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Mode of Delivery Decisions Among HIV-infected Mothers at an Urban
Maternity Hospital in Nairobi, Kenya

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

by

Jessica Hoffmann Beard

2008

MODE OF DELIVERY DECISIONS AMONG HIV-INFECTED MOTHERS AT AN URBAN MATERNITY HOSPITAL IN NAIROBI, KENYA

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Abstract:

Purpose: The objectives of this study are to describe mode of delivery decision making among HIV positive women, understand patient knowledge and attitudes regarding elective cesarean section (ECS) for prevention of mother-to-child transmission of HIV (PMTCT), and in turn quantify the use of ECS for PMTCT at an urban Kenyan maternity hospital.

Methods: This is a descriptive cross-sectional study involving the survey of postpartum HIV-infected women delivering at Pumwani Maternity Hospital (PMH) in Nairobi, Kenya. Each participant was interviewed using a standardized questionnaire.

Results: 250 women participated in this study over the course of three months. The rate of delivery by ECS for PMTCT was 4.0% (10/250), though 13.6% (34/250) planned this mode of delivery. Planning ECS was positively correlated with higher education levels (OR: 1.46; 95% CI: 1.09-1.94, p=0.028) and markers of higher socio-economic status

including having a private toilet (OR: 2.89; 95% CI: 1.43-3.84, p=0.002) and living in a home with greater than one room (OR: 2.89; 95% CI: 1.07-7.80, p=0.033). The strongest correlates of ECS planning included having a surgical history (OR=5.86, 95% CI: 2.92-11.77, p<0.001), attending clinic at PMH (OR=7.85, 95% CI: 4.63-13.30, p<0.001), and knowledge of ECS (OR=24.50, 95% CI: 8.10-93.35, p<0.001). Patient education regarding ECS for PMTCT was limited, and 64% (160/250) of participants had never heard of this PMTCT intervention. Most often cited concerns regarding cesarean section included increased recovery time (66.3%), minor complications (55.4%), and risk of death (48.7%). Post-counseling, 48.0% (120/250) of participants would choose elective cesarean section if offered, while 67.6% (169/250) would opt for this mode of delivery if the cost of ECS was the same as vaginal delivery. Correlates of ECS acceptability included high socioeconomic status (e.g. secondary education OR=1.64, 95% CI: 1.25-2.15, p<0.001; ability to pay for delivery OR=1.40, 95% CI: 1.12-1.76, p=0.003), surgical history (OR=2.79, 95% CI: 1.21-6.43, p=0.011), and attendance at PMH antenatal clinic (OR=3.03, 95% CI: 1.54-5.98 p=0.001).

Conclusions: Patient knowledge and uptake of ECS for PMTCT is limited at PMH. Although women are aware of the dangers of ECS, post-counseling acceptability of ECS, especially if the burden of cost is removed, is high.

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I. INTRODUCTION

Each day, 1800 children are newly infected with HIV worldwide, the vast majority of them in sub-Saharan Africa [1]. Generally, infected children acquire HIV from their mothers during pregnancy, at the time of delivery, or through breastfeeding. In Nairobi, Kenya, HIV prevalence among pregnant women is nearly 11% making mother-to-child HIV transmission a substantial threat to pediatric health in the country [1].

Established in 2004, the PMTCT Program at Nairobi's Pumwani Maternity Hospital (PMH) currently targets vertical transmission of HIV by providing free services to infected women and their children, including antenatal HIV counseling and testing, antiretroviral (ARV) prophylaxis, safe obstetric practices during labor and delivery, education regarding safe infant feeding options, replacement feeding with infant formula at no cost, and HIV DNA PCR testing of children. Despite these interventions, rates of HIV transmission in Nairobi hospitals range from 6-16% of infants born to infected women (compared to rates of less than 1% in the US and Western Europe) according to recent program evaluation data [2].

Elective cesarean section (ECS), defined as cesarean section before the onset of labor or rupture of membranes, is an important and effective PMTCT tool used widely in Western Europe and the United States. ECS has been shown in several studies (including one randomized clinical trial) to substantially reduce the risk of MTCT in cases where HIV-1 infected women receive no ARVs or only zidovudine prophylaxis during pregnancy [3-4]. The American College of Obstetricians and Gynecologists (ACOG) currently recommends scheduled cesarean delivery (CD) for HIV-infected women at 38

weeks gestation with plasma viral loads >1000 copies per milliliter, citing insufficient evidence of ECS effectiveness at lower viral loads [5]. Of note, Ioannidas et al. challenge this thinking in their controversial 2001 study, suggesting a continued benefit of ECS even in women with plasma viral loads <1000 copies/ml or in women receiving HAART [6-7].

A. ECS Limitations: Access, Safety, and Cost

While ECS remains a cornerstone of PMTCT care for certain populations in the developed world, the utility of ECS for PMTCT in “resource-poor” settings represents a continuous source of debate. Official World Health Organization (WHO) guidelines state that ECS “may not be appropriate in resource-constrained settings because of limited availability, cost, and the risk of complications” [8]. In this section of the Introduction, these three concerns will be addressed and in turn challenged, especially with respect to their applicability in context of Pumwani’s PMTCT Program.

As WHO guidelines suggest, access to cesarean delivery for any indication in resource-poor settings is a valid and pressing concern. A recently published survey of CD utilization in eight sub-Saharan African countries found that Kenya leads in access to this intervention with a country-wide rate of 6.7% and an urban rate of 11.1% of single live births delivered by cesarean section in 1998 [9]. In comparison, Tanzania’s overall CD rate was 2.2% while Niger represented the country with the least CD availability at 0.6% of single live births [9]. Although the rates of CD are significantly lower than those found in the United States (where CD rates are nearly 30%), access cesarean delivery may actually be higher in Kenya, even in rural areas, when compared to its availability in

other countries of sub-Saharan Africa [10]. Of note, researchers in West Africa estimate that a median cesarean section rate of 5.4 % is needed to address maternal complications of pregnancy and delivery, including protracted labor, placental abruption, previous cesarean delivery, and malpresentation [11]. Interestingly, this approximated CD rate for Africa is the same as the rate of cesarean delivery in the United States in 1970 [10]. Therefore, while Kenya may be able to address cesarean delivery needs for maternal reasons country-wide based on the aforementioned statistics, building capacity for CD services for fetal indications, including PMTCT, is an important challenge, especially outside urban centers like Nairobi.

European and North American studies suggest that although ECS for PMTCT is associated with increased maternal postpartum morbidity (PPM) over vaginal delivery, the efficacy of ECS in reducing MTCT outweighs the risk of PPM [3]. Notably, there is no data regarding infant morbidity according to mode of delivery in HIV positive women [3]. WHO ECS guidelines are based on the assumption that postpartum complications of ECS for PMTCT may occur at higher rates in resource-poor settings, an issue that remains largely unexplored in the literature. Preliminary data on this subject is conflicting and applicability remains hindered by study design. For example, a recent study conducted at Mulago Hospital in Kampala, Uganda, found increased incidence of post-cesarean endometritis and wound infection among HIV positive women when compared to their HIV negative counterparts [12]. Of note, ARV prophylaxis was generally not available to the Ugandan study participants and nearly 98% of the study's cesarean deliveries were done emergently. It is well established that post-partum morbidity is more common following emergency than elective cesarean section, therefore

this data may not be generalizable to risk of PPM after ECS [3]. A 2005 Kenyan study found that HIV status had no effect on post-CD wound infection among women in Kiambu District Hospital [13].

Data from a recent Thai cohort study, which focused specifically on post-partum morbidity after ECS for PMTCT showed that among HIV infected women receiving ARV prophylaxis in pregnancy, there was no statistically significant difference in the rate of post-operative complications when compared to a control group of non-infected women undergoing ECS for other reasons [14]. Notably, this study also demonstrated that advanced HIV disease and low CD4 count were associated with increased post-operative maternal morbidity. These results are promising concerning the safety of ECS for PMTCT in a resource-poor setting, at least in patients with less advanced HIV disease. A similar retrospective cohort study underway at Kenyatta National Hospital to characterize post-partum morbidity after ECS for PMTCT may help to elucidate this subject further.

Cost can also impede antenatal HIV positive women's access to obstetric care, including ECS. Studies in Tanzania and Nepal indicate that hospital fees as well as "unofficial costs" like transport to medical facilities represent a key barrier to the utilization of obstetric services [15-16]. Of note, the average cost of transport to hospital represents half of the expense associated with delivery in Nepal [16]. This Nepalese study also suggests that widespread improvement of access to obstetric care would place a large strain on resources in the country, as expense of such a development would represent nearly half of the country's current per capita health budget. In Africa, even basic obstetric services are a large burden on families. A recent study conducted in Benin

found that women may spend up to 34% of annual household income on a delivery complicated by dystocia [17].

