UNIVERSITY OF ZAMBIA

SCHOOL OF MEDICINE

DEPARTMENT OF PUBLIC HEALTH

A STUDY ON USEFULNESS OF A SET OF KNOWN RISK FACTORS IN PREDICTING MATERNAL SYPHILIS INFECTIONS IN THREE DISTRICTS OF WESTERN PROVINCE, ZAMBIA

BY

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This Dissertation is submitted to the University of Zambia in partial fulfillment of requirements for the award of Masters Degree in Public Health (Health Policy and Management)

2015

DEDICATION

To my wife Mable and our little sons Arthur and Jason, for the love and understanding as this period must have been confusing with the frequent travelling between three homes when my wife and I were each pursuing studies in different places.

CERTIFICATE OF COMPLETION OF DISSERTATION

I JACOB SAKALA

Hereby certify that this dissertation is a product of my own work and in submitting it for the Degree of Masters of Public Health programme. I further attest that it has not been submitted to another University in part or whole for the award of any programme.

Signed:……..

Date:…….

I Dr SELESTINE NZALA

Having supervised and read this dissertation is satisfied that this is the original work of the author under whose name it is being presented.

I confirm that the work has been completed satisfactorily and is ready for presentation to the examiners.

Signature/supervisor:…….

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DECLARATION

This dissertation is the original work of Jacob Sakala.

It has been produced in accordance with the guidelines for Masters of Public Health (Health Policy and Management) dissertation for the University of Zambia. It has not been submitted either wholly or in part for any other Degree at this or any other University nor is it being currently submitted for any other Degree.

Signed:……..

Jacob Sakala

Date:……

…….

Dr. Selestine Nzala (supervisor)

APPROVAL CERTIFICATION

The University of Zambia approves this dissertation of Jacob Sakala as fulfilling part of the requirements for the award of the Masters of Science Degree in Public Health (Health Policy and Management).

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ACKNOWLEDGEMENTS

I extend my sincere gratitude to all individuals and institutional offices that have rendered support during my training and research work.

I am completely indebted to Dr Selestine Nzala, Assistant Dean Post-Graduate who was also my supervisor during the research and Professor Charles Michelo for guiding me through this process.

I wish to thank the Ministry of Health for financially sponsoring my training. I also thank the Ministry of Community Development Mother and Child through the Provincial Medical Office for granting permission to conduct the study in health institutions.

I thank the Chairperson for Eres Coverge and her entire team not only for granting ethical clearance for this research but for extensive inputs in the protocol development process.

I am indebted to Kaoma, Luampa and Nkeyema District Community Medical Offices (DCMO) for the logistical support of ensuring availability of test kits during data collection. Through the DCMOs I extend my profound gratitude to following Health workers in the study sites for accepting the daunting task of being research assistants especially for the work done in conducting the screening tests; Mr M. Mangoni, Ms R. Samazala, Ms G. Mulawa, Ms L. Liyenda, Ms Imboela, Ms L. Mweemba, Ms K Mataa, Mr K. Muyoya, Mr M. Mwiya, Ms N. Muyunda and Mr R. Vwali.

Special thanks to Ms N. Chizuni not only for her assistance during the data analysis, her unflinching support and everything she did as a friend in keeping me updated with schedules and information when I could not personally travel to Lusaka.

This whole research would not have been possible without the respondents for willingly giving their consent to participate in the study.

Abstract

Background: Despite roll-out of cost-effective point-of-care tests, less than half antenatal attendees in rural western Zambia are screened for syphilis. This study formulated a clinical, risk-based assessment criteria and evaluated its usefulness as a non-biomedical alternative for identifying high-risk prenatal cases.

Methods: We conducted a cross-sectional survey of antenatal clinic attendees in Kaoma, Luampa and Nkeyema districts to collect data on exposure to nine pre-selected syphilis risk factors. These factors were classified into major and minor factors based on their observed pre-study association strengths to maternal syphilis. Clinical disease was defined as exposure to either two major factors, one major with two minor factors or three minor factors. Sensitivity, specificity and predictive values of the clinical protocol were then calculated in comparison to rapid plasmin reagin results.

Results: The observed syphilis prevalence was 9.3% (95% CI: 7.4 – 11.6%) and the overall sensitivity of the study criteria was 62.3% with positive predictive value of 72.9%. Sensitivities of individual case-defining categories were even lower; from 17.4% to 33.3%. Results confirmed that abortion history, still birth, multiple sexual partners, previous maternal syphilis infection, partner history of sexually transmitted infection and maternal co-morbid conditions of HIV and genital ulcer disease were significantly associated to maternal syphilis in study population as well.

Conclusion: The criteria was not as effective as biomedical tests in identifying maternal syphilis. However, it could be a useful adjunct/alternative in antenatal clinics when biomedical tests are either inadequate or unavailable.

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List of Abbreviations

ANC.....Antenatal Care
APOs……Adverse Pregnancy Outcomes
DALY…….…….Disability Adjusted Life Years
DCMO…….……..District Community Medical Office
DHIS……District Health Information System
DHS……Demographic Health Survey
FTA-Abs…….Fluorescent Treponemal Antibody Absorption
GUD……..Genital Ulcer Disease
HIV…….....Human Immuno-deficiency Virus
IUFD..... Intra-Uterine Fetal Death
IUGR.....Intra-Uterine Growth Retardation
MTCT..... Mother to Child transmission
NPV…….Negative Predictive Value
PDV…….Positive Predictive Value
POC……..…….…..……. Point of Care
RPR.....Rapid Plasma Reagin
RST……Rapid Screening Test
STI.....Sexually Transmitted Infections
TPHA.....Treponemal Pallidum Particle Agglutination
VDRL.....Venereal Disease Research Laboratory
WHO.....World Health Organization
ZDHS……..…Zambia Demographic Health Survey

Definitions of Concepts

1. **Current conventional maternal syphilis control programme**: existing practices and implementation of antenatal syphilis testing and treatment
2. **Risk assessment criteria**: proposed criteria by this study of known risk factors to detect presence of maternal syphilis
3. **Clinical maternal syphilis disease**: syphilis infection in study participant which has been identified by risk assessment criteria
4. **Maternal syphilis case**: Syphilis infection as confirmed by RPR during pregnancy
5. **Risk scoring criteria**: a scoring matrix based on strength of association of risk factors to maternal syphilis
6. **Pre-selected risk factors**: Known risk factors of syphilis chosen before commencement of this study for inclusion in the risk assessment criteria.

1.0 Background

Syphilis is a systemic disease caused by infection with *Treponema pallidum* and has a variety of clinical features depending on whether the disease progression is in the primary, secondary, latent or tertiary stages. These features may range from asymptomatic infections to death. Syphilis can be transmitted sexually or vertically from mother to child, the latter resulting in congenital syphilis in the new born.

1.1 Epidemiology of syphilis

Global overview of sexually transmitted infections (STIs) estimates that 11 million people and among them 1.5 million pregnant women are infected with syphilis every year (WHO, 2012).

Africa has the highest disease burden and for decades syphilis has been a public health concern with 33.3% of the global cases seen in sub-Saharan Africa alone. Maternal or pregnancy-related infections, in this region, can be as high as 17% (Rydzak et al, 2008) with re-infection during pregnancy reported to be as high as 10% (Walker and Walker, 2004).

In Zambia, national syphilis prevalence is estimated to be 8% as measured by the 2007 Zambia Demographic Health Survey (ZDHS). Although data suggests a general decline in syphilis prevalence between 2002 and 2007, this decrease was shown not to be statistically significant (CSO, 2007). Generally syphilis has continued to be a public health problem over the years with country prevalence estimates of 16% among people aged 15 – 49 years (MOH, 2008) and sex-specific prevalence as per 2007 ZDHS of 4% among women of reproductive age-group. Infections remain common in pregnancy with recent data showing maternal syphilis prevalence of 9.5% among women attending antenatal clinic in Zambia (Yassa et al, 2015) and 10.8% ANC prevalence in rural populations of Western province (Makasa et al, 2012).

