BARRIERS TO EARLY INFANT DIAGNOSIS AND SERVICE DELIVERY IN TWO HIGH HIV DISTRICTS IN GHANA

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Abstract

Objective: Ghana has made significant progress in its efforts to control Human Immunodeficiency virus (HIV) infections, however 31% of HIV exposed infants received early infant diagnosis (EID) services. This paper examines the factors influencing EID service delivery in two high HIV burden districts in Ghana.

Methodology: This study was conducted in two districts in the Eastern region of Ghana, Lower Manya Krobo (LMK) District (high HIV burden with low EID coverage) and New Juabeng Municipality, NJM (high HIV burden with relatively higher coverage for EID). This analysis describes the first phase (exploratory study) of a three-phased implementation research spanning over 24 months. A total of 420 women with children < 2 years in each study area were involved. Key informant interviews and focus group discussions were conducted among mothers and health workers. Data (quantitative and qualitative) were analysed with appropriate statistical measures.

Results: Relatively more women from LMKD knew about the risks for mother-to-child transmission of HIV (83.6% vs. 79.8%) and more women in LMKD had children <2 years tested for HIV. In contrast to findings from the survey, knowledge on EID during Focus Group Discussions was better in NJM than LMKD. Major demand and supply -side barriers and challenges to EID were identified.

Conclusion: Health system (supply side) and community based (demand side) barriers mitigated against the EID coverage in the two districts. More community sensitisation, improved innovative means of transporting samples and effective tracking of mothers with HIV exposed infants and linking them up to care is recommended.

Key Words: *Early Infant Diagnosis, Mother-to-Child Transmission, HIV, Ghana, Sub-Saharan Africa.*

Introduction

Ghana has made significant progress in its efforts to control Human Immunodeficiency virus (HIV) infections. Over the years, the country through the National AIDS/STI Control Programme (NACP) and with assistance from the Global Fund and other development partners has developed and implemented strategic plans, such as the National HIV and AIDS Strategic Framework I 2001-2005, National HIV and AIDS Strategic Framework II 2006-2010 and the National HIV and AIDS Strategic Plan (NSP) 2011-2015 [1]. The implementation of all these strategic plans have contributed immensely to reduction of HIV infections in Ghana. For example, results from the 2016 HIV Sentinel Survey (HSS) [2], show a reduction of national HIV prevalence among pregnant women from 3.6% in 2003 to 2.4%. The 2016 prevalence however, was an increase from the 2015 prevalence of 1.8% and 2014 prevalence of 1.6% [2].

The prevalence of HIV in the general population in Ghana is 1.6% [2]. An estimated 290,000 people are living with HIV in Ghana, among whom 32,000 are children. In addition, 20,000 new HIV infections are known to occur annually, of which 13,000 occur in adults and 7,000 among children. An estimated 15000 deaths attributed to HIV and AIDS occur annually, with over 2500 children dying as a result of HIV and AIDS annually in Ghana [2]. One of the key strategic interventions for HIV control in Ghana is Prevention of

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Mother to Child Transmission (PMTCT) of HIV. Mother to Child Transmission of HIV (MTCT), also known as vertical transmission, is the transmission of HIV virus from an infected pregnant woman to her child during pregnancy, childbirth or through breast feeding[3,4]. In the absence of interventions, it is estimated that vertical transmission of HIV will occur between 15 to 45% of pregnant women who are infected with HIV virus and their babies[3,4].

However, MTCT of HIV can be reduced below 5% with a series of interventions delivered to both mother and newborn throughout the period when transmission could occur. Ghana has thus adopted Prevention of Mother to Child Transmission (PMTCT) as one of the high impact interventions to control HIV infections in the country. The PMTCT program also offers an excellent opportunity to diagnose all HIV infected children early enough through Early Infant Diagnosis (EID) using a virology test such as the Polymerase Chain Reaction (PCR)[1].

This provides an opportunity to initiate Antiretroviral Therapy (ART) in order to significantly enhance the survival of children who acquire HIV through vertical transmission[1,5]. To increase the coverage and diagnoses of HIV infected infants early enough for clinical management, the application of e-health interventions has become increasingly important. This facilitates the ease and speed of transmission of information from health facility to the sample testing site and the relaying of information back to the client.