Research regarding expense of various modes of delivery has shown CD to be generally more costly than vaginal delivery at least in the short term [18-19]. At Pumwani Maternity Hospital, the cesarean delivery fee, although less than that at neighboring private hospitals, is more than double the cost of vaginal delivery. This cost disparity may exert a considerable influence on maternal decision making regarding mode of delivery at PMH. To date, however, there have been no studies investigating the role cost plays in the decision process regarding mode of delivery among HIV infected mothers identified antenatally. Of note, the literature indicates that issues regarding cost of various modes of delivery are often quite complex. A recently published cohort study in Nova Scotia found that cost of CD with labor is significantly increased when compared to CD without labor, suggesting a financial benefit to ECS in specific high risk populations [19]. In addition, a cost analysis of SVD vs. elective CD for term breech delivery concluded that the estimated mean cost of elective cesarean delivery was actually lower than that of planned vaginal birth, likely owing to improved neonatal outcome [20]. Finally, a decision-analysis model of elective cesarean delivery vs. vaginal delivery in HIV-infected women receiving zidovudine alone showed that ECS may actually be cost-saving on the order of \$5.3 million per year in the United States due to decreased burden of pediatric HIV disease [21]. Although ECS may be theoretically cost-effective in Kenya, especially given limited access to ARVs and pediatric HIV care, information on the long term costs associated with mode of delivery and the feasibility of improving access to obstetric care in the developing world is limited.

B. Unexplored ECS Limitations: Cesarean Delivery Knowledge and Attitudes

Although limited access to CD and increased costs and risks of the ECS for PMTCT over vaginal delivery have been well outlined by World Health Organization as possible challenges to utilization of the intervention in resource-poor settings, patient knowledge and attitudes towards ECS represent largely unexplored potential limitations to the use of the procedure in both resource-poor and cross-cultural settings. In two recent University of Nairobi Master's theses assessing Knowledge, Attitude and Practice (KAP) of PMTCT interventions at Nairobi's Kenyatta National Hospital, about half of the antenatal and postnatal women surveyed displayed "incorrect" KAP regarding the role of ECS in PMTCT [22-23]. "Correct" KAP with respect to ECS was particularly lacking when compared to knowledge, attitude, and practice of other PMTCT interventions in this population. Of note, these studies did not clearly define "correct" KAP regarding ECS for PMTCT, pinpoint the reasons for this deficiency in understanding, or characterize the attitudes held by patients about elective cesarean section for PMTCT.

Although there is anecdotal evidence from clinical practice that cultural aversion to cesarean delivery in general may exist among some women in sub-Saharan Africa, an acceptability study of CD in Ibadan, Nigeria found that 85% of antenatal women would give consent to the procedure if needed [24]. Interestingly, nearly all the study participants said they would consult the opinion of their husbands and others before making a decision. Rarely, women cited spiritual reasons or "punishment for maternal infidelity" as potential reasons necessitating cesarean section. Because the acceptability of CD has not been explored in Kenya to date, it will be important to identify and

describe the unique attitudes of Kenyan mothers regarding cesarean section for PMTCT, information which will then inform future PMTCT program development.

C. ECS at Pumwani Maternity Hospital

Upon review of the literature as described above, WHO concerns regarding utilization of ECS for PMTCT in resource poor settings may be surmountable in the Kenyan context. Nevertheless, routine use of ECS for PMTCT in resource-poor settings, especially where breastfeeding is prevalent, is probably currently unrealistic.

Interestingly, PMTCT guidelines in some sub-Saharan African countries suggest that elective cesarean section may be recommended if labor is expected to be prolonged, when complications may increase vertical transmission (e.g. placenta previa), in breech presentation, and for patients with a previous cesarean delivery [25-26]. In other words, ECS for PMTCT may be appropriate in resource poor settings when other standard indications for the procedure also exist.

In Kenya, the guidelines on ECS for PMTCT are less clear, and ECS is routinely offered to HIV infected women receiving prenatal care at the Pumwani Maternity Hospital (PMH) in Nairobi. However, elective cesarean section is not a subsidized part of the hospital's PMTCT Program. In smaller City Council or private clinics in Nairobi and throughout Kenya where facilities for emergent cesarean delivery are unavailable, ECS for prevention of mother-to-child transmission of HIV is not generally offered. Because patients attending these smaller clinics often deliver at Pumwani, the hospital's ECS policy is particularly convoluted and in need of clarification.

Currently, 32% of HIV positive women at Pumwani National Hospital and Kenyatta National Hospital are being delivered by CD, though the proportion of ECS deliveries at Pumwani remains unknown [2]. This figure is likely an overestimate of elective cesarean section rate, since both emergent and elective procedures are included in the calculation. For comparison, rates of ECS for PMTCT in Europe are 70-80%, illustrating the under-use of ECS at these Nairobi health facilities and necessitating an investigation into the utilization of this intervention as well as an assessment of actual and potential barriers prior to advocacy of implementation [27]. Current utilization of ECS for PMTCT at Pumwani Maternity Hospital should be quantified and characterized in concert with an exploration of patient knowledge and attitudes towards the procedure in order to better understand the role of ECS in the program and in turn inform future program development in regards to this PMTCT intervention.

II. STUDY OBJECTIVES

The main objective of this study is to describe decision making regarding mode of delivery among HIV positive women at Pumwani Maternity Hospital. Specific aims include:

1. Determine the utilization of ECS for PMTCT at PMH.
2. Determine HIV infected women's knowledge and attitudes regarding ECS for PMTCT.
3. Compare HIV positive women's planned and actual modes of delivery.
4. Determine correlates of mode of delivery decisions.

Given the numerous obstacles to education and access to HIV care as outlined previously, I hypothesize that the actual use of elective cesarean section for prevention of mother-to-child transmission of HIV will be quite low at Pumwani, though the number of women planning ECS may be proportionally higher. Education regarding elective cesarean section will likely be limited. Women planning and receiving ECS will be of higher socioeconomic status, and acceptability of the procedure will be largely influenced by cost.

III. METHODS

A. Study Design

This is a descriptive cross-sectional study which involves the administration of a structured questionnaire. Study participants were consenting postpartum HIV-infected women on the obstetrics wards at PMH.

B. Study Site

Pumwani Maternity Hospital, where this study was conducted, is the largest maternity hospital in East Africa. Approximately 40-60 women deliver each day at the hospital, and 3-4 of these women on average are HIV-infected. A public hospital of the City Council of Nairobi, Kenya, PMH serves a low socioeconomic population and is a referral center for complicated obstetric cases.

PMH was selected as the study site, because of the large number of daily deliveries at the hospital and the diversity of the patient population. At Pumwani, women are admitted for ECS at 38 weeks gestation to the antenatal ward and subsequently

followed post-operatively on one of two post-cesarean delivery wards. There is one operating theatre at PMH where elective cases are scheduled two days per week depending on physician availability. Emergent cases are scheduled as needed. Specifically, the postnatal wards were chosen as the site for this study instead of the postnatal clinic to avoid potential follow up bias. Because women who deliver by ECS may be more likely to be followed in the clinic postnatally, use of the postnatal wards in this study will ensure accurate calculation of the rates of various modes of delivery among HIV positive women tested antenatally. In addition, postnatal mothers of lower socioeconomic status may be less likely to attend clinic for follow-up, which could further bias results obtained outside of the postnatal wards. Finally, delivery data obtained in this setting does not rely as heavily on patient records as data obtained in the postnatal clinic. A possible drawback of conducting this study on the postnatal wards at PMH is that women's attitudes towards various modes of delivery (and satisfaction with their own delivery) may change after leaving the hospital depending on factors like late complications, pain control, and infant outcome.

C. Study Population

- **Inclusion Criteria**

All postpartum HIV infected women delivering at PMH over 18 years of age who were diagnosed with HIV antenatally were eligible to participate. Eligible subjects were able to give informed consent and complete the questionnaire. Postpartum women who were too ill or in too much pain to complete the survey were not automatically excluded. Instead they were approached when their condition had improved.

- **Exclusion Criteria**

Theoretically, women who were too sick to complete the survey were excluded, though this was never an issue during data collection.

- **Sample Size**

A total of 250 women participated in this study. With an elective cesarean section rate of 4%, this sample size allowed quantification of the utilization of ECS within +/- 3% (range 1%-7%). A post-hoc power analysis was done to determine the ability of this sample size to assess other study endpoints, using PMH clinic attendees as the exposed group with the measured outcome set as “planning ECS.” A sample size of 61 participants ensured 80% power with allowance for a type I error of 5%, illustrating the adequacy of the sample size of 250 participants.

D. Study Procedures

HIV positive women who delivered each day on the Labor Ward or in the Maternity Theatre at PMH were identified by the author using PMTCT Program Records. These women were then located on the postpartum wards, approached, and privately invited to participate. The study was explained to eligible women, including objectives, procedures involved, and potential risks. Informed consent for study participation was obtained from each subject and confidentiality was maintained by removing identifiable patient information from survey data. Ethical approval for the study was obtained from Yale University Human Investigations Committee, Kenyatta National Hospital Ethics and Research Committee, and Pumwani Maternity Hospital.