1.2 Adverse outcomes of maternal syphilis

The public health concern for maternal syphilis (pregnancy related infection) is due to its association with adverse pregnancy outcomes (APOs) such as spontaneous abortions, intra-uterine growth retardation, still births, premature deliveries, low-birth weight, perinatal deaths and congenital disease among new-born babies (Maggwa et al 2001). Reports show that when untreated maternal syphilis can be associated with APOs in about 53.4% - 81.8% of the affected women (Gomez et al, 2013). Further, an earlier demonstration study conducted at the University Teaching Hospital in Zambia found the overall risk of APOs was 8.29 and the risk of vertical transmission was 80% among women with early syphilis infections in pregnancy (Hira et al, 1990).

1.3 Conventional and alternate antenatal syphilis control programmes

There are effective measures available to prevent and treat syphilis. WHO recommends that pregnant women should be screened for syphilis as an entry point for the control of maternal syphilis and its APOs (WHO, 2007). The recommended screening tests include:

1. Rapid non-treponemal screening tests; Venereal Disease Research Laboratory (VDRL) and Rapid Plasma Reagin (RPR)
2. Confirmatory treponemal tests; Treponemal Pallidum Particle Agglutination (TPHA) and Fluorescent Treponemal Antibody Absorption or Dark Field Microscopy.

Use of point of care (POC) screening tests followed by onsite treatment has been shown in several studies to be cost effective in controlling maternal syphilis (Gloyd et al, 2001). To achieve the greatest benefit, WHO further recommends that "all pregnant women should be tested for syphilis, not just those perceived as being high risk" (WHO, 2012). Case detection among antenatal women paves way for treatment of their sexual partners and provision of health education on prevention of syphilis infection and re-infections.

Many countries in sub-Saharan Africa including Zambia adopted the WHO recommendation for antenatal screening and treatment of syphilis with varying performance levels. The WHO guidelines are dependent on ensuring availability of biomedical POC screening or off-site laboratory tests for antenatal women. However, in developing countries especially in rural settings these screening tests are not usually available. According to WHO 2011 report, out of the 63 low and middle income countries who submitted reports in 2010 on performance of antenatal screening for syphilis, only 17 achieved the global target of 90% testing coverage. Only one country (Namibia) among these was from sub-Saharan Africa. The median coverage for syphilis testing in the 27 sub-Saharan countries that reported was 59% which was the lowest compared to 73% in Latin America and the Caribbean and 78% in East, South and South-East Asia. The report showed no improvement in global median of antenatal syphilis screening between 2008 and 2010 with eight of the reporting 63 countries indicating not having offered routine testing in 2010 (WHO, 2011). In Zambia there have been varying estimates of antenatal screening proportions for syphilis. Hira et al in 1990 reported that 70-80% prenatal attendees were tested for syphilis. More recent report from the Ministry of Health in Zambia indicates 44% testing coverage among antenatal clients (MOH, 2008).

There are a number of reasons for low antenatal syphilis testing especially in resource limited settings. However, the commonest reason is inadequate resources allocation to ensure constant availability of biomedical screening test kits (Schmid, 2004).

The syphilis control guidelines in their current state do not provide an alternative method, in the absence of biomedical screening tests, for identifying syphilis especially among women with increased risk of infection. The focus for most research has been finding more cost-effective means of screening and putting up a case for more resource allocation (WHO, 2012). In the meantime however, some infections are currently going undiagnosed and consequently untreated (Fleming et al, 2013). A few studies have advocated for consideration

of development of risk factor assessment criteria for screening and indeed empirical approach to treatment of maternal syphilis (Kebede and Chamiso, 2000) and (Walker and Walker, 2004).

In a study conducted in Haiti, where a decision analytical model was used to compare alternative syphilis screening methods that included RPR test with results given a week later, rapid test with results given immediately and syndromic surveillance (presumptive diagnosis based on presence of genital ulcer disease). The cost effectiveness of rapid test with immediate test results was found to be better than RPR with results a week later which in turn was better than syndromic surveillance. However the incremental difference between RPR testing and syndromic surveillance was only 0.090 DALYS averted per patient screened. The cost of syndromic surveillance was $0.48 per patient screened compared to $1.43 for RPR testing. The study also showed that empirical treatment of all pregnant women in a rural setting was more cost-effective than screening for syphilis in settings were testing is not feasible (Schackman, 2007). However, empirical mass treatment carries disadvantages of unnecessary treatment, increased risk exposure of hypersensitivity reactions to benzathine penicillin and non-treatment of exposed sexual contacts.

1.4 Risk factors of maternal syphilis

Despite the lack of information in actual research on syphilis risk assessment criteria, several demographic, medical and behavioural risk factors associated with maternal syphilis infection have been identified (Zhou et al, 2007) that could be useful in identifying women that have an increased risk of infection. These include; a maternal history of previous infection with syphilis, history of abortion (Zhou et al, 2007), history of multiple sexual partners (Miranda et al, 2012), early maternal age at sexual debut (Todd et al, 2001), obstetric history of still birth delivery (Parker et al, 2012) (Shah et al, 2011), HIV co-infection (Uneke et al, 2006)

presence of genital ulcer disease (Urassa et al, 2001) and history of sexually transmitted infection in the partner (Nelson et al, 2004). However, there is no documented information on the formulation of an assessment criteria for maternal syphilis that incorporates these known risk factors that could be to clinically identify cases. This study formulated such an assessment criteria based on known risk factors and strength of their association to maternal syphilis. The study sought to ascertain the performance of this risk-based assessment criteria as a maternal syphilis screening tool in rural setting of Kaoma, Nkeyema and Luampa districts of Western Province.

2. Research focus

2.1 Statement of the problem

To control maternal syphilis and its associated adverse pregnancy outcomes, WHO advocates syphilis testing and treatment for at least 90% of women attending antenatal clinic. In Zambia, syphilis screening is an integral component of national ANC guidelines which state that all pregnant women must be tested at ANC first visit using RPR test (Zambian MOH, 2008). In addition the Ministry of Health recently resolved to include the use of more efficient and cost-effective Rapid Syphilis Tests (RST) in existing ANC syphilis screening guidelines following successful field evaluation tests in 2012 (Zambian MOH, 2011).

However, only 44% women accessing antenatal services in Zambia are screened for syphilis (MOH, 2008) which could be related to gaps in the health delivery systems. In Kaoma, which now covers Luampa and Nkeyema districts, of the 29,394 women who attended antenatal clinic between 2010 and 2012 only 47% were tested for syphilis (Kaoma HMIS, 2010-12). At this testing rate and with a district maternal syphilis prevalence of 4.6%, an estimated 241 maternal syphilis infections go undetected annually in this region of the country.

The national syphilis screening guidelines pre-supposes constant availability of biomedical tests. Despite being cost effective, biomedical tests are frequently unavailable in public ANC clinics and it is unclear whether the performance gaps can be addressed in the current national antenatal syphilis screening policy. Further, the guidelines do not describe any alternative method, such as a clinical assessment protocol, to identify high infection risk among pregnant women despite the fact that a number of studies have produced evidence on risk factors associated with maternal syphilis.

2.2 Study justification

There is lack of information on a risk-based assessment criteria that could be used for clinically predicting maternal syphilis despite widespread published data on factors

associated with syphilis infections in pregnancy. Some of studies have highlighted the need for research into the development of an assessment criteria to identify high risk cases for syphilis (Nelson et al, 2004) and (Kebede and Chamiso, 2000). However, no information exists on such a study being conducted.

This study will attempt to produce information on whether a collection of known risk factors of maternal syphilis infection can be used in an assessment criteria for identification of syphilis infections in pregnant women that could have gone undetected in the absence of point of care tests. This information may be useful to guide empirical treatment of women considered at high risk and influence ANC policy on alternative measures for controlling maternal and congenital syphilis in resource limited settings.