Prevention of Mother to Child Transmission of HIV (PMTCT) is considered a high impact intervention to control HIV infections and has been prioritized in all the strategic plans of the country. The national programme target for 2017 is to test and counsel 579,132 pregnant women representing 95% of expected pregnancies[2].

Results from the Ghana Demographic and Health Survey (GDHS) 2014[6] show that 97% of pregnant women attended antenatal care with 87% of these attending at least 4 antenatal visits and an estimated 74% of delivery were attended by skilled birth attendant.

Similarly, 77% of children between the ages of 12-23 months were fully immunized. Despite these relatively high coverages, only 31% of HIV exposed infants received EID[2].

The end term evaluation report of the National HIV and AIDS Strategic Plan (NSP) 2011-2015[7], shows that despite the reduction of HIV prevalence in Ghana, the overall transmission rate of HIV from mother to child including breastfeeding mothers is estimated at 16% in 2014 as against 31% in 2009[7]. This is far above the target of the Ghana AIDS Commission (GAC) and the National Aids Control Program (NACP) which is to reduce vertical transmission below 5% by 2020[8].

Mortality rate among infected infants is far higher than adults, without access to treatment and care about 30% of HIV infected infants will die before their first birthday while 75% before their fifth birthday [9,10] (WHO, 2010b; Stringer et al, 2008). This paper examines the context of PMTCT service delivery and factors influencing the uptake of EID services among clients in two high HIV burden districts in the Eastern region of Ghana.

Materials and Method

Study design

An Implementation Research Design composed of three phases: Exploratory Study (in both districts); Implementation phase (in experimental district) and Monitoring and Evaluation (in experimental district).

This analysis is on the exploratory phase, which adopted a mixed methods approach to explore barriers to uptake of PMTCT/EID using qualitative methods, and then determining the extent of the problem in the district population using quantitative methods. In general, a desk review; a survey (quantitative approach); and Key Informants Interviews (KI), and Focus group discussions (FGD) were employed.

Study Population

Study participants included:

1. Health workers directly involved in the provision of PMTCT/ EID services- doctors, midwives, CHOs/CHNs (KI, FGD).
2. Laboratory Personnel at the testing site i.e., Regional PHRL directly involved in EID/DBS (KI).
3. Health Facilities Managers and District Directors of Health Services (KI).
4. Clients/caregivers, i.e., women 18 years and above (regardless of HIV status) with children less than two years (FGD, Survey)

Study area/site

The study was conducted in 2016, in two districts in the Eastern region of Ghana, Lower Manya Krobo District- Agomanya (high HIV burden with low EID coverage) and New Juabeng Municipality-Koforidua (high HIV burden with relatively higher coverage for EID). The two districts have relatively high coverage for immunization, (over 90% coverage for Pentavalent-1 vaccine) and this service is provided through the

same platform as EID at 6-weeks[6]. The Eastern region is one of the four priority regions of Ghana, based on HIV prevalence from programme data and the HIV sentinel survey[2]. The two study areas have relatively high median HIV prevalence, 6.2% in Lower Manya Krobo District (the highest in the country) and 2.6% in New Juabeng Municipality according to the 2015 HIV sentinel survey[2].

The Lower Manya Krobo district is more rural with predominantly Krobo Ethnic group and has an estimated total population of 81941 and 37853 as population of women in fertile age (WIFA) in 2016. It has a total of 23 health facilities, one district hospital, one ART centre and 14 PMTCT sites.

The New Juabeng Municipality is an urban and more cosmopolitan area and has an estimated total population of 212398 and 119982 as population of women in fertile age (WIFA) in 2016. It has a total of 74 health facilities, one regional hospital, two ART Centres and 15 PMTCT sites.

Sample size determination

The 2014 Ghana Demographic and Health Survey (GDHS) shows 43% of females and 20% of males (aged 15-49 years) had ever been tested for HIV[6]. The estimated prevalence of the willingness of mothers to have their children also tested for HIV through EID is 43%[11]. The sample size was therefore based on this estimate. In all, 420 women with children < 2 years in each district were selected for the survey.

The survey employed the modified World Health Organization (WHO) cluster sampling method to select eligible subjects (Yawson et al, 2014). In each of the two districts, at most 420 women were selected. Each district was segmented into four clusters by natural/geographical boundaries (i.e., sub-district clusters).

