Prevalence and Associated Factors for Syphilis in Pregnant Women Attending Selected Antenatal Clinics in Juba, Southern Sudan.

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DECLARATION

This thesis is my original work and has not been presented for a degree in any other university

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DEDICATION

I dedicate this work to my dear husband Kenneth Ochieng, my son Dave, my dear parents Dr Emmanuel and Anisia; my sister Sarah, my brothers Samson, Nelson, Carey and Wilson for their love, support and encouragement.

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ABBREVIATIONS

ANC	Antenatal Clinic
CDC	Centres for Disease Control and Prevention
CPA	Comprehensive Peace Agreement
EDTA	Ethylene Diamine Tetra Acetic acid
GoSS	Government of Southern Sudan
HIV	Human Immunodeficiency Virus
JTH	Juba Teaching Hospital
LBW	Low Birth Weight
MCH	Maternal and Child Health
M (NHIC)	Malakia (National Health Insurance Centre)
MPHCC	Munuki Primary Health Care Centre
MTCT	Mother To Child Transmission
NGOs	Non Governmental Organizations
PCR	Polymerase Chain Reaction
PMTCT	Prevention of Mother To Child Transmission
PVP	Predictive Value Positive

PVN	Predictive Value Negative
RPR	Rapid Plasma Reagin
SSHHS	Southern Sudan House Hold Survey
STD	Sexually Transmitted Disease
TPHA	*Treponema pallidum* Hemoagglutination Assay
VDRL	Venereal Disease Research Laboratory
WDR	World Development Report
WHO	World Health Organization

ABSTRACT

Syphilis is a chronic infectious disease caused by the spirochaete *Treponema pallidum*. It has significant long-term morbidity for mothers and can cause serious complications in pregnancy, which may result in spontaneous abortion, stillbirth and other negative outcomes including congenital syphilis. There is currently, no data on the burden of syphilis in pregnant women in Juba Southern Sudan. A cross-sectional study was carried out in three antenatal clinics in Juba information collected was on demographics (level of education, marital status, occupation history of abortion and others). About 231 consenting pregnant women were recruited using a standard questionnaire and 5ml of blood was collected. Samples were tested for syphilis using both RPR and TPHA tests. Out of the 231 samples 51 (22.1%) tested positive for active syphilis. Significant risk factors identified were being a housewife, history of abortion and history of partner travel, while attending antenatal clinic for previous pregnancy was associated with having less syphilis factor. Factors which were not significantly associated with syphilis were polygamous marriages (p= 0.355), given birth before (p= 0.386) and duration of stay with partner (p= 0.161). The prevalence of syphilis in pregnant women in Juba Southern Sudan is still high compared to other studies. Results show that screening and treating mothers for syphilis in their first visit to ANC can reduce the prevalence and outcomes of syphilis in pregnancy. Syphilis routine testing in ANC and pregnant women should be encouraged to attend ANCs.

CHAPTER ONE

1. INTRODUCTION

1.1 Background

Syphilis is a chronic infectious disease caused by the spirochaete *Treponema pallidum* subspecies *pallidum*. The genus *Treponema* belongs to the order *Spirochaetales*, consisting of spiral-shaped pathogenic bacteria (Bhutta *et al.*, 2005). Syphilis is a complex systemic disease with protean manifestations and virtually any organ in the body can be involved (Walker, 2001). The disease normally undergoes several clinical stages which manifests several years post-infection. Syphilis is characterized by painless indurated chancre in the primary stage and progresses to skin rash and systemic infection in secondary stage. If the disease is not treated it enters latent stage. Meanwhile, tertiary syphilis manifests many years later after the infection, with the brain and the cardiovascular systems being the main organs infected (Knight *et al.*, 2007).

Syphilis has significant long-term morbidity especially for pregnant women and can cause serious complications in pregnancy, which may result in the following: spontaneous abortion, stillbirth, non immune hydrops, intrauterine growth restriction, malformations and perinatal death. Congenital syphilis results in serious sequelae in live born infected children (Genc and Ledger, 2000)

T. pallidum elicits two antibodies that have become important in diagnosis of syphilis. The first is called reagin or nontreponemal antibody. It is a nonspecific antibody that appears several weeks after infection; its recognition is the basis of screening tests for syphilis RPR, reagin (Saloojee *et al*., 2004).

The presence of syphilis has been shown to increase the chance of acquiring the HIV infection by 2 to 5 times (Chesson and Pinkerton, 2000). While there is no vaccine for syphilis, treatment in its early stages (through an intramuscular injection of penicillin) will cure the individual, and repeated treatments will eliminate the infection in its late stages. Following treatment and recovery from the infection, individuals may develop

transitory immunity to re-infection before again becoming susceptible. This progression from susceptible infected to recovered (and immune) to susceptible is the general form of the classic model (David and David, 2007).

1.2 Problem Statement

Maternal syphilis is estimated to contribute to 29% of perinatal deaths, 11% of neonatal deaths, and 26% of stillbirths around the world (Finelli *et al.*, 1998). The health infrastructure of South Sudan is poor and fragmented. Rates of access to antenatal and obstetrical care are believed to be among the lowest in the world (SSHHS, 2006). After the signing of the Comprehensive Peace Agreement (CPA), there is massive restructuring and creation of new systems in Southern Sudan with the help of Non Governmental Organizations and foreign partners; one of the foreign partners is the Centres for Disease Control and Prevention (CDC Atlanta) who conducted a Sentinel surveillance for HIV and Syphilis in antenatal clinics in 9 sites within 5 states of southern Sudan. The surveillance was conducted between January and February 2007 and Juba was not included as one of the sites. As a result of this study the prevalence of syphilis was determined to range from 12% to 21% in pregnant women in different sites. The report findings were concluded not to be representative for Southern Sudan. As the burden is unknown in Juba being one of the major towns experiencing influx of returnees from other parts of the country and refugees from the neighbouring countries (Surveillance report, 2007).

1.3 Justification

The civil war that lasted for over two decades in Southern Sudan ended with devastating outcome of massive displacement, depletion of assets, and no or limited accessible established social services. Development in a country which was already one of the most underdeveloped in the world was arrested. The health system in South Sudan is relatively new with the routine ANC screening programmes yet to be established.