2.3 Research question

To what extent can a set of known risk factors be used to identify maternal syphilis infection in situations where biomedical screening tests are unavailable?

2.4 General Objective

To determine whether a proposed clinical assessment criteria based on known risk factors for maternal syphilis is useful in predicting maternal syphilis infections in women attending antenatal clinic in Kaoma, Luampa and Nkeyema districts.

2.5 Specific objectives

1. To measure how pre-selected risk factors of syphilis are related to maternal syphilis among women attending antenatal clinic in Kaoma, Luampa and Nkeyema districts.
2. To measure the sensitivity, specificity and predictive values of a proposed risk assessment criteria in relation to RPR testing.
3. To conduct a review of performance gaps in implementation of antenatal syphilis screening policy in Kaoma, Luampa and Nkeyema districts.

3.0 Methodology

3.1 Study setting

The study was conducted in antenatal care departments of eight (8) health facilities in what was originally Kaoma district but now covers Kaoma, Luampa and Nkeyema districts. This is the most populated region of Western Province with 122,092 inhabitants, majority of whom are women of child bearing age with annual expected pregnancies of 10,531 and average first antenatal attendances of 9,989. The region lies 400km west of Lusaka and has three first referral hospitals and 34 health centres.

The maternal services department in the study facilities offer routine antenatal, delivery and postnatal services. The current guidelines outline that a test for syphilis be conducted at least once during a woman's antenatal period. Those identified with syphilis are then treated with a single dose of benzathine penicillin.

3.2 Study population

The study population included all pregnant women attending antenatal clinic in the selected primary health care facilities of Kaoma, Luampa and Nkeyema districts during the study period. The study did not differentiate first antenatal attendees or those coming for revisits but antenatal records were reviewed for the latter to ascertain whether syphilis screening and treatment services were offered at an earlier visit. Health facility personnel providing ANC services in study sites and district managers were also included in the study.

3.3 Study design

This was a cross-sectional study. Primary data on exposure to pre-selected risk factors of maternal syphilis was obtained through cross-sectional survey of women attending antenatal services in the study area. Confirmation of syphilis infection was by onsite testing of blood from respondents using RPR test. Secondary data was also collected from antenatal records

on previous syphilis and HIV services provided. A desk review of policy guidelines for ANC syphilis screening as well as health systems in relation staff capacities and logistics management was also done.

3.3.1 Variables, indicators and scale of measurement

The table below shows the variables that were used in the study.

Table 1: Variables, indicators and scale of measurement

Type of Variable	Variable	Indicator	Source	Scale of measure
Dependent Variable	Maternal syphilis infection	Sero-positive RPR test	RPR result	Present or absent
Independent variables	Maternal HIV infection	Presence of maternal HIV infection	ANC attendees questionnaire	Present or absent
	Genital ulcer disease	Presence or history of GUD in past 1 year	ANC attendees questionnaire	Present or absent
	Previous Syphilis infection	History of previous syphilis infection in the respondent	ANC attendees questionnaire	Present or absent
	STI infection in partner	History of STI infection in partner	ANC attendees questionnaire	Present or absent
	Multiple sexual partners	History of more than one sexual partner in past 2 years	ANC attendees questionnaire	Present or absent
	Previous abortion	History of previous spontaneous abortion	ANC attendees questionnaire	Present or absent
	Previous still birth	History of previous still birth	ANC attendees questionnaire	Present or absent
	Neonatal deaths	History of previous deliveries that ended in neonatal death	ANC attendees questionnaire	Present or absent
	Early initiation of sexual practice	Maternal age 16 years of below at first sex	ANC attendees questionnaire	Present or absent

3.3.2 Inclusion criteria

The study included women attending antenatal care services in the eight (8) selected health facilities either as a first visit or a re-visit.

3.4 Sampling method

The primary sample was selected using one-stage cluster design. Eight (8) health facility clusters were selected by systematic random technique from a list of 34 health centres currently in the study region. The total number of facilities was then divided by eight (required number of facilities) yielding the value of 4.25. Therefore a sampling frequency of four (4) was then employed. A starting point was selected at random from numbers one (1) to five (4) with the health facilities arranged in alphabetical order (Appendix 7). The number three (3) was selected corresponding to Kaaba Health Centre on the list. From this starting point seven (7) other facilities were systematically selected using the calculated sampling frequency. The final list of facilities selected for inclusion as study sites included Kaaba, Kaoma HAHC, Katunda, Lui, Mayukwayukwa 1, Mutondo, Namilangi and Nyambi 1.

Respondents were then recruited by selecting all consenting pregnant women attending antenatal clinic in the sampled sites over a three month period starting from April 2015. The study also included 10 health facility staff from these sites as well as 3 district managers (pharmacist, maternal child health coordinator and laboratory staff) selected purposefully.

Sample size estimation

The estimation of sample size was calculated using the formula for a single sample proportion estimate for a cross-sectional survey shown below:

$$n = \frac{Z^2 p(1-p)(DEFF)}{d^2}$$

n = sample size

Z= 1.96, z-value at 95% confidence interval for a two-sided distribution

p = 0.04 proportion estimate of antenatal syphilis prevalence

DEFF = 2, estimated design effect

d = 0.02, desired absolute precision at confidence interval of ± 2%.

The calculation gave a sample estimate of 740.

3.5 Data collection, entry and analysis

Data was collected by four (4) methods; questionnaire, antenatal record reviews, blood screening tests, desk review of antenatal guidelines and district health management systems in relation to antenatal screening. We also conducted unstructured interviews with district managers and facility staff to collect data on health management systems.

1. Questionnaire

A structured interviewer-administered questionnaire was used for data collection. Health workers providing maternal health services in the study site were recruited as research assistants to administer a questionnaire to consenting respondents during routine antenatal, delivery and postnatal clinics. The usual health providers familiar to the respondents were used in normal antenatal clinic setting to gain the trust of respondents especially that some questions could be deemed as sensitive. The questionnaire was used to obtain information on respondent's past exposure to preselected risk factors of maternal syphilis.

2. Records review

Antenatal cards and registers were reviewed to obtain data on respondent's previous syphilis and HIV infection status. Health facility stock control cards and copies of commodity requisition and reporting forms were reviewed to collect information logistics management.

3. Blood screening

Syphilis infection was confirmed by an RPR sero-positive result from a respondent's whole blood sample. Blood screening was done after administration of the questionnaire to

minimise bias. The study provided test kits to facilities were there were unavailable. The test was conducted under the usual antenatal conditions using the IMMUTREP RPR, a non-treponemal flocculation syphilis test. Approximately 50µl plasma sample from each consenting respondent was mixed with one free-falling drop of test antigen on a test card. The mixing was aided by rotating the test cards for 8 minutes after which the results were read.

Plan for data processing and analysis

The data from the questionnaires was coded, checked and cleaned before entry into a Microsoft excel sheet and imported into Stata version 13 for analysis. Data on risk factor identification and laboratory results were assigned numbers either 1 or 2 depending on presence or absence of a risk factor or disease. These were then entered in Microsoft excel and imported into Stata version 13. Proportions were used to estimate prevalence of maternal syphilis. Since data variables of risk factors was dichotomous, univariate and multivariate analysis for binary outcomes was done to find the relationship to maternal syphilis with odds ratio and chi-square as measures of association. Multiple logistic regression was done to test for significance set at 95% confidence level with p value < 0.05.

Clinical disease according to the risk scoring criteria proposed by this study was defined as either the presence of two (2) major risk factors or one (1) major and two (2) minor risk factors or three (3) minor risk factors. This classification into major and minor risk factors was based on observed strength of association or frequency of linkage of these risk factors to maternal syphilis infections. The major risk factors selected were those with observed odds ratios of 5 and above or proportion of occurrence of above 10%. The minor risk factors were defined as those with observed odds ratio of less than 5 or proportion of occurrence of 10% or below. Using RPR as confirmatory test, the sensitivity, specificity and predictive values of the proposed criteria were calculated to measure its usefulness in identifying maternal infections. The accuracy of the assessment criteria was ascertained by calculating the area

under the receiver operating curve (ROC) which compared ability of a test to differentiate between those with disease and those without. A ROC of greater than 0.80 was deemed to have good accuracy, while 0.70 to 0.80 was fair and less than 0.70 was deemed to be poor.