A cluster was chosen by a simple random sampling technique and all eligible subjects within households who consent to be part were included. Houses in the two study sites have standard house numbering systems (National health insurance or census designations). The households were coded using the house number and a three-digit code (e.g., MK 12/001 for a household within a house with house number MK 12).

Field workers were clearly educated on how to assign the codes to the households in selected communities in the two districts. In each household, the head of the household was contacted (in his/her absence an adult member of the household 18 years and above was contacted) and permission sought to interview women with children less than two years in the household. This was done until the sample size was obtained.

Purposive sampling methods were used to select service providers, laboratory personnel and health facility managers directly involved in PMTCT/EID services for the Focus group discussions and the key informant interviews.

Data collection methods and analysis

A structured questionnaire was used to collect demographic characteristics, socioeconomic and sociocultural factors including beliefs on causes and prevention of HIV, willingness for HIV testing and willingness to have children tested for HIV, and health seeking behaviours. In addition, information on barriers to EID services (delays in getting samples taken, and delays in notification and receipt of results from health facilities etc) was obtained. The questionnaire was pre-tested at Upper Manya Krobo District, a neighbouring district with similar characteristics as the experimental district.

Key Informant interviews were conducted for personnel at the regional Laboratory and health service providers (midwives, general nurses, community health officers and community health nurses) in selected health facilities in each District (6 key informants from each district).

Two FGDs were conducted in each district/ municipality for midwives and Community Health Officers / Community Health Nurses (10 in number for each FGD session) from all ART and PMTCT sites in the two study sites. Interviews Guides were employed for data collection in both the Focus group discussion and Key Informant Interviews.

Data Management and Statistical Analysis

All data were treated with a high level of confidentiality. Unique identifiers and codes were employed to de-identify the participants and were used for computer-based data entry in the exploratory phase. In all cases, questionnaires, documentations and computerized records of the survey were kept in locked cabinets and computer files respectively. These documents were accessible to the lead and co-investigator only.

Manual Thematic content analysis was used for analysis of qualitative data. Quantitative data from survey were analysed with SPSS version 20 to determine simple descriptive statistics such as proportions, frequencies and ratios for categorical data; while mean± standard deviation was used continuous measures.

Ethical considerations

Ethical clearance for this study was obtained from the Ethics Review Committee of the Ghana Health Service with proposal approval identification number GHS-ERC: 05/09/16.

The study was in conformity to the guidelines of the 1975 Helsinki Declaration. All participants provided written informed consent. Permission was obtained from Heads of institutions, District Health Authorities as well as Traditional Authorities in the study areas.

Results

Basic demographic and socioeconomic characteristics of Participants in the two districts

The median age for the 840 participants in the survey was 28± 6.3 years. The median age of participants in the two districts were Lower Manya Krobo Districts (LMKD) 28± 6.3 years and New Juabeng Municipality (NJM) 28± 6.2 years.

Table 1 demonstrates that participants from NJM had relatively higher proportions with secondary education or higher compared to LMKD. There were relatively higher proportions of widowed, single mothers and cohabiting women in LMKD compared to NJM. In addition, there was a higher proportion of Muslims in NJM relative to LMKD.

Participants from LMKD had relatively higher proportions of those currently employed compared to NJM [247(58.8%) vs. 203 (48.3%)]. Significantly, more women have stayed longer in the current place of residence in LMKD compared to NJM. About 97% of participants in both districts had NHIS card for accessing health services (Table 1).

Knowledge on HIV and risk of mother-to-child transmission of participants in the two districts

Table 2 demonstrates knowledge on HIV and risk of transmission from mother to child. Almost all the participants in both districts had heard of HIV and AIDS mainly from health workers. There was a higher proportion with knowledge on HIV prevention among participants in NJM than in LMKD (93.8% and 90.2% respectively). Interestingly, 12.1% of participants from LMKD indicated that the avoidance of spiritual curses could prevent one from getting HIV.

It is important to note that 75.5% of participants in NJM knew that an HIV positive pregnant woman could infect an unborn child, however 87.9%of all the participants knew about mother to child transmission through breastmilk.