Because primary syphilis may be asymptomatic; the disease may pass unnoticed. Moreover, there is a risk of disease transmission from mother to her unborn child. Screening and treating mothers for syphilis during pregnancy can prevent adverse pregnancy outcomes associated with maternal infection. There is currently, no data on the burden and associated factors of syphilis in pregnant women in Juba. Therefore, this study sought to determine the burden of Syphilis among the antenatal care attendees (pregnant women) in Juba Southern Sudan and to bridge the gap in knowledge.

1.4 Research Questions

- What is the prevalence and associated factors of syphilis among pregnant women attending selected antenatal clinics in Juba Southern Sudan?
- What is the sensitivity, specificity, predictive value positive and predictive value negative of RPR test?

1.5 Hypotheses

1.5.1 Null Hypothesis

- There is no syphilis infection in pregnant women attending selected antenatal clinics in Juba southern Sudan.
- There are no modifiable factors associated with syphilis in pregnant women attending selected Ante-natal clinics in Juba southern Sudan.

1.5.2 Alternate Hypothesis

- There is syphilis infection in pregnant women attending selected antenatal clinics in Juba, Southern Sudan.
- There are modifiable factors associated with syphilis in pregnant women attending selected ante-natal clinics in Juba southern Sudan.

1.6 Objectives

1.6.1 General objective

To determine the prevalence of diagnosed syphilis; associated factors and performance of RPR test among pregnant women attending selected ante-natal clinics in Juba, Southern Sudan 2009

1.6.2 Specific objectives

- To determine the prevalence of syphilis in pregnant women attending selected ante-natal clinics in Juba, Southern Sudan
- To determine factors associated with syphilis in pregnant women attending selected antenatal clinics in Juba, Southern Sudan
- To evaluate the sensitivity, specificity, Predictive Value Positive and Predictive Value Negative of the Rapid RPR test.

CHAPTER TWO

2. LITERATURE REVIEW

2.1 Etiology of Syphilis

The causative agent of syphilis is *Treponema pallidum.* The organism *T. pallidum* is a member of the order *Spirochaetales*, family *Spirochaetaceae*, and genus *Treponema*, which includes four human pathogens and at least six human nonpathogens (Singh and Barbara, 1999). The pathogenic species are *T. pallidum* subsp. *pallidum* which causes venereal syphilis, *T. pallidum* subsp. *endemicum*, which causes endemic syphilis (bejel), *T. pallidum* subsp. *pertenue* which causes yaws, and *T. carateum*, which is the etiologic agent of pinta. Initial studies indicated that these four agents were morphologically indistinguishable (Noordhoek, 1989). *T. pallidum* is a spirochete ranging from 0.10 to 0.18 µm in diameter and from 6 to 20 µm in length which makes the organism invisible by the light microscope (Singh and Barbara, 1999).

2.2 Incidence and Prevalence of Syphilis

Over the past few decades, the prevalence and incidence of syphilis in the developed world have fallen steeply due to improved access to health care, effective control programmes, and efficacious treatment (Todd *et al.*, 2001).

Syphilis has re-emerged as a global public health issue and World Health Organization (WHO) estimated that approximately 12 million new syphilis infections occur each year worldwide, many of which go untreated especially in less developed countries (WHO, 2004). Prior to the penicillin era in United States of America, the incidence of primary and secondary syphilis was reported at 66.4 cases per 100,000 persons. Rates declined to 3.9 cases per 100,000 persons by 1956 due to the availability of penicillin, changes in sexual behaviour, and public health measures (Singh and Barbara, 1999). In England during the 1990s until 1998, the number of cases of infectious syphilis diagnosed remained stable among both sexes, but then more than doubled between 1998 and 2000 (from 172 to 372) in men and rose by 53% (102 to 156) in women. In 2000, 48% of syphilis infections in men were homo-sexually acquired (Doherty *et al.,* 2002).

In many developing countries, however, syphilis remains a major public health problem, In Africa, Asia and Latin America (developing countries) syphilis is still endemic, and the incidence is high. In 1999 WHO estimated that there were 4 million cases of syphilis among adults in sub-Saharan Africa, 3 million in Latin America and Caribbean, and 4 million in south and south-east Asia (Bidia *et al.,* 2004).

Generally the prevalence of syphilis all around sub-Saharan Africa ranges between 2.5% in Burkina Faso, 8.4% in South Africa, and 17.4% in Cameroon (Gerbase, *et al.,* 1998).

In Sudan, studies have handled syphilis as one of the sexual transmitted diseases. Kafi *et al.*, (2000) reported a prevalence of syphilis among women to be 0.9% in sub-urban community in northern Sudan. The population of Southern Sudan is 8,300,000 (census report SS, 2009). There is a continuing influx of returnees from neighboring countries and the diaspora since the signing of the comprehensive peace agreement (CPA) in early 2005. Southern Sudan household survey conducted in 2006 found that maternal and child mortality rates are among the world's highest (SSHHS, 2006). The quality of maternal and child Health (MCH) care is also very low.

2.3 Syphilis Prevalence in Pregnancy

Globally, about 1 million pregnancies are affected each year by syphilis due to maternal infection, and because of these about half of the pregnancies result in stillbirth or neonatal death (Walker and Walker, 2002). In many developing countries syphilis remains a major cause of adverse pregnancy outcome (Schmid, 2004). There are several pregnancy outcomes associated to maternal syphilis, which are spontaneous abortion, stillbirth, low birth weight (LBW), premature delivery and congenital syphilis (Radolf, *et al.*, 1998). Antenatal syphilis screening is inexpensive and effective towards the reduction of syphilis impact on pregnancy, and yet syphilis continues to be a threat to pregnant women in low resource settings (Walker, *et al.*, 2002). A study Mozambique has shown that about a third of babies born to mothers with early syphilis are born without infection, a third are born with congenital

syphilis, and a third of pregnancies will result in miscarriage or stillbirth (Gloyd *et al.,* 2007). Prevalence of antenatal syphilis in Africa ranges from 3% to 17% (Temmerman, *et al.,* 2000). In resource-poor countries syphilis is responsible for up to a fifth of neonatal deaths (Watson-Jones, *et al.,* 2002).