We used content analysis method to summarize qualitative data from desk review and health personnel unstructured interviews. This was then reported by use of narratives which in some cases included direct key quotations.

Table 2: Risk scoring criteria for maternal syphilis infection

Major risk factors	**Minor risk factors**
History of previous syphilis in respondent	History or previous abortion
Presence of Genital Urinary Disease in respondent	History of still birth delivery
Multiple sexual partners in past 2 years	History of STI in partner
Maternal HIV infection	Obstetric history of neonatal death
	Sexual debut of respondent before 16years

3.6 Ethical considerations

Ethical clearance and permission for the study was sought from ERES Converge Ethics Committee, the Ministry of Community Development Mother and Child Health as well as Provincial Medical Office, Western Province.

Participation was voluntary and informed consent was sought consenting women attending antenatal clinic in the study sites. Confidentiality was preserved by avoiding use of personal identification information instead questionnaires were assigned numbers.

Syphilis and HIV tests were performed by the usual providers following the routine practices. All respondents who were identified as RPR positive were treated with benzathine penicillin as per existing guidelines. Those with HIV infection were enrolled in the antenatal HIV care programme following existing guidelines.

4.0 RESULTS

4.1 Demographic characteristics of participants

The majority of the 740 women attending antenatal clinic who participated in the study were aged between 20 and 30 years with a mean age of 26 ± 0.5 years. The results showed that the majority of the respondents were married, had more than one pregnancy and were unlikely to have gone beyond primary level of school education.

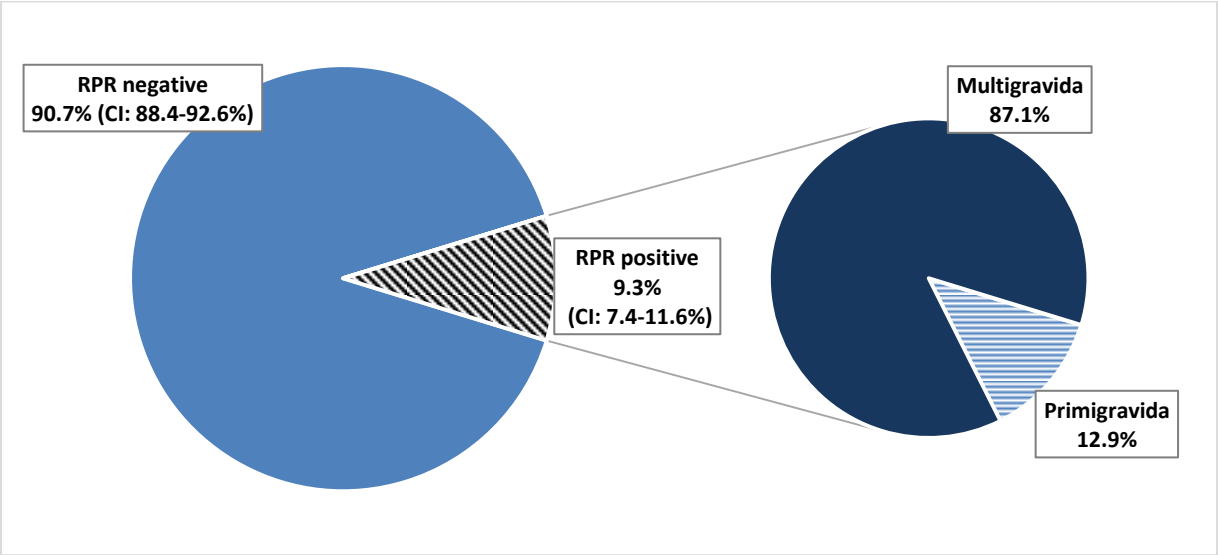
Table 3: Demographic characteristics of respondents

Characteristic	Frequency	Percentage (%)
Age		
< 20 years	170	23.0
20 – 30 years	360	48.6
21 – 40 years	192	26.0
>40 years	18	2.4
Marital status		
Single	251	33.9
Married	445	60.1
Other	44	6.0
Education Attained		
Never attended	55	7.4
Primary	497	67.2
Secondary	183	24.7
Tertiary	5	0.7
Gravidity		
Primigravidae	168	22.7
Multigravidae	572	77.3

4.2 Prevalence of syphilis among respondents

The sero-positivity of syphilis using Rapid Plasmin Reagin tests was observed to be 9.3% (95% CI: 7.4 -11.6%) among study participants. Of the women testing positive, 61 (87.1%) were multigravidas as opposed to 9 (12.9%) who were in their first pregnancy.

Graph 1: RPR test results among respondents and RPR positivity by gravidity



4.3 Correlates between risk factors and maternal syphilis infections among respondents

4.3.1 Univariate analysis

A univariate comparison of risk factors of maternal syphilis cases to RPR positivity showed that cases were more likely to be associated with a maternal history of abortion, still birth delivery and having lost a baby in the first month of birth (Table 4). The analysis also showed that respondents with syphilis were more likely to report a history of previous maternal infection with syphilis, sexually transmitted infection in the respondent's sexual partner, having multiple sexual partners in past (two) 2 years, presence of maternal genital ulcer disease and HIV co-infection. The associations of pre-selected risk factors to maternal syphilis were measured with odds ratios and significance was proven using chi-square values at 95% confidence level of P-values less than 0.05 (Table 4). However, the association between maternal syphilis infection and early sexual debut (before the age of 16 years) was found not to be statistically significant as the chi-square test for this association was found to have a P-value greater than 0.05.

Table 4: Univariate analysis: association between risk factors and maternal syphilis

Variable	RPR positive Number* (%)	RPR negative Number* (%)	OR (95% CI)	P value
Abortion history				
No	39 (66.1%)	478 (93.4%)	1.00	
Yes	20 (33.9%)	34 (6.6%)	7.21 (3.80-13.69)	<0.001
Still birth history				
No	44 (77.2%)	493 (96.3%)	1.00	
Yes	13 (22.8%)	19 (3.7%)	7.67 (3.55-16.56)	<0.001
Neonatal death history				
No	50 (86.2%)	495 (95.6%)	1.00	
Yes	8 (13.8%)	23 (4.4%)	3.44 (1.46-8.10)	0.003
Previous syphilis infection				
No	49 (71.0%)	641 (97.7%)	1.00	
Yes	20 (29.0%)	15 (2.3%)	17.44 (8.41-36.18)	<0.001
Genital ulcer disease				
No	52 (76.5%)	652 (97.9%)	1.00	
Yes	16 (23.5%)	14 (2.1%)	14.3 (6.62-30.97)	<0.001
Early sexual debut <16yrs				
No	36 (52.2%)	424 (63.2%)	1.00	
Yes	33 (47.8%)	247 (36.8%)	1.57 (0.96 -2.56)	0.072
Multiple sexual partners				
No	48 (69.6%)	573 (86.7%)	1.00	
Yes	21 (30.4%)	96 (14.4%)	2.6 (1.50-4.56)	<0.001
Partner syphilis infection				
No	37 (64.9%)	503 (94.2%)	1.00	
Yes	20 (35.1%)	31 (5.8%)	8.79 (4.57-16.90)	<0.001
HIV infection				
No	50 (72.5%)	648 (96.6%)	1.00	
Yes	19 (27.5%)	23 (3.4%)	10.7 (5.47-20.97)	<0.001

OR=Odds ratio, CI=Confidence Interval

*Not all totals sum to the recruited 740 due to missing values/non applicability of exposure factor

4.3.2 Multivariate analysis

We excluded early age at sexual debut from multivariate logistics analysis shown in table 5 as its association with maternal syphilis was found not to be significant during univariate analysis. After controlling for all variables we found that co-morbid conditions of HIV and genital ulcer disease and exposure histories of still birth delivery and previous infection with

syphilis were strongly associated with syphilis sero-positivity (OR>5). Other risk factors such as history of abortion, having more than one sexual partners and sexually transmitted infection in a sexual partner were also significantly associated with gestational syphilis infections (OR:3 to 5). At this stage we also found that a history of losing a neonate through death had was significantly associated to syphilis sero-positivity (OR 2.3, p value> 0.05). Therefore only seven (7) of the nine (9) preselected factors in the end were found to be significantly associated with maternal syphilis.