Once the participant was consented, the author administered a structured questionnaire, the main data collection tool of this study, in English or Kiswahili. In general, women who delivered vaginally were surveyed 6 to 24 hours after delivery while women who delivered via cesarean section were surveyed 24 to 48 hours after delivery to ensure patient comfort. Study participants were reimbursed 100 Kenyan shillings (about \$1.50) for their time upon completion of the questionnaire.

E. The Questionnaire

The socio-demographic portion of the questionnaire was developed using the ABC measures of socioeconomic status in collaboration with a Kenyan economist. The ABC tool was first used in the UK in the 1970s and subsequently adapted to measure socioeconomic status in Kenya based on certain individual criteria including type of housing, power and toilet facilities, occupation, and level of education. Knowledge, attitude and decision making questions were crafted based on information from past studies on cesarean section in Africa as well as information from clinical practice [22-24]. The basic outline of the survey is as follows (see Appendix A for full questionnaire):

1. Socio-demographic information
2. Medical History
3. Obstetric History
4. History of Current Pregnancy and Delivery
5. Mode of Delivery Decision Making
6. ECS Knowledge/Attitudes

Because most women have not heard of ECS for PMTCT, it was often necessary to counsel patients regarding the intervention in order to assess ECS attitudes and acceptability. Each counseling session was conducted by the author and included both the risks of ECS and benefits of the procedure. Patients were counseled specifically on potential complications of ECS in HIV infected women including wound infection, endomyometritis and other infections, increased recovery time, further immunocompromise, and even death. The author explained that ECS can reduce HIV transmission to the infant by about 50% if the mother received AZT or single dose NVP alone. Care was taken to elucidate the decreased benefits of ECS when the mother is on HAART (as a proxy for viral load) along with increased potential maternal complications with declining CD4 count.

F. Data Analysis

Data were analyzed using SPSS-PC (Chicago, Illinois, USA) Version 13.0. The chi-square test was used to compare categorical data and thus determine correlates of mode of delivery decisions and ECS for PMTCT knowledge and attitudes. Adjusted odds ratios were calculated by bivariate logistic regression.

IV. RESULTS

Interviews were conducted daily over a twelve week period. Ultimately 250 of 254 eligible participants were enrolled in the study and subsequently completed the questionnaire. Three women refused consent and one mother missed invitation to enroll due to an error in record keeping.

A. Population Characteristics

We collected extensive sociodemographic information on each study participant, using markers like cell phone ownership and type of cooking fuel as proxy indicators for income in order to accurately characterize economic status (See Table 1). In general, HIV infected mothers delivering at PMH were of low socioeconomic status. Most were housewives or jobless (54.4%) with primary education or less (52.8%) living in single room homes (71.2%), often in one of Nairobi's slums (41.6%). Interestingly, rates of television ownership among participant households (58.4%) were similar to those observed in Ghana, but much less than those observed in the US, where television ownership is nearly 100% [28-29]. All women in this study received some form of antenatal care with a median number of four clinic visits (range: 1-17 visits), but interestingly, most women attended small satellite city council clinics around Nairobi (71.2%) rather than Pumwani's antenatal clinic (ANC).

The majority of women in the study learned their HIV status during the current pregnancy (75.2%), making this a newly-diagnosed population with unique HIV counseling and education needs. Unfortunately, most women did not have an antenatal CD4 count measured (62.0%) and many received single dose nevirapine (NVP) only (54.0%) as their sole ARV prophylaxis. Of women with measured CD4 counts, the average was 394 (95% CI: 343-445). No viral load measurements were available for any participant. Interestingly, one visit to Pumwani's Antenatal Clinic was associated with superior general HIV care of patients in this study. Women who attended Pumwani were 7.61 (95% CI: 3.48-16.7, $p < 0.001$) more likely to have had CD4 count measured and 2.21 (95% CI: 1.10-4.44, $p = 0.024$) more likely to have received the most effective ARV

regimens available in Kenya (AZT+NVP or HAART). Of note, attendance at PMH Antenatal Clinic was not associated with patient education level or socioeconomic markers including ownership of a phone or access to a toilet.

Median gestational age at delivery was 39+3 weeks with average labor duration of 12.5 hours (95% CI: 11.1-13.9). Active rupture of membranes was generally avoided, and the average duration of rupture of membranes was 5.4 hours (95% CI: 3.8-6.9). Episiotomy was done in 17 patients (6.8%). The average infant born to study participants weighed almost 3 kg, and birth outcomes were poor when compared to national health statistics. WHO estimates Kenya's perinatal mortality rate at 53/1000 births, though 8.1% of the deliveries of study participants resulted in stillbirth or neonatal death [30]. While the high perinatal mortality rates observed in this study may reflect poor fetal outcomes in HIV exposed infants, these numbers may also be influenced by the fact that PMH is a referral center for complicated obstetric cases with already increased risk for adverse fetal outcome.

Table 1. Study population characteristics

Median Age	26 (range: 18-42)
<i>Marital Status</i>	
Married	196 (78.4%)
Single	26 (10.4%)
Separated/widowed	28 (11.2%)
<i>Level of Education</i>	
Primary or less	132 (52.8%)
Secondary	93 (37.2%)
College/University	25 (10.0%)
<i>Number of Rooms in Home</i>	
1	178 (71.2%)
>1	72 (28.8%)

<i>Cooking Fuel</i>	
Paraffin/Charcoal/Firewood	202 (80.8%)
Gas/Electricity	48 (19.2%)
<i>Type of Toilet</i>	
Shared	198 (79.2%)
Private	52 (20.8%)
<i>Buys the newspaper</i>	91 (36.4%)
<i>Owens a cell phone</i>	109 (43.6%)
<i>Owens a radio</i>	204 (81.6%)
<i>Owens a television</i>	146 (58.4%)
<i>Time of HIV Diagnosis</i>	
During pregnancy	188 (75.2%)
Before pregnancy	62 (24.8%)
<i>CD4 Count</i>	
Average	394 (95% CI: 343-445)
Not done	155 (62.0%)
<i>Surgical History</i>	25 (10.0%)
<i>Living Children</i>	179 (71.6%)
<i>Site of Antenatal Care</i>	
PMH (attended at least once)	38 (15.2%)
City Council Satellite Clinic	178 (71.2%)
Private Clinic	34 (13.6%)
<i>ARV Regimen</i>	
Antenatal AZT only	6 (2.4%)
Intrapartum NVP only	135 (54.0%)
Antenatal AZT and intrapartum NVP	47 (18.8%)
HAART	50 (20.0%)
No ARV Regimen	12 (4.8%)
<i>Outcome</i>	
Live Birth	240 (91.9%)
Stillbirth/Neonatal Death	21 (8.1%)
<i>Average Infant Weight</i>	2950g (95% CI: 2880-3030g)

In addition, women were questioned regarding their ability to pay for their respective modes of delivery. Nearly half (43.6%) of the participants said they were unable to pay their hospital fees at Pumwani. On average, women estimated that they were able to pay 2800 Kenyan shillings (95% CI: 2500-3100) or about 40 US dollars for delivery. This number just falls short of the approximate cost of vaginal delivery (3400 Kenyan shillings), but again, represents less than half of the required hospital fees for a cesarean delivery at Pumwani (6800 Kenyan shillings).

B. ECS Knowledge and Attitudes

Although 92% of women in the study had received some form of PMTCT counseling only 36% (90/250) of the participants had ever heard of ECS for PMTCT. Generally women learned about ECS from doctors or PMTCT counselors at their respective antenatal clinics (80.0%), though 13.3% of mothers received information about the intervention from local media, including radio and television. Of the women aware of ECS for PMTCT, most thought it was “very effective” (53.3%). Very few women (2.4%) thought incorrectly that elective cesarean section might actually increase the risk of HIV transmission to the infant.

Knowledge of ECS for PMTCT was correlated with level of patient and partner education. Women with secondary education or higher were 1.61 (95% CI: 1.25-2.07, $p < 0.001$) times more likely to have heard of the intervention than their less educated counterparts. Education on ECS was positively associated with economic markers like reading the newspaper (OR: 1.46; 95% CI: 1.06-2.01, $p = 0.024$) and owning a cell phone (OR 1.43; 95% CI: 1.08-1.88, $p = 0.013$), further demonstrating the link between patient

socioeconomic status and knowledge of the intervention. Of note, women who were diagnosed with HIV before pregnancy were 1.90 (95% CI: 1.24-2.90, $p=0.003$) times more likely to know about ECS than those diagnosed during pregnancy. Women who attended ANC at PMH at least once were 9.48 (95% CI: 4.12-21.81, $p<0.001$) times more likely to have heard of elective cesarean section than their colleagues attending other City Council clinics or private clinics.