The 1993 World Development Report (WDR) cites antenatal syphilis screening as one of the most cost effective ways to improve children's health (World Development Report, 1993). Despite this, only an estimated 38% of women attending for antenatal care in Africa receive syphilis screening (Gloyd, *et al.*, 2001). Congenital syphilis, in particular, is estimated to inflict over 1.5 million pregnant women in Sub-Saharan Africa with approximately 60% of the acute cases leading to foetal death. This amounts to nearly 500,000 infant deaths from syphilis in sub-Saharan Africa alone, rivalling those due to HIV (Schmid, 2004). A study in Tanzania found that maternal syphilis was responsible for some 50% of all stillbirths (Watson-Jones, *et al.*, 2002).

Different studies on maternal syphilis in African countries showed high rates of seropositivity for example, 4% in Kenya and Malawi, (Bique, *et al.*, 2000) 6 to 15% in South Africa, 8% in Zambia, 14% in Zimbabwe, and 5–15% in Mozambique (Bique, *et al.*, 2000). Meanwhile in 1997, studies amongst pregnant women in the North and North Eastern regions of Africa showed syphilis infection rates of 3.1% in Djibouti, 3% in Morocco and 2.4% in Sudan (WHO, 1999). Antenatal syphilis

screening is a written national policy in nearly all African Ministries of Health; however, screening is performed sporadically at best. A 1997 survey completed by 22 sub-Saharan Africa countries produced estimates that fewer than 38% of women already attending antenatal care were likely to have been screened. Failure to screen for syphilis in pregnancy was estimated to have resulted in at least 1 million missed opportunities annually to have identified and treated pregnant women with active syphilis (Gloyd, *et al.*, 2007). While prevalence of maternal syphilis reported in some sites of southern Sudan was to range from 12% to 21% in 2007 (Surveillance report, 2007).

2.4 Transmission of Syphilis

Venereal syphilis is a worldwide disease of only humans; there is no animal reservoir **(**LaFond and Lukehart, 2006). Syphilis is acquired by direct contact, usually sexual, with active primary or secondary lesions. Studies have shown that 16 to 30% of individuals who have had sexual contact with a syphilis-infected person in the preceding 30 days become infected (Peeling *et al.*, 2004). Actual transmission rates may be much higher. Infection also occurs when organisms cross the placenta to infect the foetus in a pregnant woman causing congenital syphilis and this happens particularly during the first two years of infection **(**LaFond and Lukehart, 2006). *T. pallidum* may also occasionally be transmitted as a blood-borne infection (Peeling and Hook, 2006).

2.5 Clinical Manifestation for Syphilis

Syphilis is a chronic illness which, without treatment, may proceed through the primary, secondary, and tertiary stages over a period of many years (Peeling and Hook, 2006). The primary stage is typically marked by the appearance of a single painless lesion (the hard chancre) at the site of inoculation this appears on average about 21 days post-infection. In a few cases, there may be multiple primary lesions. Primary lesions most often occur on the genitalia and may be accompanied by regional lymphadenopathy. Even without treatment, primary lesions typically resolve spontaneously due to the painless chancre and occurrence at invisible sites (Peeling and Hook, 2006). While the lesions of primary syphilis are localized to sites of initial inoculation, the pathogen is thought to invade intercellular junctions of the endothelium, resulting in haematogenous dissemination of the organism during the primary stage, seeding the central nervous system and remainder of the body. Resolution of primary lesions is followed on average (6–8 weeks later) by the secondary stage, at which time manifestations of dissemination may occur at virtually any location or organ but most commonly at other cutaneous and mucosal locations (French, 2007). Secondary syphilis may lead to a broad range of syndromes such as hepatitis, iritis, nephritis, and neurological problems (early meningovascular syphilis) with headache and involvement of the cranial nerves, particularly the (auditory) nerve. These complications of secondary syphilis are relatively uncommon, occurring in less than 10% of individuals (Rompalo, *et al*., 2001). Sexual transmission of syphilis occur following lesion contact and thus it is

effectively limited to persons with primary and secondary manifestations of infection. Again, even without treatment, both primary and secondary lesions resolve and the infection enters a 'latent' stage in which clinical manifestations are absent. Despite the absence of clinical manifestations, during the latent stage of untreated disease, the infection can still be passed to children born of untreated infected mothers. Many years later, few people with latent syphilis may progress to late (tertiary) manifestations including neurosyphilis, cardiovascular disease, and lesions of the skin, bones or viscera (gummata) (French, 2007).

In the pre-antibiotic era showed that 15–40% of untreated infected individuals develop recognizable late complications (Lindstrand, *et al.,* 1993). Clinical manifestations in congenital syphilis are classified as either early or late congenital syphilis depending on whether it presents before or after 2 years of age. The prognosis is particularly poor if symptoms of syphilis are present in the first few weeks after birth (French, 2007).

2.6 Diagnosis of Syphilis

Syphilis has adverse clinical manifestations that make the laboratory diagnosis important, although *T. pallidum* cannot be grown in culture; there are many tests for the direct and indirect diagnosis of syphilis (Ratnam, 2005). Direct diagnostic methods include the detection of *T. pallidum* by microscopic examination of fluid or smears from lesions using dark field microscopy, histological examination of tissues or nucleic acid amplification methods such as polymerase chain reaction (PCR)

(Ratnam, 2005). Indirect diagnosis is based on serological tests for the detection of antibodies. Serological tests fall into two categories: non Treponemal tests for screening, and Treponemal tests for confirmation (Fears and pope, 2001). Another study found that the Rapid Syphilis *Treponema pallidum* assay had a high sensitivity (95.6 to 98.4%) and specificity (95.7 to 97.3%) with stored sera and *Treponema pallidum* Haemagglutination assay (TPHA) as the reference test, there was high agreement between readers, suggesting that the test is easy to read (Diaz, *et al.*, 2004). Although serum may provide higher sensitivity than whole blood, this same study suggest that the Abbott Determine Rapid Syphilis TP assay could be used for diagnosis when laboratory facilities are not available and when results are needed at the point of care (Diaz, *et al.,* 2004).