Table 1: Basic demographic and socioeconomic characteristics of Participants in the two districts

Characteristics	District		Total	Chi Square/ Fishers Test (p-value)
	Lower Manya Krobo (high HIV burden with low EID)	**New Juabeng** (high HIV burden with relatively higher coverage for EID)		
	n=420	**n=420**	**N=840**	
Educational Level				
Primary	93(22.1)	57(13.6)	150(17.9)	
Middle/JHS	212(50.5)	218(51.9)	430(51.2)	28.69**(0.001)**
Secondary/High School	55(13.1)	79(18.8)	134(16.0)	
University/College	15(3.6)	21(5.0)	36(4.3)	
Vocational/Commercial/ Technical	3(0.7)	17(4.0)	20(2.4)	
None	42(10.0)	28(6.7)	70(8.3)	
Marital Status				
Married	192(45.7)	280(66.7)	472(56.2)	
Divorced	2(0.5)	2(0.5)	4(0.5)	
Widowed	8(1.9)	1(0.2)	9(1.1)	48.31**(0.001)**
Separated	12(2.9)	0(0.0)	12(1.4)	
Cohabiting	133(31.7)	94(22.4)	227(27.0)	
Single	73(17.4)	43(10.2)	116(13.8)	
Duration of stay in current place of residence				
Less than 6 Months	53(12.6)	30(7.1)	83(9.9)	
Between 6mths- 1 year	36(8.6)	39(9.3)	75(8.9)	
Between 1 and 2 years	51(12.1)	62(14.8)	113(13.5)	14.62**(0.023)**
Between 2 and 5 years	82(19.6)	99(23.6)	181(21.5)	
Between 5 and 10 years	57(13.6)	74(17.6)	131(15.6)	
More than 10 years	141(33.6)	116(27.6)	257(30.6)	
Currently employed				
Yes	247(58.8)	203(48.3)	450(53.6)	
No	173(41.2)	217(51.7)	390(46.4)	9.27**(0.002)**
Possession of Valid NHIS Card				

Yes	407(96.9)	408(97.1)	815(97.0)	0.04(0.839)
No	13(3.1)	12(2.9)	25(3.0)	
Member of a Social Club in Area of Residence				
Yes	58(13.8)	41(9.8)	99(11.8)	3.31(0.069)
No	362(86.2)	379(90.2)	741(88.2)	

Characteristics	**District**		**Total**
	Lower Manya Krobo (high HIV burden with low EID)	**New Juabeng (high HIV burden with relatively higher coverage for EID)**	
Heard of AIDS			
Yes	410(97.6)	416(99.0)	826(98.3)
No	10(2.4)	4(1.0)	14(1.7)
Total	420	420	840
Heard of HIV			
Yes	411(97.9)	417(99.3)	828(98.6)
No	9(2.1)	3(0.7)	12(1.4)
Total	420 (100)	420	840
Know How HIV is transmitted			
Yes	379(90.2)	394(93.8)	773(92.0)
No	41(9.8)	25(6.0)	66(7.9)
Total	420 (50.0)	420	840
Main source of information			
Health Worker	267(65.1)	222(53.1)	489(59.1)
Family Member	2(0.5)	5(1.2)	7(0.8)
Friend	18(4.4)	12(2.9)	30(3.6)
Media	84(20.5)	136(32.5)	220(26.6)
Church/Mosque	3(0.7)	3(0.7)	6(0.7)
Social Club	1(0.2)	3(0.7)	4(0.5)
Others	35(8.5)	37(8.9)	72(8.7)
Total	410	418	828
Knowledge of risk factors for HIV transmission			
Sexual intercourse	347(82.6)	366(87.1)	713(84.9)
Sharing sharps	302(65.7)	276(65.7)	578(68.8)
Blood transfusion	106(25.2)	49(11.7)	155(18.5)
Sharing needles	106(25.2)	25(6.0)	131(15.6)
Spiritual causes	51(12.1)	5(1.2)	56(6.7)
Family curse	40(9.5)	3(0.7)	43(5.1)
Others	54(12.9)	47(11.2)	101(12.0)
Know prevention of HIV			
Yes	354(84.3)	390(92.9)	744(88.6)
No	66(15.7)	30(7.1)	96(11.4)
Total	420	420	840
Can a healthy-looking person have HIV			
Yes	351(83.6)	335(79.8)	686(81.7)
No	69(16.4)	85(20.2)	154(18.3)
Total	420	420	840
Can HIV positive pregnant woman infect unborn child			
Yes	366(87.1)	317(75.5)	683(81.3)
No	54(12.9)	103(24.5)	157(18.7)
Total	420	420	840
Can HIV positive mother infect child through breastmilk			
Yes	380(90.5)	369(87.9)	749(89.2)
No	40(9.5)	50(11.9)	90(10.7)
Total	420	420	840