In an effort to understand women's attitudes towards cesarean delivery in general, all participants were asked open-ended questions about CD regardless of their mode of delivery. Table 2 illustrates the mothers' concerns regarding the dangers of cesarean section, and data represent the number of women who cited each issue without prompting. Although the most women were worried about increased recovery time and minor complications after CD when compared to vaginal delivery, about half of the study participants cited death (presumably anesthesia-related mortality as this issue was usually expressed as "going to sleep and not waking up") as a worrisome complication of CD. These data illustrate that most participants were acutely aware of the dangers of cesarean delivery, even the most serious complications. Of note, concerns labeled as "Other" in Table 2 include stigma of cesarean delivery, which may be considered a sign of maternal weakness in Kenyan culture (in Kiswahili, delivering vaginally is called "kuzaa kwa kawaida" or the "normal" mode of delivery), complications secondary to physician mistake (specifically instruments or towels left in the patient's abdomen), and increased risk of HIV transmission of baby via CD.

Table 2. Cesarean delivery concerns

Increased recovery time with CD	128 (66.3%)
Increased complications (especially delayed wound healing/infection) with CD	107 (55.4%)
Increased risk of death with CD/general anesthesia over vaginal delivery	94 (48.7%)
Increased pain with CD	64 (33.2%)
Increased cost with CD	21 (10.9%)
Decreased future fertility with CD	18 (9.3%)
Other	22 (8.8%)

C. Mode of Delivery Decision Making

Generally, study participants did have plans regarding mode of delivery (85.6%), and most women planned to deliver vaginally (72.0%). The main reasons for planning SVD included lack of knowledge of ECS (70.6%), increased complications and/or recovery time with ECS (7.8%), and decreased safety of ECS (6.7%) when compared with SVD. Several women cited less pain and cost with SVD as their reasons for opting against ECS, and just one participant was worried that ECS might disclose her HIV status.

Most study participants planned to deliver at Pumwani Maternity Hospital (80.4%) though 18% of the patients planned to delivery at a secondary health facility such as a City Council or private clinic. Three (1.2%) women planned to deliver at

home. Generally women who planned to deliver at clinics were referred for evaluation of obstetrical complications including poor labor progression or fetal distress.

Notably, 14.4% (36/250) of the study population had no delivery plan. These women stated that they had not received counseling regarding mode of delivery or did not think of it prior to the time of delivery. Correlates associated strongly with having a mode of delivery plan included being diagnosed with HIV before pregnancy (OR: 10.26; 95% CI: 1.47-71.71, $p < 0.001$), attending ANC at PMH at least once ($p = 0.025$), and knowledge of ECS for PMTCT (OR: 3.62; 95% CI: 1.42-9.24).

CD planners represented 13.6% (34/250) of the study group, though of note, 8 of these women did not realize that cesarean section must be performed before labor and rupture of membranes to optimally prevent transmission of the virus to the infant. These women actually planned to come to PMH in labor and deliver by cesarean in hopes of preventing infection of their child, illustrating that even among women educated about ECS for PMTCT, correct understanding may be lacking. Interestingly, correct understanding of ECS may also be lacking amongst health care workers at Pumwani, as one participant was advised by a PMH obstetrician on the Labor Ward that cesarean delivery prevents HIV transmission to the infant even after onset of labor. Nearly all women who planned ECS (33/34) did so for PMTCT purposes though 2 patients cited placenta previa while 2 patients cited a history of CD as secondary indications. One patient planned ECS because she had a history of three previous CD but had not heard of ECS for PMTCT.

Planning ECS was positively correlated with higher education levels (OR: 1.46; 95% CI: 1.09-1.94, $p = 0.028$) and markers of higher socio-economic status including

having a private toilet (OR: 2.89; 95% CI: 1.43-3.84, $p=0.002$) and living in a home with greater than one room (OR: 2.89; 95% CI: 1.07-7.80, $p=0.033$). The strongest correlates of ECS planning included having a surgical history (OR=5.86, 95% CI: 2.92-11.77, $p<0.001$), attending clinic at PMH (OR=7.85, 95% CI: 4.63-13.30, $p<0.001$), and logically, knowledge of ECS (OR=24.50, 95% CI: 8.10-93.35, $p<0.001$).

The majority of women who planned ECS ended up delivering either vaginally (52.9%) or by emergency CS (26.5%) with just 20.6% (7/34) planning and subsequently delivering by ECS. Generally this change in delivery plan was caused by labor before scheduled ECS (55.6%, 15/27) or poor patient education regarding ECS (29.6%, 8/27). Other reasons for planning and not delivering by ECS included IUFD (1/34), not being offered ECS at PMH (1/34) or lack of operating theatre availability (1/34).

Correlates of actual delivery by elective cesarean section included secondary education (OR=1.74, 95% CI: 1.24-2.45, $p=0.034$), attending clinic at PMH at least once (OR=2.82, 95% CI: 1.24-6.41, $p=0.26$), and planning to deliver by ECS (OR=6.22, 95% CI: 3.63-10.67, $p<0.001$).

Table 3 illustrates planned vs. actual modes of delivery. Women who delivered by ECS but planned another mode did so after coming to PMH in false labor, being admitted to the hospital and subsequently counseled on ECS. Of note, the actual rate of ECS at Pumwani is quite low at 4% when compared to the utilization of this intervention at Nairobi's Kenyatta National Hospital where the ECS among HIV-infected mothers is 35% [2].

Table 3. Planned vs. actual modes of delivery¹

		Actual Mode of Delivery			
		<i>SVD</i>	<i>ECS</i>	<i>Emergent CD</i>	<i>Total</i>
Planned Mode of Delivery	SVD	145 (80.6%)	1 (0.6%)	34 (18.9%)	180 (72.0%)
	ECS	18 (52.9%)	7 (20.6%)	9 (26.5%)	34 (13.6%)
	No plan	30 (83.3%)	2 (5.6%)	4 (11.1%)	36 (14.4%)
	Total	193 (77.2%)	10 (4.0%)	46 (18.4%)	250 (100%)

Study participants were also surveyed regarding satisfaction with their respective modes of delivery, and there was a trend between satisfaction with delivery mode and delivery by ECS for PMTCT ($p < 0.001$). All women delivering by ECS (10/10) were “very satisfied” with their mode of delivery while patients delivering by emergent cesarean tended to be less satisfied with their mode of delivery. Emergent CD proved to be “somewhat” satisfactory 25.5% (12/47) of the time and unsatisfactory to 40.4% (19/47) of patients. All ten women who actually delivered by ECS would strongly recommend this mode of delivery to other HIV-infected antenatal women.

D. Post-counseling ECS Attitudes

At the conclusion of the questionnaire, study participants were counseled on ECS for PMTCT. Care was taken to elucidate the benefits as well as risks and discomforts of the procedure, especially in a resource poor setting like Pumwani. Post-counseling,

¹ The percentages in Table 3 represent the proportion of actual modes of delivery within each planned mode of delivery group while cumulative figures represent percentages of the total study population.

48.0% (120/250) of the women would have consented to the procedure if offered to them during this pregnancy or would opt for the procedure in the future. If the cost of ECS for PMTCT was the same as vaginal delivery at PMH, 67.6% (169/250) of the mothers would opt for ECS. Thus, although ECS is a relatively acceptable form of delivery in this population, cost represented a significant barrier to choosing this mode.

Table 4 demonstrates the correlates of post-counseling acceptability of ECS for PMTCT, with socioeconomic status, surgical history, and attendance at PMH ANC being most strongly associated with a positive attitude towards ECS for PMTCT. On logistic regression analysis, secondary education, having living children or a surgical history, and attending clinic at PMH at least once remained significantly associated with ECS acceptability. Because no one marker for economic status exists in this study, we cannot say that economic status is not associated with ECS acceptability (as different markers may confound each other).

Table 4. Correlates of post-counseling ECS acceptability²

<i>Correlate</i>	<i>Would opt for ECS</i>	<i>OR (95% CI)</i>	<i>P value</i>	<i>Adjusted OR (95% CI)</i>
Some secondary education or higher				
Yes	71 (60.2%)	1.64 (1.25-2.15)	<0.001	2.15 (1.16-3.99)
No	49 (37.1%)			
Partner with some secondary education or higher				
Yes	97 (51.6%)	1.16 (1.002-1.33)	0.048	1.22 (0.62-2.39)
No	23 (37.1%)			
Greater than one room in home				
Yes	12 (75.0%)	3.25 (1.08-9.80)	0.025	1.61 (0.45-5.79)
No	108(46.2%)			

² The percentages in the “Would opt for ECS” column represent the proportion of women of each row’s stated group who would choose ECS as their mode of delivery after counseling. Adjusted odds ratios on logistic regression that remain significant are shown in bold.

