4.96	5.18

	(4.09-17.64)	(1.68-15.75)	(1.64-17.61)
Marital status			
Never married	1		1
Divorced/widowed	1.54		3.15
	(0.21-31.75)		(0.33-75.20)
Not living together	0.69		1.16
	(0.17-3.09)		(0.20-7.78)
Living together	1.046		0.82
	(0.30 -3.96)		(0.19-3.78)
Married	0.87		1.13
	(0.36 -1.90)		(0.40-2.88)
Residence			
Rural	1	1	1
Urban	2.75	1.10	1.41
	(1.60- 4.98)	(0.45-2.73)	(0.55-3.75)
Abroad/not dejure	0.57	0.45	0.48
	(0.19- 1.78)	(0.13-1.62)	(0.14-1.81)
HIV status			
Negative	1		1
Positive	2.79 (0.95- 11.93)		2.76 (0.78-14.00)

[*] *Crude odds ratios from bivariate logistic regression analysis. Missing values in the outcome variable are categorized as "no knowledge" in both crude and the adjusted models.*

[**] *Model I. Multiple logistic regression analysis including predictors significant in the bivariate analysis*

.[***] *Model II. Multiple logistic regression analysis including all predictors.*

[a] *Missing values are included on the "No" category.*

[b] *Missing values are included in the "No religion" category.*

4.4. Association between wealth quintile and education

For two characteristics, education and wealth quintile, there were a pronounced difference between the crude odds ratios from the bivariate logistic regressions and the adjusted odds ratios from the adjusted model I, adjusted for significant predictors from bivariate logistic regression, and model II, adjusted for all predictors. These results were shown within certain categories. For education, the difference in odds ratios for secondary and higher education were especially remarkable. For wealth quintile, the richest quintile also showed remarkable differences between different odds ratios. Therefore, multiple logistic regressions were performed to investigate which of the other characteristics might cause this. Education and wealth quintile were only tested against the other socioeconomic differentials that appeared significant in bivariate logistic regression. Education was tested against knowledge about PMTCT and each of the other significant characteristics separately i.e. residence, as this was the only one except for wealth quintile and education that was significant in the crude analysis. The same test was performed for wealth quintile. Wealth and education were also tested with each other against knowledge about prevention of mother-to-child transmission.

When testing education and type of residence together against knowledge about PMTCT, it showed a significant difference for both education and type of residence. Education tested with wealth quintile against knowledge showed a significant difference for education and only the richer and richest category for wealth quintile. Education together with both residence and wealth quintile tested against the knowledge showed the same results that were shown in model I adjusted for the significant predictors, i.e. education and richer and richest quintile were significant.

When testing wealth quintile and type of residence against knowledge about PMTCT, results showed a significant difference for wealth quintile but not for type of residence. The above analyses thus clearly show that there is an issue with multicollinearity and results should be interpreted with caution.

5. Discussion

Most of the women seem to have knowledge about prevention about mother-to-child transmission, as much as 74% of women did have knowledge. Results showed that the two of the most important socioeconomic factors for having knowledge was having some kind of education and belonging to a higher wealth quintile.

There are both strengths and limitations in this secondary analysis. The first strength is that this secondary analysis is using secondary data from DHS, which is considered good quality data, making the internal validity good and minimizing potential bias, for example measurement bias that can occur with a research team that is not very familiar with the setting etc. The second strength is that this topic is not well explored among pregnant women in particular so therefore it is important to address this issue due to the fact that pregnant women is the target group. Though women that intend to become pregnant, or are becoming pregnant anyways, are also important to focus on which can be a limitation due to the fact that this secondary analysis does not include those women. Yet another aspect of this is that these women may not be as easy to find as those who are actually pregnant. Many women do get pregnant even though this was not intended from the beginning and women might not be aware of their pregnancy at first. Therefore, due to the limitation that this report only includes pregnant women, it may not be possible to generalize this to a larger population.