Pregnancy and HIV testing history of mother and child

The HIV testing histories of participants indicated that approximately over 9 out of 10 participants had had an HIV test NJM (92.6%) and LMKD (95.5%) done mainly during their last pregnancy. Only 20.5% of children from LMKD and 16.9% of children from NJM had been tested for HIV due to reasons illustrated in Table 3 which were corroborated by mothers in the focus group discussion.

Mother 1 indicated *'I think the baby is too small to be at risk for HIV. I may not do the test because it the child is too young to have the disease'.*
Mother 2 puts her view quite succinctly *'The test for the baby is not necessary because the disease does not have a cure, hence there is no point in testing to know and to worry my little baby with needle pricks'.*

Table 3 shows a higher proportion of LMKD participants considered HIV testing for children useful, were aware of the test results of their children and had made follow up visits to the health facility where the child was tested. In contrast, the focus group discussion among participants indicated limited knowledge and awareness on the need for EID and noted that health

workers do not explicitly explain to mothers why the child need to be tested.

Mother 3 said '*I do not know much about this test. The nurses normally say they want to test the child to know if he or she has HIV disease just like it is done when you are pregnant. They do not offer any prior advice or counselling. When health workers come to us for outreach services, they must mention it*'.

Table 3: Pregnancy and HIV testing history of mother and child in the two districts

Characteristics	District		Total
	Lower Manya Krobo (high HIV burden , low EID)	New Juabeng (high HIV burden higher coverage for EID)	
Number of children			
1-4	382(91.0)	396(94.3)	778(92.6)
5 or more	38(9.0)	24(5.7)	62(7.4)
Total	420	420	840
Ever tested for HIV			
Yes	389(92.6)	401(95.5)	790(94.0)
No	31(7.4)	19(4.5)	50(6.0)
Total	420	420	840
Were you tested in last pregnancy			
Yes	387(92.1)	399(95.0)	786(93.6)
No	33(7.9)	21(5.0)	54(6.4)
Total	420	420	840
Has child less than 2 years ever been tested for HIV			
Yes	86(20.5)	71(16.9)	157(18.7)
No	334(79.5)	349(83.1)	683(81.3)
Total	420	420	840
Reasons for child not ever been tested			
Never had opportunity	87(20.7)	115(27.4)	202(24.0)
Child not at risk	59(14.0)	59(14.0)	118(14.0)
Not necessary	53(12.6)	59(14.0)	112(13.3)
Have tested negative previously	27(6.4)	46(11.0)	73(8.7)
Test is for adults	19(4.5)	8(1.9)	27(3.2)
Child not sick	15(3.6)	12(2.9)	27(3.2)
Health worker not Confidential	12(2.9)	5(1.2)	17(2.0)
Don't have time	11(2.6)	2(0.5)	13(1.5)
Afraid of outcome	2(0.5)	3(0.7)	5(0.6)
Is HIV testing of child useful			
Yes	392(93.3)	382(91.0)	774(92.1)
No	28(6.7)	38(9.0)	66(7.9)
Total	420	420	840
Willing to get child tested			
Yes	400(95.2)	405(96.4)	805(95.8)
No	20(4.8)	15(3.6)	35(4.2)
Total	420	420	840
Ever sent child for immunization			
Yes	415(98.8)	412(98.1)	827(98.5)
No	5(1.2)	8(1.9)	13(1.5)
Total	420	420	840
How many times gone for immunization			
None	2(0.5)	8(1.9	10(1.2)
1	21(5.1)	15(3.6)	36(4.3)
2 or more	391(94.4)	397(94.5)	788(94.5)
Total	414	420	834

Findings from the focus group discussion

Participants generally indicated that challenges with scheduling of visits by health workers and not keeping the scheduled appointments were major barriers to EID. In addition, lack of privacy and confidentiality in discussing issues with the health workers and the fear of disclosure to spouse or family were noted to be major barriers.