Has private toilet				
Yes	34 (65.4%)	2.05 (1.22-3.42)	0.005	1.03 (0.43-2.51)
No	86 (43.4%)			
Uses gas/electricity for fuel				
Yes	35 (72.4%)	2.92 (1.62-5.24)	<0.001	1.65 (0.71-3.80)
No (paraffin/charcoal/firewood)	85 (42.1%)			
Owens cell phone				
Yes	64 (58.2%)	1.51 (1.13-2.01)	0.004	1.15 (0.61-2.16)
No	56 (40.0%)			
Owens television				
Yes	81 (55.5%)	1.35 (1.09-1.67)	0.005	1.36 (0.72-2.55)
No	39 (37.5%)			
Owens radio				
Yes	105(51.5%)	1.15 (1.02-1.29)	0.021	1.24 (0.58-2.66)
No	15 (32.6%)			
Living children				
Yes	94 (52.5%)	1.20 (1.02-1.40)	0.023	2.09 (1.12-3.90)
No	26 (36.6%)			
Surgical history				
Yes	18 (72.0%)	2.79 (1.21-6.43)	0.011	3.23 (1.15-9.05)
No	102(45.3%)			
Attended clinic at PMH at least once				
Yes	28 (73.7%)	3.03 (1.54-5.98)	0.001	3.06 (1.32-7.13)
No	92 (43.4%)			
Able to pay for delivery				
Yes	79 (56.4%)	1.40 (1.12-1.76)	0.003	1.78 (0.997-3.20)
No	41 (37.3%)			

V. DISCUSSION

These data illustrate that knowledge of elective cesarean section for PMTCT and in turn uptake of ECS is limited among HIV-infected women delivering at Pumwani Maternity Hospital. Although women are acutely aware of the dangers of this surgical intervention as evidenced by stated concerns regarding cesarean delivery, post-counseling

acceptability of ECS, especially if the burden of cost is removed, is quite high. The findings confirm those of previous studies that although surgical delivery when warranted is acceptable in an African population, HIV-infected women in Nairobi continue to be poorly educated regarding elective cesarean section for PMTCT [22,24]. In the subsequent discussion, specific areas of interest will be highlighted, including issues unique to this patient population such as general health status and quality of HIV care, and in turn concerns regarding patient counseling at Nairobi clinics engendered by study results. Decision making regarding mode of delivery and post counseling patient attitudes towards ECS for PMTCT will be further explored. Limitations of the study will be pointed out, and suggestions for program development and future study with the ultimate goal of improvement of patient care will be outlined.

A. The HIV-infected Mother at Pumwani

Pumwani Maternity Hospital is a referral center for complicated obstetrical cases. Many women who ultimately deliver at PMH have attended antenatal clinic at small satellite city council clinics in their respective Nairobi neighborhoods. Women generally visit these clinics, because the fees are less than those of PMH. In addition, because the clinics are usually closer to their homes, patients do not have to pay extra fees for transport (so-called “unofficial costs” of medical care). Often women plan to deliver at these clinics as well. While city council clinic delivery fees are significantly less than those of PMH, generally ranging from 20-100 Kenyan shillings (less than 2 US dollars), these facilities are not staffed by physicians. Certain medicines and cesarean delivery are unavailable. Therefore, cases involving pre-eclampsia, obstructed labor, fetal distress,

and other complications are often transferred from these clinics to PMH. Currently, HIV infection in pregnancy is not considered a complication requiring referral or transfer to PMH. Because of these patterns of clinic attendance, quality of antenatal care (including basic HIV and PMTCT services as well as counseling) was not standard among women delivering at Pumwani, a rather unexpected characteristic of the patient population.³

In fact, attending Pumwani Maternity Hospital's Antenatal Clinic at least once was associated with improved patient education and ultimately patient care. Women who attended PMH were more likely to have been counseled on ECS for PMTCT and ultimately receive the intervention. In addition, Pumwani ANC clinic attendees tended to receive superior HIV and PMTCT care, including CD4 count measurements and more effective ARV regimens than their counterparts at City Council clinics. While it cannot be concluded that attending clinic at PMH directly resulted in these benefits for patients, it is likely that PMH's numerous resources and a well developed PMTCT program may lead to improved quality of care over outside clinics.

Infant feeding is an issue specific to this population which remains controversial among researchers and patients alike. Breastfeeding has been shown to nearly double the risk of mother-to-child transmission of HIV with increasing infections associated with prolonged duration of breastfeeding, though safety and acceptability in resource poor settings has recently come into question [31]. Although formula feeding is currently offered as a subsidized part of Pumwani's PMTCT Program, mothers are given a choice regarding the feeding of their newborns according to WHO guidelines. Many Pumwani

³ Although not directly measured by this study, the characterization of clinic attendance patterns among women delivering at PMH was described to the author by PMH PMTCT counselors and patients and observed qualitatively.

women choose to exclusively breastfeed for six months, though the prevalence of different kinds of feeding (including so-called “mixed” feeding, which carries an increased risk of HIV transmission to the child) remain unexplored at PMH. The efficacy of ECS for PMTCT has been called into question in populations where replacement feeding and the use of ARV prophylaxis are prevalent, but there is no research on the influence of high rates of breastfeeding on the value of elective cesarean section as a PMTCT tool [32].

B. Patterns of Clinic Attendance Inform Program Development

Although not a stated goal of this research study, the understanding and characterization of these patterns of clinic attendance turns out to be a crucial piece of information necessary for effective program development. Based on our data, improvement of PMTCT services at Pumwani will not reach most of the patients who ultimately deliver at PMH. To ensure optimal counseling and services for HIV-infected mothers in Nairobi, development and monitoring of PMTCT programs should begin at the level of the satellite City Council clinics. In addition, this study is limited by the inclusion of women who delivered in a hospital setting. In Nairobi, many women labor and deliver at home alone or with traditional birth attendants, so education and programming must also be targeted at the community in more creative ways as well. Because patient education and care were directly correlated with socioeconomic status in this study, efforts must be focused on ensuring equitable PMTCT care for all women in Kenya, even the poorest. Finally, a City Council clinic policy of referral of HIV-infected pregnant patients to PMH for evaluation is a potential way to improve the care of this

high-risk population, though an increase in clinic attendance could initially overwhelm resources currently available at Pumwani.

One especially troubling piece of data is the finding regarding mode of delivery planning. Nearly 15% of women participating in the study stated that they did not have a plan regarding their mode of delivery, specifically that they had not received counseling regarding mode of delivery as part of their standard antenatal care. Mode of delivery planning is a key element of antenatal care for HIV-infected and non-infected patients alike. This issue needs to be addressed at the level of the community clinics as well at the PMH Antenatal Clinic by incorporating mode of delivery planning into standard pregnancy counseling. Of course, HIV-infected women should be counseled accordingly (which will be outlined in the subsequent section) but care should be taken to ensure appropriate support for delivery planning for all antenatal patients.

C. Recommendations for Policy on Antenatal Mode of Delivery Counseling

One of the specific aims of this study is to determine patient knowledge regarding elective cesarean section for prevention of mother to child transmission. Our data indicate that although nearly every study participant had some form of PMTCT counseling, only one-third of these women said they had heard of ECS. This could mean that most women could not recall learning about ECS, that they were not counseled at all about this intervention, or a combination of both these scenarios. In either case, counseling regarding this intervention was ineffective. In fact, one study participant who delivered by SVD at Pumwani actually worked as a PMTCT counselor at a Nairobi City Council clinic, and she herself had not heard of ECS for PMTCT.

“Correct” understanding of ECS for PMTCT such as the procedure’s declining effectiveness by viral load and potential complications of ECS unique to HIV-infected women were not directly studied in the survey. However, we did find that 23.5% (8/34) of women who planned CD for PMTCT did not understand the definition of ECS as CD before labor and rupture of membranes, a lack of knowledge that prevented them from receiving optimal PMTCT care. This aspect of ECS education, which is directly tied to general mode of delivery planning, is therefore an area of counseling requiring special attention. Because one study participant was counseled incorrectly regarding ECS for PMTCT by a PMH Labor Ward physician, education regarding this intervention needs to be readdressed at the level of the care-giver as well.

An issue regarding advocating increased and/or improved patient education regarding ECS for PMTCT is the limited availability of this intervention in resource-poor settings. One may argue that counseling on ECS may not be a necessary element of standard PMTCT education in settings like Nairobi’s City Council clinics, where the procedure is not offered. We would contend that because ECS for PMTCT is offered at larger care facilities like Pumwani and Kenyatta National Hospital, each pregnant woman has the right to be educated on the issue and choose for herself.

Care must be taken in designing and implementing an education program regarding ECS for PMTCT to avoid inappropriate counseling bias either for or against the procedure. HIV-infected mothers should be informed of both the benefits and risks of the procedure in light of current evidence and ultimately be allowed to make an informed decision regarding their preferred mode of delivery. Unbiased counseling is necessary not only to respect patient autonomy but also because evidence exists both for and against

the utilization of ECS for PMTCT in resource-poor settings. A similar need for unbiased counseling exists in the realm of patient education and practice regarding infant feeding, as both replacement feeding and exclusive breastfeeding have their respective risks and benefits. Thus the standard of patient choice regarding PMTCT interventions already exists in current counseling models, so inclusion of ECS counseling in this framework should not be a difficult task.