Table 5: Multivariate analysis: association of risk factors with maternal syphilis

Variable	RPR positive Number* (%)	RPR negative Number* (%)	OR (95% CI)	P value
Abortion history				
No	39 (66.1%)	478 (93.4%)	1.00	
Yes	20 (33.9%)	34 (6.6%)	4.5 (1.82 – 11.21)	0.001
Still birth history				
No	44 (77.2%)	493 (96.3%)	1.00	
Yes	13 (22.8%)	19 (3.7%)	6.4 (1.92 – 21.05)	0.002
Neonatal death history				
No	50 (86.2%)	495 (95.6%)	1.00	
Yes	8 (13.8%)	23 (4.4%)	2.3 (0.59 – 9.28)	0.228
Previous syphilis infection				
No	49 (71.0%)	641 (97.7%)	1.00	
Yes	20 (29.0%)	15 (2.3%)	6.1 (2.07 – 17.81)	0.001
Genital ulcer disease				
No	52 (76.5%)	652 (97.9%)	1.00	
Yes	16 (23.5%)	14 (2.1%)	6.4 (1.68 – 24.74)	0.007
Multiple sexual partners				
No	48 (69.6%)	573 (86.7%)	1.00	
Yes	21 (30.4%)	96 (14.4%)	4.0 (1.56 – 10.04)	0.004
Partner syphilis infection				
No	37 (64.9%)	503 (94.2%)	1.00	
Yes	20 (35.1%)	31 (5.8%)	3.3 (1.32 – 8.26)	0.011
HIV infection				
No	50 (72.5%)	648 (96.6%)	1.00	
Yes	19 (27.5%)	23 (3.4%)	8.4 (3.26 – 21.49)	0.001

OR=Odds ratio, CI=Confidence Interval
Non-exposure response to risk factors reference
*Not all totals sum to the recruited 740 due to missing values/non applicability of exposure factor

4.4 Sensitivity, specificity and predictive value of proposed risk assessment criteria

The proposed assessment criteria identified 59 (8%) of the respondents with presumptive clinical disease. Of these, 43 were true positive (TP) cases of syphilis. The criteria also identified 655 women as true negatives (TN). However, 26 (37.7%) women with disease were missed and 27.1% were incorrectly classified as diseased when they were syphilis sero-negative. The overall sensitivity of the assessment criteria was 62.3% with a positive predictive value (PPV) of 72.9% and its specificity was 97.6% with a negative predictive value (NPV) of 96.2%. The area under the receiver operating curve (ROC) to measure accuracy of the overall effect was 0.780 corresponding to a fair accuracy result.

The individual case definition categories showed lower sensitivities than their combined effect. Presence of two major risk factors was more sensitive at 33.3% sensitivity, followed by the category with one major and two minor factors and the least was the category with three minor factors. The areas under the ROC for the individual case categories were all lower than 0.7 showing their reduced accuracy.

Table 6: Sensitivity, specificity and predictive value of proposed risk assessment criteria

Screening criteria	Frequencies	Sensitivity	Specificity	PPV	NPV	ROC
All assessment categories combined	TP:43 FP:16 FN:26 TN:655	62.3%	97.6%	72.9%	96.2%	0.780
Two major risk factors	TP:23 FP:7 FN:46 TN:664	33.3%	98.9%	76.7%	93.5%	0.662
One major and two minor risk factors	TP:20 FP:6 FN:49 TN:665	29.0%	99.1%	76.9%	93.1%	0.641
Three minor risk factors	TP:12 FP:4 FN:57 TN:667	17.4%	99.4%	75.0%	92.1%	0.584
TP = True positives. FP = False positives. TN = True negatives. FN = False negatives PPV = Positive predictive value. NPV = Negative predictive value						

4.5 Performance gaps in antenatal syphilis screening

4.5.1 Reasons for not doing the syphilis test

Interview of 14 ANC providers and district maternal child health coordinator revealed that the main reason for missed opportunities for ANC syphilis testing was stock outs of syphilis test kits. Some of the reasons for stock outs included:

1. Under-supply of syphilis tests kits to ANC clinics from central commodity stores despite submission of correct orders based on consumption needs. "*We are never supplied RPR kits from Medical Stores Limited (MSL) according to what we ordered*" one of the ANC staff at Mulamba Health Centre explained.
2. Two facilities did not submit commodity orders based on consumption data.
3. Inadequate funds at district level to supplement national consignment through individual local procurement.
4. Difficulties in distribution of RPR kits to primary health facilities from hospitals as the latter are the main recipients as per laboratory logistics management and information system (LMIS). *"The RPR kits are supplied by MSL to the hospital and health centres order from the hospital. The RST however are supplied to district health offices and later distributed to health centres. This is different from HIV tests which are delivered directly to health centres by MSL"* the laboratory technologist explained the differences in commodity supply systems in use for the syphilis screening programme.

4.5.2 Gaps in the antenatal syphilis screening guidelines

1. The guidelines require first visit antenatal syphilis screening for pregnant women, however commodity supply in terms of biomedical tests are not quantified based on expected pregnancies for a health facility.
2. When biomedical tests are unavailable, no antenatal syphilis control services are provided in an ANC clinic. No attempt is made to clinically identify syphilis cases similar to what happens in syndromic management in an STI clinic. Nearly all ANC providers said that the guidelines do not provide this particular alternative and five providers were not aware of syndromic management of STI.
3. All ANC frontline personnel were oriented on simple technique of using RST however they were not fully aware of revision in syphilis guidelines promoting their use.

5.0 Discussion

This study has illustrated that most of the pre-selected socio-demographic, behavioural and medical risk factors were significantly associated with maternal syphilis infection. We found that respondents with syphilis were not only more likely to have co-morbid conditions like HIV and genital ulcer disease but also reported a history of multiple sexual partners, previous abortion, previous still birth delivery, previous syphilis infection and having a sexual partner with a sexually transmitted infection. This was consistent with what was observed from other studies around the world (quoted in background section) and confirmed the decision to use the risk factors in a syphilis clinical assessment protocol. The overall sensitivity of the protocol compared well to off-site field validation tests for point of care (POC) treponemal tests conducted in a syphilis clinic in Manaus, Brazil. In this study, off-site POC tests were reported to have sensitivities in the range of 45.8 to 66.7% (Benzaken et al, 2011). The sensitivity of this study's assessment criteria however, with its inherent limitations was inferior to the widely recommended on-site rapid syphilis screening tests such as treponemal-based immuno-chromatographic strips (ICS). The latter have been reported to have field sensitivities ranging from 85 to 95% (Bonawitz et al, 2015 and Terris-Prestholt et al, 2007).

The limitations of this study included possible sources of bias as the risk factors used in the clinical protocol were pre-selected from studies conducted in other places. It remains unclear whether there were any omitted factors relevant to the local study population that should have been included in the criteria. Further, evaluation of clinical disease was essentially based on self-reported exposure to risk factors. It is likely therefore that the results may be affected by the participants' ability and willingness to recall and disclose exposure to certain risk behaviours. These results however, can be generalized to the three districts of Kaoma, Luampa and Nkeyema as study sites within these districts were selected at random. It is also not unfathomable that the findings may apply in other districts Western Province due to

similarities in socio-economic and demographic characteristics of population groups in these areas.