Mother 4 intimated strongly *'The nurses who do the test should "shut their mouth". They talk too much and spread the news about the status of patients to other people'.*

Mother 5 indicated her challenge in accessing care for the baby as '*Some of us don't get the time to always bring our babies to the hospital. I work under someone as a trader, and you do not always get permission when you request for it'.*

Despite these barriers, most of the test for the children were conducted before the age of 12months, mainly in the hospital setting as demonstrated in Table 3. Almost all the children of the 840 participants had received immunization as well. The mothers however, expressed their concerns in accessing health care at the health facilities:

Mother 6 stated that *'The nurses should be patient when we come to their service delivery points. They should take time and explain things to us. Yes, the way*

the health workers talk to us sometimes discourages us from coming back'.

Mother 7 was of the view that *'If this test can be done at home for our babies, I will prefer that very much. Cost of transportation and the long waiting times discourages some of us from using the service'*

Health workers in health facilities of the two districts provided reasons for the barriers to EID services as challenges with transporting samples to the laboratory due to unavailability of transport or paying for the transfer of samples to the laboratory, delays in getting feedback on results of sample analysis from the Regional Laboratory. In addition, delays in relaying results of test to clients because mothers do not come back to the health facilities again with their babies and that key personnel in charge of some health facilities where HIV testing are done are not trained to conduct EID.

Health worker 1, '*Our main challenge is with transporting the samples to the Laboratory. Sometimes we use personal funds to transport the samples. We usually cannot rely on the hospital'.*

Health worker 2, '*The results delay for too long in the regional laboratory and when we finally get them, clients referred to us from other districts do not come for the results. We can't reach them on phone either'***.**

Regional Laboratory Personnel 1 indicated '*samples may be taken in the health facility but it takes too long in getting to the laboratory, example, this sample* (personnel shows a sample) *was taken 20th October, 2015 at the facility but got here in January, 2016'.*

Regional Laboratory Personnel 2 stated 'Sometimes *the health facilities are notified but coming here for the results is always the challenge. Currently, they prompt us when their drivers or other officers are coming here for other assignments so that it can be collected on their behalf. In fact, getting the results to them timely is difficult'.*

Discussion

The study demonstrates that participants from the more urban and cosmopolitan New Juabeng Municipality (NJM) had relatively higher proportions with secondary education or higher compared to the more rural and indigenous Lower Manya Krobo District (LMKD). Interestingly, relatively more women in LMKD have higher knowledge on the HIV and the risk of transmission of HIV from mother to child. These findings are not surprising due to the urban nature of NJM compared to the relatively more rural and more indigenous LMKD. Many more women usually stay for much longer periods in these settings (as demonstrated in this study Table 1). The relatively higher knowledge of women in the more rural district, could potentially be due to increased routine health education on HIV by health workers. In addition, it may be because repeated health education messages are provided by health workers in such a high HIV burden district[2], and that the relatively longer duration of stay of mothers in the LMKD foster long-lasting relationships with the health workers in the rural health facilities.

Regardless of the relative differences in knowledge, almost all the mothers in both districts had heard about HIV and AIDS which agrees with findings from the Ghana Demographic and Health Survey, 2014 which found an almost universal knowledge on HIV by women 15-45 years (i.e., 0ver 97%)[6]. The national efforts towards control of the HIV epidemic have provided several focused HIV activities in these high burden districts[1].

It was observed that, most of the women received information of HIV and prevention of mother-to-child transmission of HIV (PMTCT) from health workers. This emphasises the need to reduce missed opportunities in the health facilities concerning testing for HIV by pregnant women and mothers. The Child welfare clinics (CWC) offer opportunities for early infant diagnosis (EID) as most mothers are likely to send their children for immunization. The first CWC attendance/ immunization service is at six weeks, which also provides an opportunity for EID. This study observed a high rate of immunization among the children of these mothers, however with a concomitant lower coverage for EID. This demonstrates missed opportunities for EID at the service provision points.

HIV testing services is the primary gateway to all systems of AIDS-related care[13,14,15]. One critical means of curbing new infections and AIDS-related deaths especially among children is by encouraging early diagnosis through testing within the first two months of delivery. In Ghana, significant investments have been made to increase access for HIV testing [1,16]. However, several bottlenecks exist to the delivery of EID services to infants.