All non treponemal tests measure both immunoglobulin IgG and IgM antiphospholipid antibodies formed by the host in response to lipoidal material released by damaged host cells in early infection and lipid from the cell surfaces of the treponemes. All treponemal tests use *T. pallidum* or its components as the antigen (Larsen *et al*., 1998). Many clinics which provide screening and treatment for syphilis do not have the capability to perform confirmatory treponemal tests. The confirmatory treponemal test is frequently done off-site; with the results being obtained after the patient has been treated and has left the clinic. This sometimes results in unnecessary treatment for persons with false-positive nontreponemal test results (Fears and Pope, 2001). Most common and inexpensive tests which are used

frequently in screening programs for pregnant women are serological tests which include; non-Treponemal antibodies test Rapid Plasma Reagin (RPR) as a screening test and Treponemal antibodies test (TPHA) as a confirmatory test. In developing countries there are many antenatal clinics without laboratory facilities and the laboratories have many constraints and shortage of reagents is usual. RPR is a simple test which can be performed without a microscope by any trained person.

2.7 Treatment of syphilis

Intramuscular benzathine penicillin 2.4 mega units either as a single dose or weekly in two to three doses are the mainstay of treatment for syphilis including pregnant women (Goh, 2005). In patients allergic to penicillin, oral doxycycline 100 mg twice daily for 2 weeks is given or tetracycline 500 mg four times daily for 2 weeks or azithromycin 500 mg daily for 1 week. A recent study suggests that azithromycin 2 g as a single dose or as two doses 1 week apart may be as good as benzathine penicillin for the treatment of early syphilis (Goh, 2005). There is no satisfactory alternative to penicillin for the treatment of syphilis during pregnancy. Erythromycin is not recommended because it frequently fails to eradicate syphilis in both the mother and the foetus (Genc and ledger, 2000). While Tetracycline is the only other agent that has been proved effective, it is not recommended because of dental staining and impairment of long bone growth in the foetus and hepatotoxicity when given intravenously to pregnant women with coexisting renal insufficiency (Sanchez and Wendel, 1997).

2.8 Congenital Syphilis

Congenital syphilis is a rare disease in most developed countries; but it remains a severe pregnancy outcome in developing countries (Walker and Walker, 2002). *T. pallidum* can be transmitted from the bloodstream of the infected woman to her developing foetus at any time during pregnancy, although risk of foetal infection is much higher during early maternal syphilis (the first year of infection) than during later stages (Sheffield, *et al.*, 2002).

Transmission of syphilis to a foetus depends largely on the duration of the disease in the mother. A long interval between infection and pregnancy results in a benign outcome in the infant (Lindstrand *et al.*, 1993). The risk of transmission is 70%–100% in women with primary or secondary syphilis, 40% with early latent syphilis and 10% in late latent cases. About 40% of pregnancies in women with infectious syphilis result in the death of the foetus (Finelli, *et al.*, 1998). The clinical spectrum in surviving infants ranges from a complete lack of symptoms to severe clinical manifestations (Ameeta, *et al*., 2007). Antibiotic treatment of the mother during the first two trimesters is usually sufficient to prevent negative outcomes, but later treatment or lack of treatment may result in foetal death, foetal damage, or birth of an infected infant (Mascola, *et al.*, 1985). Destructive effects are thought to depend upon the immune response of the foetus and include spontaneous abortion, stillbirth, and premature delivery. Affected infants typically have low weight at birth, and infants with congenital syphilis may be underweight even relative to other infants of

the same gestational age (Mascola, *et al.*, 1985). Pulmonary haemorrhage, secondary bacterial infection, and severe hepatitis cause death of approximately 4% of *T. pallidum*-infected neonates soon after delivery (LaFond and Lukehart, 2006).

2.9 Prevention and Control of Syphilis in Pregnancy

To prevent congenital syphilis, it is imperative to screen for syphilis early in pregnancy; but this remains a challenge. A study found that pregnant women who came for a first antenatal care visit had a median gestational period of 20 weeks (Saloojee, H *et al.*, 2004). Promotion of earlier attendance at antenatal care is a simple prevention strategy which should be advocated (Romoren and Rahman, 2006). Another study also determined that antenatal screening and treating women during pregnancy can prevent maternal syphilis (French, 2007). Interventional program launched in Nairobi by the Nairobi City Council department of public health in early 1990s, has been subjected to monitoring and evaluation; and shows that the effort lead to the downward trend of syphilis during pregnancy from prevalence of 7.2% in 1993 to 3.4% in 1998, and also changes in health seeking behaviour and improved health care (Temmerman, *et al.*, 2000). Likewise in Shenzhen (China) a screening and interventional program led to high increase in coverage for antennal care clinics; which lead to a cost effective decrease in incidence of congenital cases by half from 43.3 per 100,000 to 22.0 per 100,000 pregnant woman screened in 2002 and 2003 (Cheng, *et al*., 2006).

2.10 Risk Factors for Syphilis

There are several factors that can be associated with syphilis in pregnancy. A Study in Mwanza, Tanzania has shown that the age of 15 years to 34 years is associated with high incidence of syphilis especially in women; also women who had lived away from their community during the past 2 years were significantly at higher risk of syphilis incident and that there was no association between syphilis and polygamy (Todd, *et al., 2001*). Another study in Nairobi showed that lower education, being single, having multiple sex partners, a history of STD, a history of preterm delivery, inadequate antenatal care, and HIV infection were risk factors for syphilis infection (Temmerman, *et al.,* 2000). Syphilis seropositive women were also more likely to have a history of alcohol use, to be clinically wasted, to have clinical anaemia, and pruritic dermatitis (Temmerman, *et al.,* 2000).