Another limitation of this study is to know if the data management has been correct. The major issue in this report is to know if the women have been connected to the right HIV test. All the information about the socioeconomic and sociodemographic factors came from one dataset and the HIV test results came from another dataset, so these datasets had to be connected by case id, i.e. the number of eligible women included in this secondary analysis may not be correct. Another limitation in this secondary analysis is that even though it is data from Kenya Demographic and Health Survey, this is cross-sectional data. With cross-sectional data it is difficult to draw conclusions about cause and effect. An additional limitation is the fact that this topic in particular has not been explored in detail, which makes it difficult to compare the results to other studies. The few studies being compared to this secondary analysis are both qualitative and quantitative, which makes the methods diverse. This is

considered to be a strength due to the fact that the results in terms of for example the issue of cost is coherent and points to the same conclusions.

In terms of knowledge about PMTCT, as mentioned in the results in descriptive statistics (see Table 1.), results showed that in general most women seem to have knowledge about PMTCT which is in agreement with other studies (45,52–54). Results showed that education with all its categories, in both model I, adjusted for all significant factors, and model II, adjusted for all factors, were statistically significant associated with the women knowing about the fact that a mother who takes drugs during pregnancy, labor or delivery can prevent HIV being transmitted to the child. A significant association was also shown for the wealth quintiles. Though wealth quintile only showed a significant association in the richer and richest category in model I, adjusted for all the significant characteristics. In model II, adjusted for all characteristics, only the richest quintile showed a significant association when tested against knowledge about prevention of mother-to-child transmission. Even so, there seems to be a trend that with increasing wealth quintile, women are more prone to having knowledge about PMTCT. These results indicate that education and wealth quintile might play an important role in who has knowledge about PMTCT, which is in agreement with Kinuthia et al. (43) that demonstrated that higher level of education and higher level of SES seemed to be associated with delivering at health facilities and hence taking ARVs in the purpose of preventing mother-to-child transmission. It is reasonable to assume that taking ARV to prevent the child from acquiring HIV indicates having knowledge about it, though this is of course speculations. In another study by Kinuthia et al. (38), results showed that women who actually gets tested for HIV during ANC are those who have a higher socioeconomic status and a higher level of education. It is plausible that women who do not want to get tested for HIV are those with less knowledge about the consequences of HIV. For example that it can be transmitted between mother and child.

Kinuthia et al. (43) showed in another study previously mentioned, that cost, distance to health facility and harsh treatment when arriving at a facility are disincentives for delivering at a health facility among HIV-infected women. These results might indicate that behavior, in terms of delivering at a health facility, among HIV-infected women is different from behavior among HIV-uninfected women. Though the results

from the analyses in this study did not show any significant difference in terms of knowledge about PMTCT between HIV-infected women and HIV-uninfected women. This might be due to very few participants being HIV-infected.

The cost being a barrier for antenatal care and delivering at a health facility also came up in another study (44). This issue with cost seems to be a recurring factor for many women. This indicates that women with lower socioeconomic status have more financial constrains hindering them from delivering at health facilities. Dealing with this issue might increase the number of women coming to health facilities. Potential solutions for addressing this problem could be giving out for example vouchers to the mothers so they do not have to pay for transport themselves. Also reducing or remove fees for antenatal care could be a potential solution for this issue.

In this secondary analysis, residence appeared significant in bivariate and multiple logistic regressions, indicating that type of residence can be associated with whether the respondent has knowledge about PMTCT or not, though in one study, the knowledge about prevention of mother-to-child transmission did not seem to differ between rural and urban areas (34). Due to the fact that distance to health facility came up as an issue for many HIV-infected women, living far away from a health facility can plausibly make the woman less likely to receive antenatal care and therefore not receiving antiretroviral therapy. Not attending antenatal care might affect her knowledge that HIV can be transmitted between mother and child.