Although ECS for PMTCT counseling should theoretically be unbiased, certain patient populations may benefit uniquely from the procedure. For example, women with other indications for cesarean delivery such as malpresentation, placenta previa, or history of cesarean delivery may be appropriate candidates for specialized counseling. Often these patients understand CD is their safest delivery option, but because of lack of patient and care-giver education and organizational infrastructure for elective cesarean delivery planning at PMH, they may labor before receiving CD. In this case, a potentially useful PMTCT tool has gone unutilized. In addition, because evidence shows that emergent cesarean delivery is associated with more complications in an HIV-infected population than ECS, these women have been placed at unnecessary increased risk [3].

As highlighted in the Introduction, PMTCT guidelines in Tanzania and Lesotho suggest recommendation of ECS where CD may be ultimately required including cases in which labor is expected to be prolonged, when complications may increase vertical transmission (e.g. placenta previa), in breech presentation, and for patients with a previous cesarean delivery [25-26]. Interestingly, our data illustrate that a history of CD is associated with increased patient acceptability of ECS for PMTCT, making this an ideal population for utilization of this procedure. To avoid lost opportunity for PMTCT

intervention observed in this study, we suggest a Kenyan policy of ECS for PMTCT counseling targeted specifically at this patient population to promote maximally efficient use of minimal resources. Further, ECS for PMTCT may ultimately be recommended to HIV-infected women in this population and in turn subsidized by Kenyan PMTCT Programs. Because ECS may pose unjustifiable risks to certain patient populations, especially women on HAART with low viral loads, counseling at PMH and other antenatal clinics should be adjusted accordingly for these women [3-4]. Identifying patients at increased risk for complications after ECS, however, may prove difficult given limited access to viral load measurement. Again, more research on the safety of ECS for PMTCT in resource limited settings is needed to further clarify this issue and in turn inform future policy development.

D. ECS Attitudes and Acceptability: a Closer Look

Characterization of patient attitudes concerning elective cesarean section for prevention of mother-to-child HIV transmission represents a specific aim of this study. In regards to this objective, we found high acceptability of ECS in the context of relatively negative attitudes towards CD in this patient population. Unprompted, nearly half of the study participants cited death, specifically through anesthesia-related complications, as a worrisome complication of CD. A study of cesarean section refusal for “absolute” indications (including two or more previous CD or placenta previa) illustrated a similar fear of death among Nigerian women delivering in south-eastern Nigeria. Approximately half of women in this study refused elective cesarean delivery secondary to fear of death, though interestingly this choice was associated with

significantly increased maternal and perinatal mortality when compared to their consenting counterparts [33]. In a recent Nigerian study by Osinaike et al, 82% of participating patients expressed a high level of concern regarding anesthesia-related death as a complication of general surgery [34]. Although it is well characterized in popular Kenyan culture that Kenyans tend to fear complications of general anesthesia, no Kenyan studies exist on this issue. Of note, there exists a general (albeit improving) distrust of the care afforded women delivering at PMH along with rumors in the community regarding poor patient services at the hospital, which may inform patient fears regarding cesarean delivery at Pumwani. Because the magnitude of participant concern regarding particular surgical risks was not quantified in this study, conclusions cannot be drawn regarding the extent or implication of these concerns.

Despite concerns regarding the risks of CD voiced by HIV-infected women delivering at PMH, elective cesarean section was found to be a relatively acceptable PMTCT intervention in this population, especially if cost of CD was the same as SVD. We therefore recommend that along with improved ECS counseling and development of hospital infrastructure to support elective cases, the PMH PMTCT Program consider subsidizing elective cesarean section for appropriate candidates. This would allow the 20% of women who would choose ECS over SVD if cost was not an issue to make an informed decision unconfined by limited resources and in turn increase the equity of patient care with regards to socioeconomic status at PMH.

The pregnant patient with HIV is in a uniquely emotional position, and she is often riddled with guilt and fear about her influence on the health of her child. Decisions regarding PMTCT interventions are therefore immensely personal and depend on many

maternal factors. A study participant, who was already the mother of one HIV-infected child actually stated, “I would rather die than have another child with HIV.” Another mother felt the risks of CD were too high for her to justify potential benefit to her child. Given the current literature on the subject of cesarean delivery, both women express valid points and personal choice should be respected in PMTCT counseling sessions as outlined previously. Therefore, although our data demonstrate a high level of ECS for PMTCT acceptability, each patient needs to be approached individually.

E. Institutional Limitations on Mode of Delivery Decisions

The main objective of this study is to describe decision making regarding mode of delivery among HIV positive women at delivering at Pumwani Maternity Hospital. Most of the patients in this study planned to deliver by SVD, because they were not aware of other mode of delivery options. Among the women who planned to deliver by ECS, more than one-half failed to deliver by their planned mode because they went into labor before their scheduled cesarean section. For certain patients, this change in delivery plan could have been avoided. Several women had ECS scheduled after 38 weeks, increasing the chances of delivery before the elective CD. In one case there was confusion between patient and physician regarding the date of delivery. Thirty percent of patients planning ECS changed their delivery plan secondary to poor understanding of the procedure. Finally, one patient went into labor while awaiting an operating theatre for her elective cesarean section and another patient planned ECS but was not offered this intervention when she attended clinic.

This characterization of delivery planning illustrates the influence of patient education, hospital infrastructure and resources, and ultimately Pumwani's PMTCT Program on mode of delivery decision making. Instead of being an informed personal choice made by each patient, the decision to deliver by ECS is largely directed by the presence or absence of patient counseling and the limitations of infrastructure in Pumwani's PMTCT Program to support elective delivery planning. The decision to deliver by ECS, if offered by a PMTCT Program, should not be based on such limitations but instead be informed by patient preference. In addition, the data demonstrate that the cost of the procedure represents a potential patient limitation to personal decision making and in term access. If the PMH PMTCT Program continues to include ECS as a PMTCT intervention, such infrastructure should be developed to ensure that each patient desiring to deliver by elective cesarean section has unimpeded access to the procedure.

The aforementioned limitations to informed decision making echo WHO concerns regarding the implementation of ECS for PMTCT in resource-poor settings, namely limited access and increased cost of the procedure. Another potential concern regarding implementation of ECS for PMTCT in this particular population is the question of gestational age dating. Nearly all the participants in this study used last menstrual period to date their pregnancies, and prenatal ultrasound is not generally available to this patient population. This presents an issue in terms of the final WHO ECS concern: safety. Inaccurate dating with subsequent preterm cesarean delivery is a potential complication of ECS in these women as well as a potential threat to fetal health, especially given limited resources for neonatal care and resuscitation. Even if antenatal ultrasound was made available to all HIV-infected pregnant patients at PMH (which is currently

unrealistic given costs and resources), certain women would still miss being accurately dated if they discovered their HIV status later in pregnancy when fetal ultrasound is less reliable for gestational age dating.

F. Study Limitations

Several limitations of this study have been highlighted throughout this discussion, and the remaining limitations will be outlined here. First, the number of women planning and actually delivering by ECS for PMTCT was small, and thus close characterization of the mode of delivery decisions of this group was not possible. In addition, given the sample size, we were only able to quantify the utilization of ECS for PMTCT to within +/- 3%, thus, the use of ECS at PMH may be as low as 1% or as high as 7%. Finally, the nature of the survey of patient attitudes towards elective cesarean section for PMTCT may have introduced bias. Because most women had not heard of elective cesarean section for PMTCT or possessed an incorrect understanding of the procedure, it was necessary to counsel study participants on this intervention. Close care was taken to elucidate both risks and benefits sensitively and equally and use standard counseling with each patient. Despite these efforts, it is possible that the very nature of conducting a study on a particular subject may make it more acceptable in this population. Related to this issue, baseline acceptability of ECS for PMTCT (that is to say the number of women who opted for ECS in proportion to the number who had heard of ECS antenatally) was 38% (34/90). As previously mentioned, the acceptability of ECS post-counseling was found to be 48%, an increase which may represent bias, greater acceptability associated with more complete understanding, or an insignificant difference.

G. Recommendations for Future Study

Further study is needed to elucidate issues of safety of ECS in HIV-infected patients before advocacy of widespread implementation. Because cost represents a significant obstacle to utilization of ECS for PMTCT both on the level of the individual patient and medical institution, a study of cost-effectiveness of elective cesarean section in certain populations in resource poor settings may be warranted. In addition, monitoring of patient understanding following a counseling intervention will be necessary to ensure effective patient education. Finally, an assessment of barriers to safe and effective implementation of ECS in the current health system at PMH will be helpful in designing policy that will ensure delivery of this PMTCT intervention.