This study through a qualitative assessment has demonstrated that key health system challenges (supply side) and community-based factors (demand side) inhibit the coverage and uptake of EID services. Key

demand side factors identified were mothers who know their status from previous testing unwilling to get their children tested and hence view the testing of the child as unnecessary; mother thinking the baby is too small to be at risk of HIV, persistence of HIV and AIDS related stigma and mothers getting lost to follow up, especially after delivery. These belief systems and social and community factors limit access to care for the children. These mothers may have tested some time ago in early pregnancy, however, there still exist the risk of acquiring HIV in pregnancy and hence the need to get re-tested at 34 weeks in pregnancy. The rate of testing at 34 weeks in pregnancy is generally low in Ghana[1].

Key health system (supply side) challenges included poor EID sample management (unavailability of transport; delays in retrieving results of tests from Regional Laboratory (even after notifications have been sent electronically), and delays in relaying test results to clients. Poor healthcare worker capacity was another challenge observed as in some health facilities where HIV testing is done, the key personnel had not been trained to provide EID services. Early infant diagnosis improves survival of the child when treatment is initiated early. Delays in relaying the results to mothers create difficulties for attending clinicians and discourages mothers from continuing with care. The availability of ART has transformed what was once a deadly disease into a manageable chronic condition[17]. However, due to these barriers related to HIV treatment, not all persons in need of ART in resource-limited settings utilize the service. This has dire consequence for the survival of these children[18-21].

Limitation

The assessment was based purely on responses from mothers and health care workers there was no objective measure to ascertain the veracity of their answers. The sample size was, however, large enough to mitigate this challenge.

Conclusion

Both health system (supply side) and community based (demand side) barriers mitigated against the EID coverage in the two districts. More community sensitisation on the need and benefit of EID is imperative, as well as the training of key health providers who offer PMTCT to provide EID services and training/ refresher on PMTC/EID for those previously trained. Reduction of missed opportunities and optimising testing of infants during immunisation/ child welfare clinic, whenever the mothers/ caregivers visit the health facility will be key to improve coverage.

In addition, effective local arrangement at the district level and the Regional Laboratory is necessary to overcome difficulties in sample transfer and all locally available opportunities should be explored.

Declarations

Ethics approval and consent to participate

Ethical clearance for this study was obtained from the Ethics Review Committee of the Ghana Health Service with proposal approval identification number GHS-ERC: 05/09/16. The study was in conformity to the guidelines of the 1975 Helsinki Declaration. All participants provided written informed consent. Permission was obtained from Heads of institutions, District Health Authorities as well as Traditional Authorities in the study areas.

Consent to publish

All participants were informed about the study and consent obtained. Participants provided written informed consent, duly administered and witnessed before data collection. Participants were informed that the findings would be shared with Ghana Health Service and the wider scientific community.

Availability of data and materials

All data obtained from participants have been fully represented and provided in the three tables contained in the results section of the manuscript.

Competing interests

The authors declare that they have no competing interest. The views expressed in this paper are those of the authors. No official endorsement by the Ministry of Health or Ghana Health Service is intended or should be inferred.

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Authors' contributions

AEY, EA, NAHS and PB developed the concept, AEY, NAHS and DA assisted with data collection. AEY and NAHS analysed the survey data. AEY and NAHS wrote the first draft manuscript, all authors contributed to the writing and reviewing of the various sections of the manuscript. All the authors reviewed the final version of the manuscript before submission. All authors read and approved the final manuscript.

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Abbreviation

ANC	Antenatal Clinic
ART	Antiretroviral Therapy
ARVs	Antiretroviral
CHN	Community Health Nurse
CHO	Community Health Officer
CHPS	Community-Based Health Planning and Services
CWC	Child Welfare clinic
DBS	Dried Blood Spot
DHIMS	District Health Information Management System
EID	Early Infant Diagnosis of HIV
eMTCT	Elimination of Mother to Child Transmission of HIV
GAC	Ghana AIDS Commission
GDHS	Ghana Demographic and Health Survey
GHS	Ghana Health Service
HIV	Human Immunodeficiency virus
HSS	HIV Sentinel Survey
LMK	Lower Manya Krobo
MTCT	Mother to Child Transmission of HIV
NACP	National AIDS/STI Control Programme
NJM	New Juabeng Municipality
NSP	National HIV and AIDS Strategic Plan
PMTCT	Prevention of Mother to Child Transmission of HIV
UNICEF	United Nations Children Fund
WHO	World Health Organization