Even though not all the categories in wealth quintile were significant, this socioeconomic factor seems to be important in terms of belonging to a higher wealth quintile, the women seems to have an increased knowledge about PMTCT compared to lower wealth quintiles. In terms of education, with a higher level of education, the women seems to have an increased knowledge compared to women with a lower education. This finding can be associated with the fact that a woman who completes higher levels of education has a higher probability of learning this in school. Not only through the teacher, but also the women have the opportunity to talk to each other in school and spread the knowledge. This study showed that education level and wealth quintile is associated with each other. It is very likely that a woman with a higher level of education might belong to a higher wealth quintile because it can be easier to

find a well paying job when having an education. It could also be the other way around that a girl who belongs to a higher wealth quintile has the opportunity to go to school, compared to someone who may not have the financial opportunities to send their children to school. One aspect that is interlinked with financial status and education is the woman's autonomy. In this kind of setting not all the women have the same opportunities when it comes to education and financial aspects, especially due to the fact that women are a vulnerable group.

Multicollinearity appears when two or more factors are closely connected to each other and are affecting one another. When testing for multicollinearity, results showed that education and residence together against the outcome had a significant difference in both education and residence. Education tested with wealth quintile against knowledge about PMTCT, showed a significant difference for education and only the richer and richest category for wealth quintile. Education together with both residence and wealth tested against knowledge, showed a significant difference for education and richer and richest quintile, but not for residence. Also, when testing wealth quintile and residence against knowledge, the test showed a significant difference for wealth quintile but not for type of residence. These results might indicate that residence is strongly connected to the level of education the women has and also even more to the wealth quintile that the woman belongs to. Though as mentioned earlier, these three socioeconomic factors are most likely to be associated with each other.

Some of the factors appeared significant in some tests and not significant in other tests. The first example is that type of religion showed a significant difference in the Chi-square test but not in the bivariate logistic regression test, which was surprising. This might have been caused by the "No religion" category being too small and affecting the logistic regression tests. It can also be due to incorrect data management though the risk of that is not very high due to the fact that the tests were performed several times. In terms of residence, when comparing having knowledge about PMTCT between the different types of residences, results showed only a significant difference in the bivariate logistic regression and only between rural and urban residences and not in model I, adjusted for all the significant predictors, or model II, adjusted for all the predictors. The fact that type of residence did not appear significant in the adjusted models can be due to confounding or multicollinearity. One

reasonable explanation for residence not being significant in the adjusted models is that this factor might be affected by the type of wealth quintile and further by the type of education. Without any education, the woman are at risk of ending up in a lower quintile, and thus are at risk of living only where she can afford, i.e. most likely in rural areas.

The rate of mother-to-child transmission were shown to be higher among adolescent mothers in a study performed in South-Africa (63). This was shown even though there were high levels of attendance in antenatal care clinics among adolescents. This result indicates that adolescents are a particularly vulnerable group when it comes to prevention of mother-to-child transmission. In the combination of being a young HIV positive mother, this group might need extra support and friendly family planning services with PMTCT services as well.

An important aspect of prevention of mother-to-child transmission when it comes to taking drugs is adherence to the drugs. One study explored which predictors might affect the adherence to antiretroviral therapy (39). Non-adherence to the drug nevirapine was associated with giving birth at home, no high school education and low birth weight of the newborn child. A strength with this study is that it included many women, 760 HIV-positive mothers. Also, the majority gave birth at the clinic and most women and children, over 90%, received nevirapine to prevent HIV transmission between mother and child (39). This is yet another example of the fact that education plays an important role when it comes to HIV and mother-to-child transmission.