Interviewer: _____

Date of Interview: _____

Study Number: _____

I. Socio-demographic Information:

QI01	Age:	
QI02	Nationality/Country of Birth:	
QI03	Residence:	
QI04	Marital Status:	<input type="checkbox"/> Single <input type="checkbox"/> Married-monogamous <input type="checkbox"/> Married-polygamous <input type="checkbox"/> Separated/Divorced <input type="checkbox"/> Widowed <input type="checkbox"/> Other: _____
QI05	Religion:	<input type="checkbox"/> Catholic <input type="checkbox"/> Protestant <input type="checkbox"/> Muslim <input type="checkbox"/> Other: _____
QI06	Level of Education Completed:	<input type="checkbox"/> Primary <input type="checkbox"/> Some Secondary <input type="checkbox"/> Secondary <input type="checkbox"/> Some University <input type="checkbox"/> University <input type="checkbox"/> Graduate/Professional School <input type="checkbox"/> Not sure
QI07	Level of Education Completed by Partner:	<input type="checkbox"/> Primary <input type="checkbox"/> Some Secondary <input type="checkbox"/> Secondary <input type="checkbox"/> Some University <input type="checkbox"/> University <input type="checkbox"/> Graduate/Professional School <input type="checkbox"/> Not sure
QI08	Occupation (specify Part vs. Full-time):	
QI09	Occupation of Partner (specify Part vs. Full-time):	

QI10	Number of rooms in house:	Bedrooms: _____ Total rooms: _____
QI11	Main source of fuel for cooking:	<input type="checkbox"/> Electricity <input type="checkbox"/> Gas <input type="checkbox"/> Charcoal <input type="checkbox"/> Paraffin <input type="checkbox"/> Wood <input type="checkbox"/> Other: _____
QI12	Type of toilet:	<input type="checkbox"/> Water Flush Toilet/Water Closet <input type="checkbox"/> Pit Latrine <input type="checkbox"/> Both Latrine and Toilet <input type="checkbox"/> No facility/bush <input type="checkbox"/> Other: _____
QI13	Do you share the toilet facility with another household (s)?	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Don't Know
QI14	Do you or your partner own a car?	<input type="checkbox"/> Yes (Specify make: _____) <input type="checkbox"/> No
QI15	Do you buy the newspaper?	<input type="checkbox"/> Yes, daily <input type="checkbox"/> Yes, at least once a week but not daily <input type="checkbox"/> Rarely (Specify how often: _____) <input type="checkbox"/> No, never
QI16	Do you own a cell phone?	<input type="checkbox"/> Yes <input type="checkbox"/> No
QI17	Does your partner own a cell phone?	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Not applicable
QI18	Do you or your immediate family own any of the following appliances?	a) Television: <input type="checkbox"/> Yes <input type="checkbox"/> No b) Radio: <input type="checkbox"/> Yes <input type="checkbox"/> No c) Refrigerator: <input type="checkbox"/> Yes <input type="checkbox"/> No
QI19	Which radio station do you listen to most often?	

II. Medical History:

QII01	Date of HIV Diagnosis:	
QII02	WHO Stage of HIV Disease:	
QII03	Last CD4 Count (with Date):	

QIV03	Site of Antenatal Care:	<input type="checkbox"/> PMH <input type="checkbox"/> Other: _____ <input type="checkbox"/> None
QIV04	ARV Regimen During Pregnancy:	<input type="checkbox"/> Antenatal AZT <input type="checkbox"/> Intrapartum NVP <input type="checkbox"/> Antenatal AZT and Intrapartum NVP <input type="checkbox"/> HAART <input type="checkbox"/> Other: _____ <input type="checkbox"/> No ARV regimen
QIV05	Complications During Pregnancy:	
QIV06	Date of Admission:	
QIV07	Date of Delivery:	
QIV08	Gestational Age at Delivery (weeks + days):	
QIV09	Gestational Age Determined by:	<input type="checkbox"/> LMP <input type="checkbox"/> Ultrasound <input type="checkbox"/> Other: _____
QIV10	Mode of Delivery:	<input type="checkbox"/> SVD <input type="checkbox"/> Operative vaginal delivery (vacuum/forceps) <input type="checkbox"/> ECS (CS before labor/ROM) for PMTCT <input type="checkbox"/> ECS for a reason besides PMTCT (Specify: _____) <input type="checkbox"/> Emergency CS (Specify reason: _____) If ECS for any reason, proceed to QIV14
QIV11	Duration of Labor:	
QIV12	Duration of ROM:	
QIV13	Episiotomy Done:	<input type="checkbox"/> Yes <input type="checkbox"/> No
QIV14	Outcome:	<input type="checkbox"/> Live birth <input type="checkbox"/> FSB <input type="checkbox"/> MSB <input type="checkbox"/> Other: _____
QIV15	Infant Information:	Weight: _____ Sex: _____ Apgar scores: _____

QIV16	Complications During Labor/Delivery:	
QIV17	Postpartum Complications:	

V. Mode of Delivery Decision Making:

QV01	Did you have a plan for the mode of delivery of this pregnancy?	<input type="checkbox"/> Yes (Proceed to QV02, but skip QV13) <input type="checkbox"/> No (Proceed to QV13)
QV02	Which mode of delivery were you planning?	<input type="checkbox"/> Vaginal (Proceed to QV03, but skip QV05 and 06) <input type="checkbox"/> ECS (Proceed to QV03, but skip QV07 and 08) <input type="checkbox"/> Other: _____
QV03	Why did you choose this mode of delivery? _____ Probe for answers. Do not read out choices. Record answer verbatim and then code.	<input type="checkbox"/> To prevent my child from getting HIV <input type="checkbox"/> The doctor/counselor suggested it. <input type="checkbox"/> A family member suggested it. (Specify: _____) <input type="checkbox"/> Cost (Specify: _____) <input type="checkbox"/> Not sure. <input type="checkbox"/> Other: _____
QV04	Which of the following played a role in your decision making regarding mode of delivery? Read out answer choices. Probe for specifics.	<input type="checkbox"/> Desire to prevent my child from getting HIV <input type="checkbox"/> Advice from a doctor/counselor <input type="checkbox"/> Advice from a family member/friend (Specify: _____) <input type="checkbox"/> Safety (Specify: _____) <input type="checkbox"/> Complications (Specify: _____) <input type="checkbox"/> Pain (Specify: _____) <input type="checkbox"/> Future fertility (Specify: _____) <input type="checkbox"/> Cost (Specify: _____) <input type="checkbox"/> Site of delivery (Specify: _____) <input type="checkbox"/> Stigma (Specify: _____) <input type="checkbox"/> Rumors about delivery at Pumwani (Specify: _____) <input type="checkbox"/> Other: _____

<p>QV05</p>	<p>Why did you choose not to deliver vaginally?</p> <p>_____</p> <p>Probe for answers. Do not read out choices. Record answer verbatim and then code.</p>	<ul style="list-style-type: none"> <input type="checkbox"/> Because ECS prevents MTCT <input type="checkbox"/> The doctor/counselor suggested ECS. <input type="checkbox"/> A family member/friend suggested ECS. (Specify: _____) <input type="checkbox"/> I was not worried about complications. <input type="checkbox"/> CS is safe at PMH. <input type="checkbox"/> I was able to pay for ECS. <input type="checkbox"/> Other: _____
<p>QV06</p>	<p>Which one of the following played a role in your choice against vaginal delivery?</p> <p>Read out answer choices. Probe for specifics.</p>	<ul style="list-style-type: none"> <input type="checkbox"/> Desire to prevent my child from getting HIV <input type="checkbox"/> Advice from a doctor/counselor <input type="checkbox"/> Advice from a family member/friend (Specify: _____) <input type="checkbox"/> Worry about complications of vaginal delivery (Specify: _____) <input type="checkbox"/> Safety (Specify: _____) <input type="checkbox"/> Cost (Specify: _____) <input type="checkbox"/> Pain <input type="checkbox"/> Other: _____
<p>QV07</p>	<p>If you opted for vaginal delivery, why did you choose not to deliver by ECS?</p> <p>_____</p> <p>Probe for answers. Do not read out choices. Record answer verbatim and then code.</p>	<ul style="list-style-type: none"> <input type="checkbox"/> I have never heard of ECS. <input type="checkbox"/> I was not offered ECS. <input type="checkbox"/> The doctor/counselor suggested vaginal delivery. <input type="checkbox"/> A family member/friend suggested vaginal delivery. (Specify: _____) <input type="checkbox"/> CS is not safe at PMH. <input type="checkbox"/> I was worried about complications after CS. (Specify: _____) <input type="checkbox"/> I was worried about having general anesthesia. <input type="checkbox"/> I was worried about pain. <input type="checkbox"/> CS might decrease my future fertility. <input type="checkbox"/> Presence of stigma if I did not deliver vaginally (Specify: _____) <input type="checkbox"/> Delivery by ECS might disclose my HIV status. <input type="checkbox"/> I was planning to deliver at home. <input type="checkbox"/> I was worried about rumors I heard about delivery at Pumwani. (Specify: _____) <input type="checkbox"/> ECS does not prevent HIV transmission from mother to child. <input type="checkbox"/> Cost (Specify: _____) <input type="checkbox"/> Other: _____