Another study in Shenzhen (China) found a significant association between unmarried status and lower education attainment as risk factors for syphilis infection (Zhou, *et al.,* 2007); and also found a significant association of syphilis infection in pregnant women with the overnight travel of a sex partner during the past year (Zhou, *et al.,* 2007). An interventional study in the Shenzhen (China) showed syphilis positive pregnant women to have the adverse pregnancy outcomes like miscarriages, stillbirth and perinatal death (Cheng, *et al.,* 2007). A study in Nairobi (Kenya) confirmed risk factors for maternal syphilis infection at delivery and the predictable fact that syphilis positive women more often showed a risky sexual

behaviour, had a lower level of education and inadequate antenatal care (Temmerman, *et al.*, 2000)

CHAPTER THREE

3. MATERIALS AND METHODS

3.1 Southern Sudan

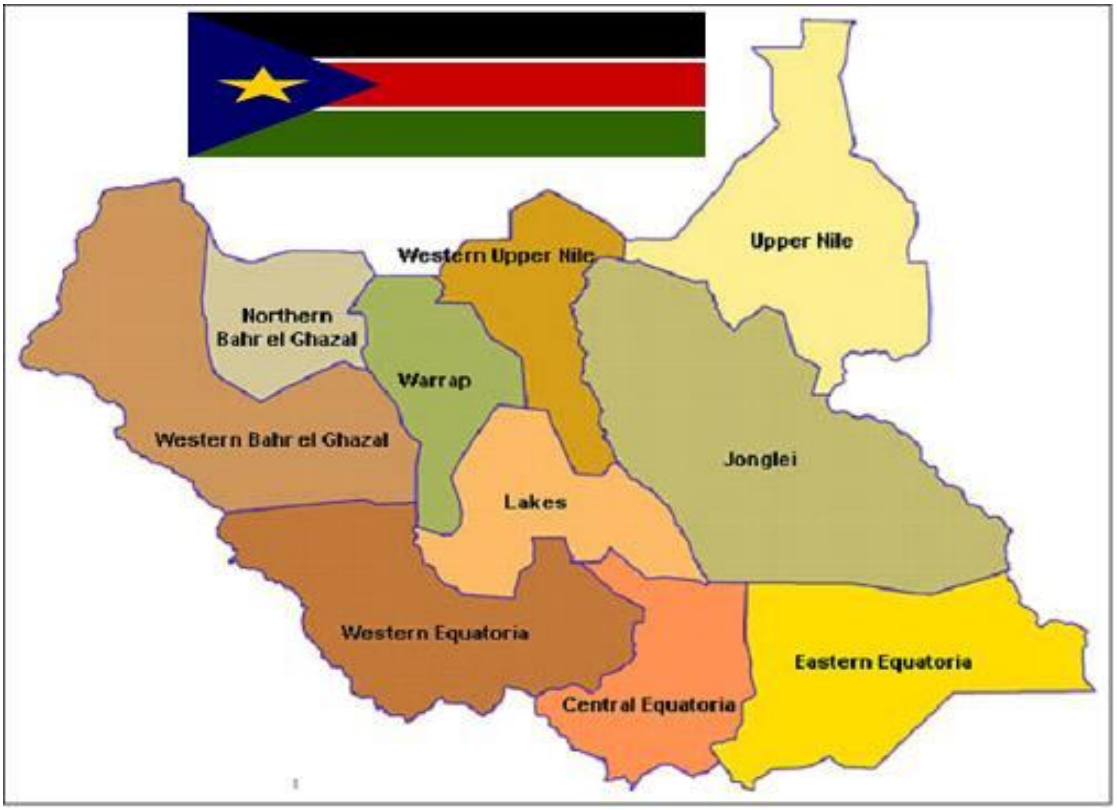

Figure 3.1 Map of Southern Sudan showing the ten states

Southern Sudan is situated in the Horn of African region with an area of approximately 231,177 square miles (figure 3.1). It borders Kenya, Uganda, Ethiopia, Democratic Republic of Congo and Central Africa Republic (CAR). Southern Sudan is the whole southern region of the republic of Sudan; it consists of ten states formerly composed of provinces of Equatoria, Bahr el Ghazal and Upper Nile. The ten states are: Central Equatoria, Eastern Equatoria, Western Equatoria, Western Bahr el Ghazal, Northern Bahr el Ghazal, Lakes, Warrap, Upper Nile, Unity and Jonglei states.

3.1.1 Study Area (Juba, Southern Sudan)

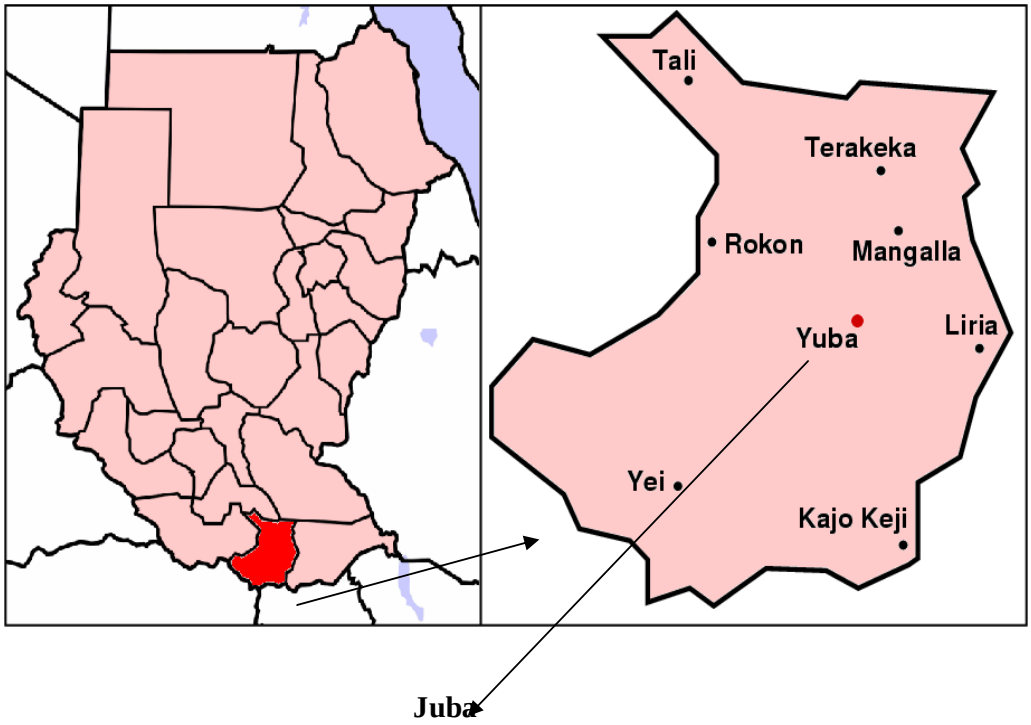

Figure 3.2 Map of Sudan showing Central Equatoria and Juba

Juba is situated in Central Equatoria state (Figure 3.2). It has a population of 1,118,233 people (Census Report, 2008). It is the current capital city of southern Sudan region. Juba is divided into three main payams (sub counties) which are Juba, Kator and Munuki payam. All the governmental and non-governmental headquarters are based as it serves as the main town of connection to other states of southern Sudan. Juba has three hospitals and a number of Primary Health Care Centres and Primary Health Care Units with a good number of private clinics which offer convenient health care services.