Using an odds ratio of five (5) as a differentiation cut-off point between major and minor risk factors, a history of previous still-birth delivery was found to be one of the major risk factors and a history of multiple sexual partners was only a minor factor associated with maternal syphilis. This was in slight contrast to the proposed pre-study classification based on information from other studies (page 13). In other studies only a minor association of previous still birth delivery to maternal or congenital syphilis has been observed, OR 3.37, 95% CI 1.24 – 9.16 (Parker et al, 2012). In other cases this association has been statistically insignificant (Shah et al, 2011). We argue that the pronounced risk of still birth delivery observed in the study population may be due to carry-over of untreated syphilis infections from previous pregnancies as a consequence of missed opportunities for antenatal case detection. This argument is strengthened by a similarly high risk association of a previous history of syphilis infection to gestational sero-positivity. Unlike still-born births, a respondent's history of having more than one sexual partner in the past 2 years had a lower risk association with syphilis than what was observed in other studies (Miranda et al, 2012). This may point towards issues of unwillingness by some respondents to disclose information on the number of sexual partners.

A nationally representative investigation of maternal syphilis risk factors would be a vital requirement for development of any clinical protocol that may be relevant for inclusion in antenatal syphilis control guidelines. This would also serve to avoid including locally insignificant risk factors to the protocol such as the two observed in this study. Early maternal age at sexual debut did not seem to be an important factor for acquiring syphilis infection in the study population. Todd et al had argued that the significance of early sexual initiation to infection may be due to increased possibility of multiple sexual partners and longer duration

of exposure to infection (Todd et al, 2001). In the study however, we observed that respondents reporting history sexual debut before 16 years of age tended to be young most likely in their initial sexual experiences with equally young partners. This in our view would limit their exposure risk. The reason for the lack of significance of a reported neonatal death history to a mother's risk of developing maternal syphilis was unclear. It would have been natural to assume that women with such a history would carry the same risk as those reporting a still birth delivery. The observed finding would suggest that there could be other more important causes, than congenital syphilis, of neonatal deaths in this region.

Unexpectedly, the clinical protocol performed reasonably well in predicting maternal syphilis infections even though the proportion of clinically presumed infections (8%) was lower than the sero-positive cases (9.3%). We considered the possibility that the observed protocol's performance might be due to sample-size related over-estimation of sero-prevalence which differed considerably from routine data in the study area. However, the observed maternal syphilis sero-prevalence compares well to estimates from other studies in the country which generated information from antenatal clinics. In 2014, at the University Teaching Hospital in Lusaka, in a study to evaluate rapid Dual HIV and syphilis tests showed high syphilis prevalence of 9.5% among women attending antenatal clinic (Yassa et al, 2015). This was similar to what was observed by Makasa et al, when they found high sero-prevalence of 10.8% in rural sites of Western province using antenatal sentinel surveillance data (Makasa et al, 2012). It is unclear although reasonable to assume that the disease-prediction performance of the clinical protocol would be affected by prevalence level of the disease. Therefore a broader study needs to be performed to study results variability at different syphilis point prevalence levels.

The difficulty in predicting syphilis infections clinically with symptoms or risk factors is the reason WHO-guided national policies recommend antenatal testing for all pregnant women

using biomedical tests. However, despite having a policy in place, there are still challenges in ensuring that all ANC attendees access syphilis screening services. Some of these challenges arise from weaknesses in health systems such as ineffective laboratory commodity supply and reporting systems, partial roll-out of the more cost-effective and easier to use rapid syphilis screening tests and lack of universal dissemination of revised screening guidelines. The overriding challenge in affecting antenatal syphilis screening is the limitations in resources allocation to ensure availability of biomedical tests. The current level of commodity supply of biomedical syphilis test in the study area does not reflect political will to adhere to recommended policy of screening all women attending antenatal clinic. Maintaining political will during implementation in Zambia is still a challenge despite recommendations which were accepted by the Ministry of Health to introduce point-of-care RST tests in national syphilis control guidelines (Ansbro et al, 2015). This political will may diminish further as data show declining trends of syphilis prevalence (Makasa et al, 2012)

There seems to be limited available alternatives to this problem. Some researchers have therefore recommended development of a dual test that would incorporate the much more politically acceptable HIV antenatal test (Yassa et al, 2015) or epidemiological treatment for all pregnant women. This study's proposed clinical assessment protocol may be useful in identifying high risk infections for treatment. It could also carry an advantage over epidemiological treatment in that sexual partners of the clinically identified women could also access treatment. It remains to be seen whether such a risk based protocol could provide a guide for selective biomedical screening especially in resource limited settings.

6.0 Conclusion

This study was able to illustrate that a clinical assessment protocol that is based on known socio-demographic, behavioral and medical risk factors of maternal syphilis can be used to

identify women at high risk of infection. Despite its diagnosis limitations, the protocol would offer an alternative screening method which is lacking in the national syphilis control guidelines that can be used by frontline care providers.

Even though Biomedical syphilis tests remain the most cost-effective means of identifying antenatal syphilis infections, there are some challenges related to health delivery systems in Zambia that have affect regular commodity availability. However, the proposed clinical protocol could offer an acceptable means of either identifying some cases in absence of biomedical tests or prioritizing those to be screened especially in resource limited settings and should be considered for inclusion in antenatal syphilis guidelines.

7.0 Recommendations

1. On site biomedical rapid syphilis screening are the most effective means of identifying maternal syphilis and should be made widely available through adequate resource allocation by health policymakers.
2. The Ministry of Health needs to fully roll out implementation of the revised 2012 national syphilis control guidelines that introduced more cost-effective and simpler rapid syphilis screening tests in place of rapid plasmin reagin tests.
3. There is need to nationally develop a clinical assessment criteria based on risk factors of maternal syphilis for use in antenatal clinic for identifying maternal syphilis in the absence of biomedical tests and to guide those to be screened in resource limited settings.
4. More research needs to be conducted to find dual tests that would link syphilis screening to more politically prioritize antenatal HIV screening.
5. A larger study will need to be conducted to identify any locally relevant risk factors that may have been excluded from pre-selection of risk factors.

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8.0. Appendices

Appendix 1a: Information sheet

Title of study: Usefulness of a set of known risk factors in predicting maternal syphilis infections in Kaoma, Luampa and Nkeyema districts of Western Province, Zambia

To the participants,

This is to let you know that this study is being conducted by Jacob Sakala a student at the University of Zambia, Department of Community Medicine in the School of Medicine.

The purpose of the study is to find out whether it is possible to identify syphilis infection in a pregnant woman by using an assessment method that inquires on the presence or past history of known risk factors of syphilis.

You have been selected at random from among women accessing services at this clinic. Should you choose to participate in the study, you will be asked some questions concerning exposure to risk factors for syphilis by the antenatal care provider at the clinic. The process may involve collecting a blood sample to test for syphilis if you have not yet been routinely tested during this or your recent past pregnancy. The whole process will take between 10 to 15 minutes of your time.

They may not be any direct benefit to you but your responses will assist in providing information on how syphilis is being controlled. Should the result of the RPR test show that you are infected with syphilis, you will be given the appropriate treatment that would protect you and your baby. There are no anticipated risks in your participation in this study. There will not be any monetary gain to you should you choose to participate.

Be informed also that your participation in this study is purely voluntary and as such you are free to decline participation, or answering any question you deem sensitive and withdraw at any time. This action will not disadvantage in any way in accessing health services.

Please feel free to seek clarification when in doubt and also note that the information you will provide will be strictly confidential. The study information will be disseminated to the relevant authorities who will have no direct link to you since anonymity will strictly be observed.

PERSONS TO CONTACT FOR PROBLEMS

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2. The Chairperson, Eres Converge, Research Ethics Committee, Joseph Mwila Road, Rhodes Park Lusaka, Zambia. Tel 0955155633; Email eresconverge@yahoo.com

Appendix 1b: Pampili ya zibiso

Toho ya taba ye ba tisiswa: Butokwa bwa lisupo ze zibisa bu tata bwa butuku bwa manansa kumuima mwa likiliti za Kaoma, Luampa ni Nkeyema mwa Bulozi.