<p>QV08</p>	<p>Which one of the following played a role in your choice against delivery by ECS?</p> <p>Read out answer choices. Probe for specifics.</p>	<ul style="list-style-type: none"> <input type="checkbox"/> I have never heard of ECS. <input type="checkbox"/> I was not offered ECS. <input type="checkbox"/> Advice from a doctor/counselor <input type="checkbox"/> Advice from a family member/friend (Specify: _____) <input type="checkbox"/> Worry about complications after CS. (Specify: _____) <input type="checkbox"/> Safety (Specify: _____) <input type="checkbox"/> Fear of general anesthesia (Specify: _____) <input type="checkbox"/> Cost (Specify: _____) <input type="checkbox"/> Pain <input type="checkbox"/> Worry about future fertility. (Specify: _____) <input type="checkbox"/> Presence of stigma if I did not deliver vaginally (Specify: _____) <input type="checkbox"/> Delivery by ECS might disclose my HIV status. <input type="checkbox"/> I was planning to deliver at home. <input type="checkbox"/> Worry about rumors I heard about delivery at Pumwani (Specify: _____) <input type="checkbox"/> ECS does not prevent HIV transmission from mother to child. <input type="checkbox"/> Other: _____
<p>QV09</p>	<p>How did you choose the mode of delivery?</p> <p>Probe for answers. Do not read choices.</p>	<ul style="list-style-type: none"> <input type="checkbox"/> I talked with my doctor/counselor. <input type="checkbox"/> I talked with a family member/friend (Specify: _____) <input type="checkbox"/> I decided on my own. <input type="checkbox"/> Other: _____
<p>QV10</p>	<p>When did you decide on the mode of delivery?</p>	<ul style="list-style-type: none"> <input type="checkbox"/> When I found out I was pregnant <input type="checkbox"/> When I had my first antenatal visit <input type="checkbox"/> When I found out I have HIV <input type="checkbox"/> When I received counseling on PMTCT strategies <input type="checkbox"/> When I went into labor <input type="checkbox"/> Other: _____ <input type="checkbox"/> Did not have a mode of delivery plan

<p>QV11</p>	<p>If your actual mode of delivery was different than your planned mode of delivery, why is this so?</p> <p>_____</p> <p>Probe for answers. Do not read out choices. Record answer verbatim and then code.</p>	<p><input type="checkbox"/> Complications during pregnancy (Specify: _____)</p> <p><input type="checkbox"/> Complications during labor (Specify: _____)</p> <p><input type="checkbox"/> Labor before scheduled ECS</p> <p><input type="checkbox"/> Lack of theatre availability</p> <p><input type="checkbox"/> Cost (Specify: _____)</p> <p><input type="checkbox"/> Doctor/counselor suggested the change.</p> <p><input type="checkbox"/> A family member/friend suggested the change (Specify: _____)</p> <p><input type="checkbox"/> I changed my mind.</p> <p><input type="checkbox"/> Other: _____</p>
<p>QV12</p>	<p>Which of the following played a role in your change in mode of delivery plan?</p> <p>Read out answer choices. Probe for specifics.</p>	<p><input type="checkbox"/> Complications during pregnancy (Specify: _____)</p> <p><input type="checkbox"/> Complications during labor (Specify: _____)</p> <p><input type="checkbox"/> Labor before scheduled ECS</p> <p><input type="checkbox"/> Lack of theatre availability</p> <p><input type="checkbox"/> Cost (Specify: _____)</p> <p><input type="checkbox"/> Doctor/counselor suggested the change.</p> <p><input type="checkbox"/> A family member/friend suggested the change (Specify: _____)</p> <p><input type="checkbox"/> I changed my mind.</p> <p><input type="checkbox"/> Other: _____</p>
<p>QV13</p>	<p>If you did not have a mode of delivery plan, why not?</p> <p>Probe for answers. Do not read choices.</p>	<p><input type="checkbox"/> I was not counseled on mode of delivery planning.</p> <p><input type="checkbox"/> I did not think of it.</p> <p><input type="checkbox"/> I did not realize I had a choice in the mode of delivery.</p> <p><input type="checkbox"/> It is the doctor's choice, not mine.</p> <p><input type="checkbox"/> Not sure</p> <p><input type="checkbox"/> Other: _____</p>
<p>QV14</p>	<p>Where were you planning on delivering?</p>	<p><input type="checkbox"/> PMH (Proceed to QV16)</p> <p><input type="checkbox"/> Other hospital/clinic (Specify: _____)</p> <p><input type="checkbox"/> Home</p> <p><input type="checkbox"/> Other: _____</p> <p><input type="checkbox"/> Did not have a site of delivery plan</p>
<p>QV15</p>	<p>If you were not planning to deliver at PMH, why did you deliver here?</p>	<p><input type="checkbox"/> Complications during labor (Specify: _____)</p> <p><input type="checkbox"/> A family member suggested it (Specify: _____)</p> <p><input type="checkbox"/> Other: _____</p>

QV16	How satisfied are you with your actual mode of delivery?	<input type="checkbox"/> Very satisfied <input type="checkbox"/> Somewhat satisfied <input type="checkbox"/> Not satisfied <input type="checkbox"/> Not sure
QV17	What has been the best/most satisfying thing about your actual mode of delivery?	
QV18	What has been the worst/least satisfying thing about your actual mode of delivery?	
QV19	Rate your current level of pain/discomfort:	<input type="checkbox"/> Very uncomfortable <input type="checkbox"/> Somewhat uncomfortable <input type="checkbox"/> Comfortable <input type="checkbox"/> Not sure
QV20	Would you recommend your actual mode of delivery to other HIV positive women?	<input type="checkbox"/> Yes, strongly <input type="checkbox"/> Yes, somewhat <input type="checkbox"/> No <input type="checkbox"/> Not sure
QV21	How worried are you that your child will become/already is infected with HIV?	<input type="checkbox"/> Very worried <input type="checkbox"/> Somewhat worried <input type="checkbox"/> Not worried <input type="checkbox"/> Not sure
QV22	Estimated cost of delivery and hospital stay:	_____ ksh
QV23	Are you able to pay this amount for your delivery?	<input type="checkbox"/> Yes (Proceed to QVI01) <input type="checkbox"/> No <input type="checkbox"/> Not sure
QV24	If no to QV23, how much are you able to pay for your delivery?	_____ ksh

VI. ECS Knowledge/Attitudes:

QVI01	Did you receive PMTCT counseling?	<input type="checkbox"/> Yes <input type="checkbox"/> No (Proceed to QVI03) <input type="checkbox"/> Not Sure (Proceed to QVI03)
QVI02	How satisfied are you with the PMTCT counseling you received?	<input type="checkbox"/> Very satisfied <input type="checkbox"/> Somewhat satisfied <input type="checkbox"/> Not satisfied <input type="checkbox"/> Not sure
QVI03	Before today, had you heard of ECS for PMTCT?	<input type="checkbox"/> Yes <input type="checkbox"/> No (Proceed to QVI05) <input type="checkbox"/> Not Sure (Proceed to QVI05)

QVI04	From whom did you learn about ECS for PMTCT?	<input type="checkbox"/> Doctor <input type="checkbox"/> Counselor <input type="checkbox"/> Friend/relative (Specify: _____) <input type="checkbox"/> Other: _____
QVI05	In your opinion, does ECS reduce risk of MTCT?	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Not Sure
QVI06	How effective is ECS at reducing MTCT?	<input type="checkbox"/> Very effective <input type="checkbox"/> Somewhat effective <input type="checkbox"/> Not effective <input type="checkbox"/> Not sure
QVI07	By how much does ECS reduce MTCT?	<input type="checkbox"/> 0% (no reduction) <input type="checkbox"/> 25% (one-quarter) <input type="checkbox"/> 50% (one-half) (Proceed to QI08 but skip QVI11 and QVI12) <input type="checkbox"/> 75% (three-quarters) <input type="checkbox"/> 100% (eliminates MTCT)
QVI08	If ECS for PMTCT was offered by your doctor, would you opt for ECS as your mode of delivery?	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Not Sure
QVI09	If the cost of vaginal delivery was the same as the cost of ECS, would you opt for ECS as your mode of delivery?	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Not Sure
QVI10	If delivery was free, which mode of delivery would you choose?	<input type="checkbox"/> Vaginal delivery <input type="checkbox"/> ECS <input type="checkbox"/> Not Sure
QVI11	In general, ECS reduces MTCT by half. Knowing this, which mode of delivery would you choose?	<input type="checkbox"/> Vaginal delivery <input type="checkbox"/> ECS <input type="checkbox"/> Not Sure
QVI12	Knowing that ECS reduces MTCT by half, if delivery was free, which mode of delivery would you choose?	<input type="checkbox"/> Vaginal delivery <input type="checkbox"/> ECS <input type="checkbox"/> Not Sure

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