3.2 Study Sites

The study was conducted in the antenatal clinics of Juba teaching hospital (JTH), Malakia National Health Insurance Centre (MNHIC), and Munuki Primary Health Care Centre (MPHCC). These clinics serve almost 70% of pregnant women visiting antenatal clinics in Juba, southern Sudan as they are also located in the three main payams of Juba city.

3.2.1 Juba Teaching Hospital

Juba teaching hospital (JTH) is one of the main facilities in southern Sudan with relatively good referral capacity. The hospital has several departments, the ANC falls under the department of Obstetrics and Gynaecology which is headed by a Gynaecologist. The ANC serves pregnant women six days in a week and they are

mostly attended by midwives and nurses. There is no syphilis screening program in the clinic, while HIV testing was initiated by the government & an NGO in August 2009 for PMTCT adding RPR testing can be cost effective. The clinic serves an approximate of 50 to 60 pregnant women on a daily basis from Monday to Saturday.

3.2.2 Malakia National Health Insurance Centre

Malakia national health insurance centre is located in Kator payam, Juba. The health centre has two medical officers, two nurses, one dentist, two laboratory technologists, and six midwives. The centre offers antenatal care for approximately 20 to 30 pregnant women on a daily basis from Monday to Friday. No syphilis screening programme has been implemented in this facility for pregnant women. There is a daily HIV educational programme conducted for pregnant women without testing at this facility by an NGO, they encourage all the pregnant women to visit the voluntary and counselling and testing centre to know their status.

3.2.3 Munuki Primary Health Care Centre (MPHCC)

Munuki PHCC is located in Munuki payam in Juba County. The centre is under the Central Equatoria state Ministry of Health. The centre has five medical assistants (Clinical officers), with one of them serving as the centre director, five laboratory assistants, two nurses and 6 midwives who work in shifts. The centre offers basic

health care services for outpatient and maternal services an approximate of 50 to 60 patients on a daily basis. It has wards for short time admissions and Voluntary Counselling and testing centre for HIV. Munuki Primary Health Care Centre offers daily antennal care services for about 10 to 25 pregnant women daily from Monday to Friday. The centre administration came up with an initiative of encouraging pregnant women to do a self screening for syphilis within the health centre which was to be self carter, so the pregnant women don't feel obliged to the idea.

3.3 Study Design

This was a cross-sectional study design conducted between August and November 2009.

3.3.1 Sampling Technique

Simple random sampling was done to recruit the study participants blindly.

3.4 Sample Size Determination

Assuming a prevalence of syphilis among pregnant women to be 18% (Romoren and Rahman, 2006) and using Cochran's formula for sample size calculation for continuous data $n=z^2pq/d^2 = Z^2 \times p\ (1-p) \div d^2$ for estimation of population proportions (Bartlett *et al.*, 2001) ,

Where n = required sample size

z = confidence level at 95% (standard value of 1.96)

d= margin of error at ±5% (ref) (standard value of (0.05)

p= estimated prevalence of the disease among pregnant women which is 0.18 (Romoren and Rahman, 2006) which is (unknown) in the area.

q= 1- p

$n=z^2pq/d^2 = (1.96)^2 (0.18) (0.82)/ (0.05)^2$

$= 3.8416*0.1476/0.0025$

$=226$

The minimum sample size calculated was 226 study participants

3.5 Study Population

These were pregnant women attending Antenatal clinics in Juba Teaching Hospital, Malakia Health Insurance Centre and Munuki Primary Health Care Centre between August to November, 30th 2009.

3.5.1 Inclusion Criteria

Any consenting pregnant woman attending antenatal clinics in Juba Teaching Hospital, Malakia National Health Insurance Centre and Munuki Primary Health Care Centre between August and November, 2009 were recruited for the study.

3.5.2 Exclusion Criteria

Non pregnant women and pregnant women who are on syphilis treatment or who refused to give consent were excluded from the study.

3.6 Data Collection

Four research assistants were trained for data collection before the study; pilot testing was done to test the questionnaire (Appendix II). Study participants were recruited by simple random method; using written informed consent (Appendix I) pregnant women were informed about the study, pregnant women who consented were recruited in the study.

3.6.1 Sample Collection

Five millilitres of venous blood from consenting study participants was drawn into an EDTA vacutainer tube (BD Vacutainer® Safety-Lok™Blood). Samples were centrifuged in a TGW16 Table top high speed capacity centrifuge, for 3000 rpm for 5 min to obtained plasma. Plasma were stored in freezer at -16°C and were analyzed for TPHA after one month from collection according to manufacturers recommendation, stored samples can be test within 45 days of storage.

3.6.2 Samples Testing Procedures

The samples were aliquoted and numbered with serial numbers and date of collection; one aliquot tested using RPR as the screening and rapid test. The second aliquot was later analyzed for treponemal antibodies and confirmed for syphilis using TPHA test, studies have shown that to test for active syphilis these two tests are recommended.

3.6.2.1 Rapid Plasma Reagin (RPR)

The samples were initially tested using RPR kit (Fortress Diagnostic Ltd, UK) as a screening test to detect the non Treponemal antibodies. The test was carried out following manufacturer's instructions as follows:

Samples and reagents were brought to room temperature. Using a pipette (Fortress Diagnostic Ltd, UK) one drop(100 µl) of sample was added to the test cards, and same quantity of RPR carbon antigen reagent was added to the sample on the test cards. Then the sample was rotated manually by hands for 8 to 12 min. A positive test was seen as flocculation within 8 min indicating the sample contained Reagin. The addition of one drop carbon particles which take no part in the reaction assists in the visualization of the flocculation and a negative test was seen by the absence of the flocculation. Positive and negative controls were also done.