Kwa ba putehi,

Mwa zibiswa kuuli lipatisiso ze zieziwa kibo Jacob Sakala baituti kwa sikolo sesi pahami satuto mwa Zambia, mwa liluko la likalafo za macaba, mwa sikolo sesi talima za milyani.

Mutomo wa tuto ye uyemi fa ku batisisa haiba kwa konahala kuziba Kamba ku tongola butuku bwa manansa kumuima kaku itusisa muineelo wa mutu wa kale wo fumaneha mwa hala likozi ze tisa manansa.

Mu ketilwe mwa hala basali ko kusina kutalima kwa meto ku baba hamuhela lituso kwa kapatela nyana kaluna. Haiba mui lakaleza kuba ni kabelo mwa patisiso ye mu ka kupiwa ku halaba lipuzo ze amana butata bo butiswa ki manansa mi mu ka buziwa kimu beleki ya bona zaba Sali kwa kapatela nyana. Mu sebezi wo uka ama ku tatuba butuku bwa manansa ka ku miinga mali. Mu sebezi wo ukanga nako ye eza mizuzu ye lishumi ni mizuzu ye lishumi ye keta lizoho.

Ha muna ku fumana tifo ni yekana kono li Kalabo za mina lika lika kutusa kufumana zibo ya mo manansa akona kulwaniswa mwasicaba. Haiba tatuho ya mali ebonisa kuli kele mufumaneha ni manansa, mu kafumana kalafo ye ka sileleza mina ni mbututu wa mina. Hakuna kozi ye kamitela kaku ba ni kabelo mwa patisiso ye.

Mu zibiswa hape kuli kabelo ya mina mwa patisiso mo ki buitomboli kacwalo muluku luhile ku hana kappa kusa alaba zengwi ze mui kutwa kuli za swabisa kappa kui tulela kana ye mulata kaufela. Nto ye haina kumi paleliswa kufumana lituso ka mukwa ufi kamba ufi kwa ka patella nyana ka.

Mu luku luhile ku buza fo musa utwisisi ka ufela mi lumi sepias kuli li ka labo za mina ikaba li kunutu. Li taba zezi ka zwa mwa patisiso ye lika iswa ku ba bahulu ba mu sebezi ba ba swa nela baba sa mizibi ni haiyani mi habana ku mi buza ni kamuta.

<u>BATU BA KU ZIBISA AMU FUMANA BUTATA BAKENISA PATISISO</u>

1. Jacob Sakala. University of Zambia, School of Medicine, Department of Community Medicine, P.O. Box 50110, Lusaka, Zambia. Cell: 0977174691

2. The Chairperson, Eres Converge, Research Ethics Committee, Joseph Mwila Road, Rhodes Park Lusaka, Zambia. Tel 0955155633; Email eresconverge@yahoo.com

Appendix 2: Informed consent form

The purpose of the study has adequately been explained to me and I understand the aim, benefits, risks and confidentiality of the study. I further understand that; if I agree to take part in this study, I can withdraw at any time without having to give an explanation and taking part in this study is purely voluntary.

I----------(Names) consent to participate in this study

Signed: ---------- date :----------
(Participant) Participants signature or thumb print

Signed; ----------date :----------
(Witness)

Name of the interviewer: ----------

Signed: ---------- date; ----------
(Interviewer)-

PERSONS TO CONTACT FOR PROBLEMS

1. Jacob Sakala. University of Zambia, School of Medicine, Department of Community Medicine, P.O. Box 50110, Lusaka, Zambia. Cell: 0977174691

2. The Chairperson, Eres Converge, Research Ethics Committee, Joseph Mwila Road, Rhodes Park Lusaka, Zambia. Tel 0955155633; Email eresconverge@yahoo.com

Appendix 2b: Pampili ya kulumela

Ni tolokezwi mulelo wa patisiso ye mi ni utwisize milelo, botokwa, butala ni li kunutu ze inzi mwa patisiso ye. Mi hape ni utwisize kuli hani lumela kuba ni kabelo mwa patisiso ye, na kona kui tulela ka nako ifi kamba ifi kusina kufa libaka hape ni zibile kuli kuba ni kabelo mwa patisiso ki kui tombola.

Na ……..... (Ma bizo) ni itombozi kuba ni kabelo kwa patisiso

Ku nyatela: …… Li zazi:……...
(Ba putehi)

Ku nyatela: …… Lizazi:…….
(Mu paki)

Li bizo ya mu buzi:……...

Ku nyatela:…….Li zazi……. (Mu buzi)

<u>BATU BA KU ZIBISO AMU FUMANA BUTATA BAKENISA PATISISO</u>

3. Jacob Sakala. University of Zambia, School of Medicine, Department of Community Medicine, P.O. Box 50110, Lusaka, Zambia. Cell: 0977174691

4. The Chairperson, Eres Converge, Research Ethics Committee, Joseph Mwila Road, Rhodes Park Lusaka, Zambia. Tel 0955155633; Email eresconverge@yahoo.com

Appendix 3:

QUESTIONNAIRE

Section A: Demographic data

Name of Health facility: _____ Date of interview___/___/2015

Identification number of respondent: | | | | | |

Name of interviewer: _____

Instructions to Interviewer:

1. Kindly introduce yourself to would be respondent and explain purpose of interview
2. Obtain consent from to proceed with interview and explain that information will be strictly confidential
3. Fill in response on space provide/Cycle the number for appropriate response in the coding category column
4. Follow normal procedures for RPR and HIV tests as per established antenatal care routine
5. Treat all patients found to be RPR as per established antenatal routine

No.	Questions & Filters	Coding categories	Skip
01	How old were you on your last birthday?	_____years	
02	What is your marital status?	Never Married.....1 Married.....2 Other?.....3	
03	What is the highest education level you have attended?	Never attended.....1 Primary.....2 Secondary.....3 Tertiary.....4	
04	Is this your first pregnancy?	Yes.....1 No.....2	→ 08
	SECTION B: Factors associated with maternal syphilis		
05	Have you ever had previous abortions/miscarriages? (loss of pregnancy before 28weeks / 7months)	Yes.....1 No.....2	
06	Did you have any pregnancies that have ended in a still birth? (delivery of dead baby from 28 weeks onwards)	Yes.....1 No.....2	
07	Have you ever given birth to a baby who died soon after delivery before the first month of birth?	Yes.....1 No.....2	
08	Have you had any previous antenatal visits in the current pregnancy? (For women who have just delivered/postnatal mothers; ask about any antenatal visits in last pregnancy)	Yes.....1 No.....2	→ 11
09	Where you tested for syphilis during current pregnancy? (In last pregnancy for women who have just delivered/ postnatal mothers)	Yes.....1 No.....2	→ 11
10	If yes to question 9, what was the result of the syphilis test?	Syphilis(+).....1 Syphilis (-).....2	

		Not sure……3	
11	Have you ever being diagnosed with syphilis in the past before this pregnancy? (before the last pregnancy for women who have just delivered/ postnatal mothers)	Yes……1 No……2 Not sure……3	
12	Do you have any genital ulcer or had in the past one year?	Yes……1 No……2 Not sure……3	
13	Have you ever been tested for HIV?	Yes……1 No……2	
14	What was the result of HIV test?	HIV positive……1 Tested HIV (-)……2 Not sure……3	
15	How old were you when you had your first sexual encounter?	Less than 16 yrs……1 16 yrs and above……2	
16	How many sexual partners have you had in past 2 years?	More than one……1 One……2	
17	Has your sexual partner/s suffered from a sexually transmitted infection before? (Ask about genital ulcer, genital rash, urethral discharge, HIV infection)	Yes……1 No……2 Not sure……3	
	Section C: Review of Antenatal Record		
18	Verify syphilis test result on antenatal record (Review client's antenatal record)	Test not done……1 RPR positive……2 RPR negative……3	
19	Verify HIV test result on antenatal record (Review client's antenatal record)	Test not done……1 RPR positive……2 RPR negative……3	
	Section D: Laboratory investigations		
20	Perform RPR test as per routine antenatal guidelines and show result (for Antenatal clients not yet test for RPR in current pregnancy and postnatal mothers not tested in last pregnancy)	RPR positive……1 RPR negative……2	
21	Refer patient for HIV counselling and testing as per routine antenatal guidelines and show result	Test not done……1 HIV positive……2 HIV negative……3	
	Section E: Health Workers interview guide/record review		
22	Are the any challenges you are facing and a provider/facility in provision of antenatal syphilis tests?		
23	Explain some of these challenges		
24	Review commodity requisition and report systems at district and facility level		