As proven by Spangler et al. (50), discloser of HIV status seems to increase the numbers of antenatal care visits and also receiving antiretroviral treatment for prevention of mother-to-child HIV transmission (50). This is proof that the stigmatization and taboo around HIV needs to be dealt with. If more women feel like they can be open about their HIV status they might feel more comfortable to seek the care that they need. Kohler et al. (49) also showed that the majority of women who had self-disclosed their HIV status accessed prevention of mother-to-child transmission services. This is yet another conclusion of the fact that it is beneficial to be open about one's HIV status. To decrease the stigmatization around HIV, it would

be possible to increase the equity aspect in this. It is preferable to give all the women the treatment they need individually but to do so, it is important to know which treatment a specific women need. HIV treatment differs between different individuals (64). Without knowing the HIV status, it is difficult to give the right treatment and advices. For example young HIV positive mothers might need a different approach in terms of advice as oppose to older women. As mentioned earlier, women from rural areas thought they would be better off consulting their partner before being tested for HIV (34), this is really indicating that women's autonomy is important and that place of residence can in fact matter in terms of the opportunity to know about and receive PMTCT.

Mushamiri et al. (51) showed the importance of mobile phones within this topic. Both women and community health workers seemed to benefit from this approach. Community health workers could easily do their job in tracking women who were pregnant and pregnant women received antenatal care and prevention of mother-to-child transmission services to a larger extent. This might be a sign on what to focus on within this topic. In a study by Smillie et al. (65), the use of mobile phones for retention in HIV care were explored and results disclosed that many people had a mobile phone and knows how to use it. Also, participants seemed optimistic in using mobile phones (65). This study also established the fact that stigmatization around HIV is a barrier for retention in HIV care (65). According to these studies, mobile phones seem to be a potential way of increasing the use of health services needed.

Going back to the concept map guiding this secondary analysis in figure 1, the association between the different components in the framework seems to be reasonable, although not all of the socioeconomic and sociodemographic differentials seems to be equally important. The exposure, which is the HIV status, does not seem to be as important as expected due to the fact that HIV seems to change certain behavior (43). Either these results from this study points to HIV status not being of great importance, or it is plausible that the number of HIV infected women were to small.

As previously mentioned, Millennium development goal 6 is focusing on combating HIV/AIDS, malaria and other diseases (1). Even though many countries have done

progress in doing so, the goal has not been fulfilled completely. Because the progress of HIV is more rapid in children than in adults (13), one major focus for hindering the HIV pandemic should be not only on the mothers, but the children as well. Giving drugs to the mothers in the purpose of preventing HIV transmission between the mother and child is not a 100% guarantee that the child will not acquire HIV. Therefore, it is important to remember that antiretroviral therapy should also be given to the child. This is of course not possible during pregnancy, but during delivery and labor the child should be given attention in terms of antiretroviral therapy. With this in mind, there seem to be remaining barriers to achieving Millennium development goal 6. It is important that policymakers and politicians are aware of this remaining problem and that these women and children are not left behind. HIV in certain countries can be stigmatized and difficult to talk about. It is therefore important to raise this issue on a societal level, national level and global level to take away the stigmatization around HIV. One barrier is always the financial constrains a low-income country such as Kenya might face. And it is a fact that antiretroviral therapy costs a lot of money. Furthermore, politicians and policymakers play an important role in this issue to make all treatment as available as possible for everyone. In terms of the MDGs, there are other relevant aspects that seem to be important to address due to the fact that the social differentials are probably due to inequalities and inequities when it comes to women's autonomy. MDG number 3 is about promoting gender equality and empower women (66) which seems to be an underlying issue when interpreting the results from this secondary analysis.

6. Conclusion

Education and socioeconomic status seems to be the two major social differentials affecting if the mother has knowledge about PMTCT or not, though these factors might also be interlinked closely to each other. This topic needs to be explored in more detail among pregnant women to be able to know which women have the least knowledge about prevention of HIV between mother and child and when knowing that, it is easier to know which women to target to be able to increase the knowledge among the populations with high prevalence of HIV in low- and middle income countries. Women who deliver at health facilities have a higher chance of receiving ARVs for preventing MTCT of HIV, therefore women with lower socioeconomic status and lower level of education should be targeted due to the fact that these are the ones with lowest chance of delivering at a health facility.

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