3.6.2.2 *Treponema pallidum* Heamagglutination Assay (TPHA)

This is a Treponemal specific antibodies test used for either confirmation of syphilis or as a routine second test. The reagent system consists of red blood cells coated with antigens of *T. pallidum.* Avian cells were used as they are nucleated and therefore heavier, producing a faster reaction time. In this test the samples were incubated following the kit manufacturer's instructions (Randox Ltd. Antrim, UK) at room temperature, samples were diluted 1:20, and 10µl from the diluted sample was added in 96 well microtitre plates, then 100µl test reagent (avian cells) was added to the sample; and then incubated for 45-60 min in room temperature. A positive result

was indicated by a 'carpet' of red cells across the well. A negative reaction was indicated by a button or ring of red cells across the bottom of the well. Positive and negative controls were also done.

3.7 Experimental procedure

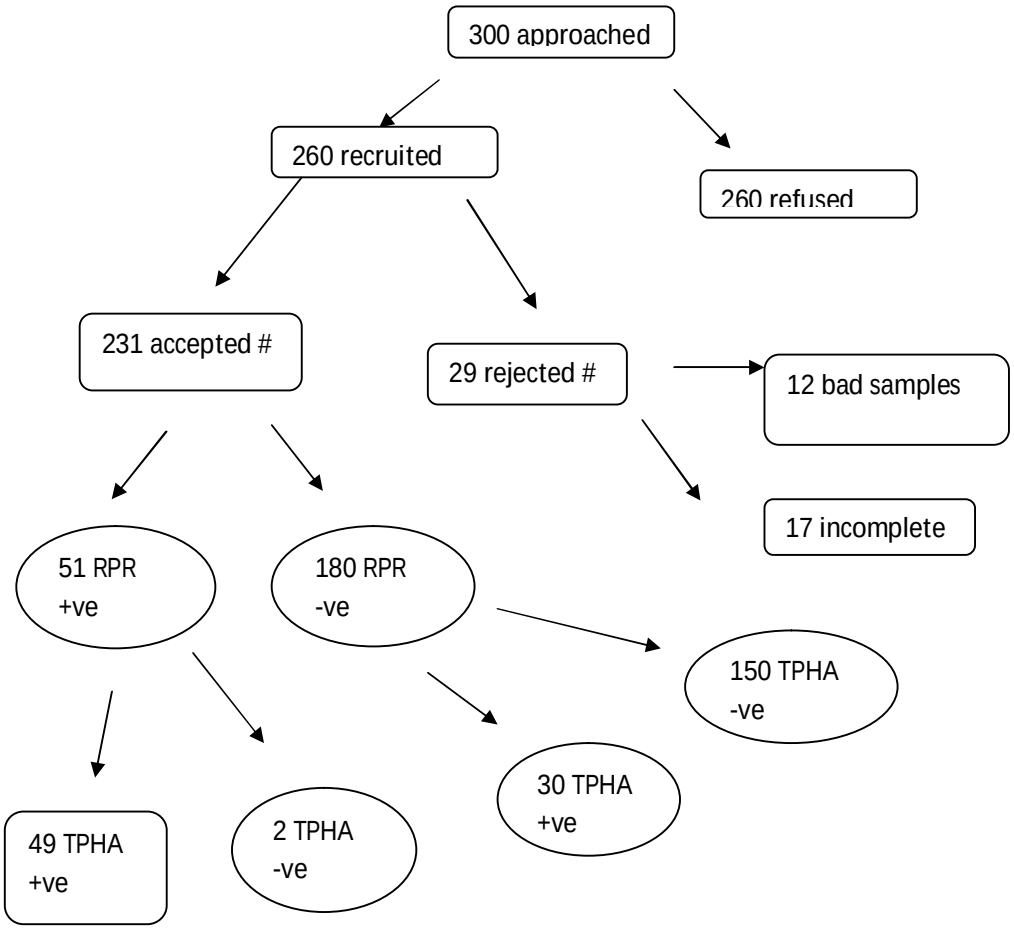

Figure 3.3: Experimental procedure of samples for study participants in the selected ANCs in Juba, southern Sudan.

3.8 RPR Test Evaluation

Using the TPHA as a confirmatory test for syphilis, the TPHA was used as the Gold standard to calculate the performance of RPR test kit (Table 3.1). A is for RPR and TPHA positive (true positive), B is for RPR positive and TPHA negative (false positive), while C is for TPHA positive and RPR negative (false negative) and D is for RPR and TPHA negatives (true negatives).

Table 3.1: Method for evaluation of RPR test using TPHA test on samples from pregnant women attending selected ANCs in Juba Southern Sudan, 2009

	TPHA		
		Positive TPHA	Negative TPHA
RPR	Positive RPR	A	B
	Negative RPR	C	D

Calculation of sensitivity, specificity, predictive value positive and predictive value negative for RPR test.

Sensitivity = A/A+C Specificity = D/B+D

PVP= A/A+B PVN = D/C+D

3.9 Data Management

The eligible participants who consented to participate in the study were recruited by administration of a standard design questionnaire. The data obtained was cleaned, entered into a computer using Epi info 3.5.1(CDC, Atlanta Georgia USA, 2006) software for analysis and storage. Confidentiality was assured by removing the personal identifiers from the questionnaires before analysis and access was to authorize persons only, and computer was in a password protected computer.

3.9.1 Data Analysis

Data was analyzed for proportions, and statistical associations. Descriptive analysis was done by using the frequencies, means, standard deviations and 95% confidence interval to get the general description of study participants and proportions. Bivariate analysis was done to determine the potential factors associated with syphilis by using Chi-square Yates corrected for statistical significance between several exposures and syphilis infections. Odds ratio was used to compare sero-positivity of syphilis infection with history of exposure to associated factors. A Factor with p. value less than 0.05 were considered as having significant association with syphilis. All potential factors associated with syphilis and factors with higher p-values were subjected to unconditional logistic regression model. Stepwise backward elimination logistic regression was used to come up with the final model for statistically significant factors.

3.10 Ethical Consideration

Approval for this study was granted by the Board of postgraduate studies of Jomo Kenyatta University of Agriculture and Technology. Ethical clearance was obtained from the Ethical Review Board in the Ministry of Health, Government of Southern Sudan (Appendix IV). The medical directors for the Health facilities were consulted before the study. Written/verbal informed consents were sought from the participants after being informed about the study and to agree to participate (Appendix I). Numbers were used instead of names to ensure participants confidentially and limited access to the data was maintained.