Appendix 4:

PAMPILI YA LIPUZO

Section A: Demographic data

Li bizo ya ka patela nyana:_____ Li zazi la li puzo___/___/2015

Nombolo ya pampili: | | | | | |

Li bizo ya mubuzi :_____

Instructions to Interviewer:

6. Kindly introduce yourself to would be respondent and explain purpose of interview
7. Obtain consent from to proceed with interview and explain that information will be strictly confidential
8. Fill in response on space provide/Cycle the number for appropriate response in the coding category column
9. Follow normal procedures for RPR and HIV tests as per established antenatal care routine
10. Treat all patients found to be RPR as per established antenatal routine

No.	Questions & Filters	Coding category	Skip
01	Ne muna nili limo ze kai fa mu kiti ofitile wa mina wa kupepwa?	_____years	
02	Maemo amina kiafi ku amana ni kalulo za manyalo?	Likwasha……1 Ni nyezwi……2 Zemu?……3	
03	Kwa neku latuto ki sitopa mani sesi pahami kaku fitisisa se mukeni?	Nalikuba anikene..1 Sitopa sa 1-7……2 Sitopa sa 8 -12 …..3 Sikolo sesipahami.4	
04	Kana mu lwalo wo kouna wapili?	Eni……1 Batili……2	→ 08
	SECTION B: Factors associated with maternal syphilis		
05	Kana ne mukile mwa sinyehelwa ki mu lwalo ye sikafita likweli ze 7?	Eni……1 Batili……2	
06	Kana ne mu kile mwa pepa kapa ku puluha mbututu ye shwile mulwalo aseni ufitele fa likweli ze 7 kuisa kwa pata?	Eni……1 Batili……2	
07	Ne mukile kushwela ki mbututu hasa mulaho wa kupepwa isi ka kwa nisa kale kweli ya ku pepwa?	Eni……1 Batili……2	
08	Fa mu lwalo wo ne mukile mwa ya teni kwa sipimo mwa likweli za kwa mulaho? (Kana ne muyanga kwa sipimo fa mba ye fitile ona ye kappa ya ma felelezo?)	Eni……1 Batili……2	→11
09	Ne mu tatubilwe butuku bwa manansa fa mulwalo wo? (Ne mu tatubilwe butuku mwa manansa fa mba ya mwana yo musika puhuha kale?)	Eni……1 Batili……2	→11
10	Li nepo neli zwile cwani ya tatuho ye ya manansa?	Bafuma ni butuku.1	

		Nekusina butuku.2 Ani zibi.....3	
11	Mukile mwa kula fateni butuku bwa manansa musika itwala kale mba ye? (Mukile mwa kula fateni butuku bwa manansa mu sika itwala kale mba ye mu puluhile / ya mwana yo?)	Eni……1 Batili.....2 Ani zibi……3	
12	Kana munani litombo kwa busali kapa mwa mazazi a silimo sesi fitile?	Eni……1 Batili.....2 Ani zibi……3	
13	Kana mukile mwa tatubiwa fa teni ko kwani ya HIV?	Eni……1 Batili.....2	
14	Li nepo neli zwile cwani za tatuho ye ya HIV?	Ba fumani kokwani.1 Ne kusina kokwani..2 Ani zibi.....3	
15	Ne muna ni lilimo zekai amu bani somano ya pili mwa bu pilo bwa mina?	Ani sikafita 16 yrs....1 Fa 16yrs kuisa kwa pata ……2	
16	Mwa lilimo ze peli ze zi felile mukile mwa ba kappa ku kopana kwa miseme nibaana ba bakayi?	Kufita alimumwi……1 Bali mbamu……2	
17	Kana ba kumina kappa baana be mu kopana kwa miseme ba kile ba kula fateni butuku bwa sihule? (Lu buza kaza litombo kwa buuna, ku tuluka kwa buuna, ku zwa bu lalu, niza ku yambula kokwani ya HIV)	Eni……1 Batili.....2 Ani zibi……3	
	Section C: Review of Antenatal Record		
18	Verify syphilis test result on antenatal record (Review client's antenatal record)	Test not done……1 RPR positive……..2 RPR negative…….3	
19	Verify HIV test result on antenatal record (Review client's antenatal record)	Test not done……1 RPR positive……..2 RPR negative…….3	
	Section D: Laboratory investigations		
20	Perform RPR test as per routine antenatal guidelines and show result	RPR positive……..1 RPR negative……2	
21	Refer patient for HIV counselling and testing as per routine antenatal guidelines and show result	Test not done…….1 HIV positive……..2 HIV negative……3	
	Section E: Health Workers interview guide/record review		
22	Are the any challenges you are facing and a provider/facility in provision of antenatal syphilis tests?		
23	Explain some of these challenges		
24	Review commodity requisition and report systems at district and facility level		

Appendix 5: Budget

Activity	**Quantity**	**Unit cost (ZMK)**	**Total (ZMK)**
RPR Test kits	12*100 strips	140	1,680
Stationary			
- A4 ream of paper	10	35	350
- Pens	10	0.5	5
- Pencils	10	0.5	5
- Flash discs	2	60	120
- Staples	1 box	20	20
Proposal printing and binding	5	70	350
Ethics Committee fees	1	1000	1000
Pre-testing questionnaire			
- Printing questionnaire	30	3	90
- Researcher	2	50	100
Training research assistants			
- Research assistants lunch allowance	7	50	350
- Transport refunds	7	50	350
- Refreshments	10	10	100
Data collection			
- Research assistant allowance	7*24 days	50	8400
- Supervisor allowance	12	295	3540
- Transport	80*12	9.92	952.32
Printing and binding final report	5	200	1,000
Total			**18,412.32**
Contingency (10%)			**1841.232**
GRAND TOTAL			**20,253.55**

Appendix 6: Work Plan

Activity	**March 2015**	**April 2015**	**May 2015**	**June 2015**	**July 2015**
Finalizing proposal					
Permission to conduct research					
Training of research assistants					
Data collection					
Data analysis					
Report Writing					
Submission of report					
Dissemination of information					

Appendix 7: List of Health Centres in Kaoma, Luampa and Nkeyema districts

S/N	Health Facility	Population	Women of child bearing age
1	Afumba	2040	449
2	Chitwa	7032	1547
3	Kaaba	2962	652
4	Kabilamwandi	4364	960
5	Kahare	12219	2688
6	Kandende	5346	1176
7	Kaoma HACH	14614	3215
8	Kaoma urban	12814	2819
9	Kasabi	4598	1012
10	Kasimba	6657	1465
11	Katunda	4218	928
12	Longe	7473	1644
13	Luampa HACH	4884	1074
14	Luena Hosp	5696	1253
15	Lui	6225	1370
16	Lunyati	5664	1246
17	Mangango HACH	11565	2544
18	Mangango ZNS	5931	1305
19	Mayukwayukwa1	7930	1745
20	Mayukwayukwa2	6808	1498
21	Mbanyutu	4707	1036
22	Mulwa	3348	737
23	Mutondo	2628	578
24	Mwanambuyu	6310	1388
25	Nakayembe	2953	650
26	Namando	1741	383
27	Namilangi	8456	1860
28	Njonjolo	4570	1005
29	Nkenga	4184	920
30	Nkeyema	12786	2813
31	Nyambi1	1612	355
32	Nyambi2	1693	372
33	Shibanga	4330	953
34	Winda	4714	1037