References

1. Ghana Health Services, National AIDS/STI Control Programme, Annual Report. Accra, Ghana. 2016.
2. Ghana Health Services, National AIDS/STI Control Programme, HIV Sentinel Survey (HSS) Report. Accra, Ghana. 2016.
3. World Health Organization. Prevention of Mother-To-Child Transmission (PMTCT) strategic vision 2010–2015. World Health Organization, Switzerland, Geneva: 2010.
4. Painstil E, Andiman WA. Update on successes and challenges regarding mother-to-child transmission of HIV. *Current Opin Pediatr*. 2009;21:94–101.
5. Barker PM, Mate K. Eliminating mother-to-child HIV transmission will require major improvements in maternal and child health services. *Health Aff.* 2012; 31:1489–1497.
6. Ghana Statistical Service, Ghana Health Service, ICF, MACRO. Ghana Demographic and Health Survey 2014.
7. Ghana Health Services, National AIDS/STI Control Programme, End Term Evaluation Report. Accra, Ghana. 2015.
8. National HIV and AIDS Strategic Plan (NSP) 2011-2015 Ghana AIDS Commission, Ministry of Health, Accra, Ghana. 2010.
9. World Health Organization. Rapid advice: use of antiretroviral drugs for treating pregnant women and preventing HIV infection in infants. Switzerland: World Health Organization. 2010.
10. Stringer EM, Chi BH, Chintu N, Creek TL, Ekouevi DK, Coetzee D, Tih P, Boulle A, Dabis F, Shaffer N, Wilfert CM, Stringer JSA. Monitoring effectiveness of programmes to prevent mother-to-child HIV transmission in lower-income countries. *Bull World Health Organ.* 2008; 86:1–80.
11. Dako-Gyeke P, Aikins M, Aryeetey R, McCough L, Adongo PB. The influence of socio-cultural interpretations of pregnancy threats on health-seeking behavior among pregnant women in urban Accra, Ghana. *BMC Pregnancy Childbirth*. 2013; 13:211.
12. Yawson AE, Labi AK, Yawson AO, Bonsu G, Aluze-Ele S, Owusu Amanhyia NA, Lartey M, Adjei A., Lawson A., Beckwith C., Kwara A., Flanigan T. Sex differences in perceived risk and testing experience of HIV in an urban fishing setting in Ghana. *Int. J. Equity Health* 2014; 13:109.
13. Marks G, Crepaz N, Janssen RS. Estimating sexual transmission of HIV from persons aware and

unaware that they are infected with the virus in the USA. *AIDS*, 2006;20:1447-1450.

14. Matovu JKB, Makumbi FE. Expanding access to voluntary HIV counseling and testing in sub-Saharan Africa: Alternative approaches for improving uptake, 2001_2007. *Trop. Med. Int. Health* 2005;12: 1315-1322.
15. Snow RC, Madalane M, Poulsen M. Are men testing? sex differentials in HIV testing in Mpumalanga Province, South Africa. *AIDS Care* 2010;22: 1060-1065.
16. Baiden F, Akanlu G, Hodgson A, Akweongo, P, Debpuur C, Binka F. Using lay counselors to promote Community-based voluntary counseling and HIV testing in rural Northern Ghana: a baseline survey on community acceptance and stigma. *J. Biosoc. Sci* 2007; 39:721-733.
17. Reeves M. Scaling up prevention of mother-to-child transmission of HIV: what will it take? Washington: Center for Strategic and International Studies; 2011.
18. Makwiza I, Nyerinda L, Bongololo G, Talumba B, Chimzizi R, Theobald S. Who has access to counseling and testing and anti-retroviral therapy in Malawi-an equity analysis. *Int. J. Equity Health* 2009; 8:1–9.
19. Ebrahim SH, Anderson JE, Weidle P, Purcell DW. Race/Ethnic disparities in HIV testing and knowledge about treatment for HIV/AIDS: United States 2001. *AIDS Patient Care STDs* 2004; 18:27–33.
20. Posse M, Baltussen R. Barriers to access to antiretroviral treatment in Mozambique, as perceived by patients and health workers in urban and rural settings. *AIDS Patient Care STDs* 2009; 3:867–875.
21. Van Damme V, Kober K, Laga M. The real challenges for scaling up ART in sub-Saharan Africa. *AIDS* 2006; 20:653–656.