Study Limitations

- Temporal relationship between pregnancy and syphilis could not be established.
- Study was done in three antenatal clinics in Juba excluding other antenatal clinics; the findings could not be generalized to Juba.
- Some of the study participants could be in sub-clinical stage of the disease, which could have let to misclassification bias.
- Study participants were not comfortable giving history of sexual behaviour, which made it difficult to assess sexual behaviour against syphilis in pregnant women.

CHAPTER FOUR

4. RESULTS

4.1 Demographic and Clinical Information of the Study Participants

During this study, 91 (40%), 80 (35%), and 60 (25%) participants were enrolled in Juba Teaching Hospital, Malakia National Health Insurance Centre and Munuki Primary Health Care Centre respectively. The participants ranged from 15 to 37 years (mean age 24 ± 4.8 years, median age =23 years).

Table 4.1: Age distribution of study participants by ANC (health facility) in Juba, southern Sudan

Age	JTH	MNHIC	MPHCC
	n=(91)	n= (80)	n= (60)
Range	15-37	15-37	15-37
Mean	24	24	24
Std dev	4.7	5.0	5.0
Median	24	23.5	24

Study participants reported none and primary as high level of education giving a (27% and 37.4%) in JTH, (30% and 36%) in MHNIC and (30% and 28.3%) in MPHCC. Secondary and Tertiary education was low by (28.5% and 6.6%) in JTH, (22.5% and 11%) in MHNIC and (2.7% and 13.3%) in MPHCC (Figure 4.2).

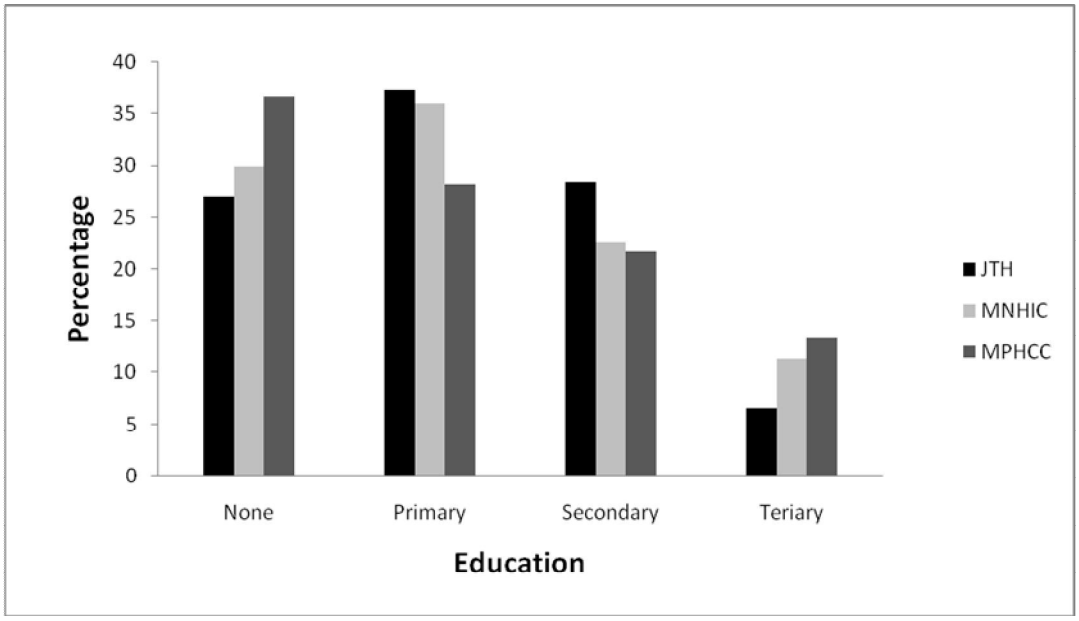

Figure 4.1: Level of Education of study participants in the three antenatal clinics of JTH, MHNIC and MPHCC in Juba Southern Sudan.

Majority of the participants in (figure 4.2) were housewives giving a percentage of not less than 70% of the study participants in the three ANCs; while being employed was 17.6% in JTH, 12.5% in MHNIC and 15% in MPHCC. Informally employed were 9.9% in JTH, 6.3% in MHNIC and 8.3% in MPHCC.

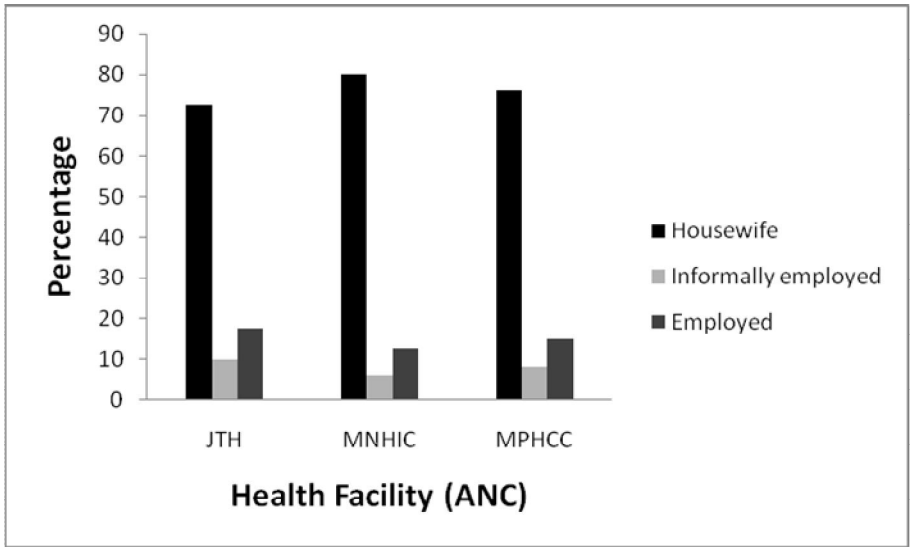

Figure 4.2: Percentage of occupation of study participants in the three antenatal clinics of JTH, MHNIC and MPHCC in Juba Southern Sudan

Most of the participants are married monogamous giving a percentage of 61-65% in the three antenatal clinics. Polygamous marriages attained 28.3-31%; being single accounted for 3-5% while cohabiting, widowed and divorced accounted for less than 2% of study participants in the three antenatal clinics (Figure 4.3).

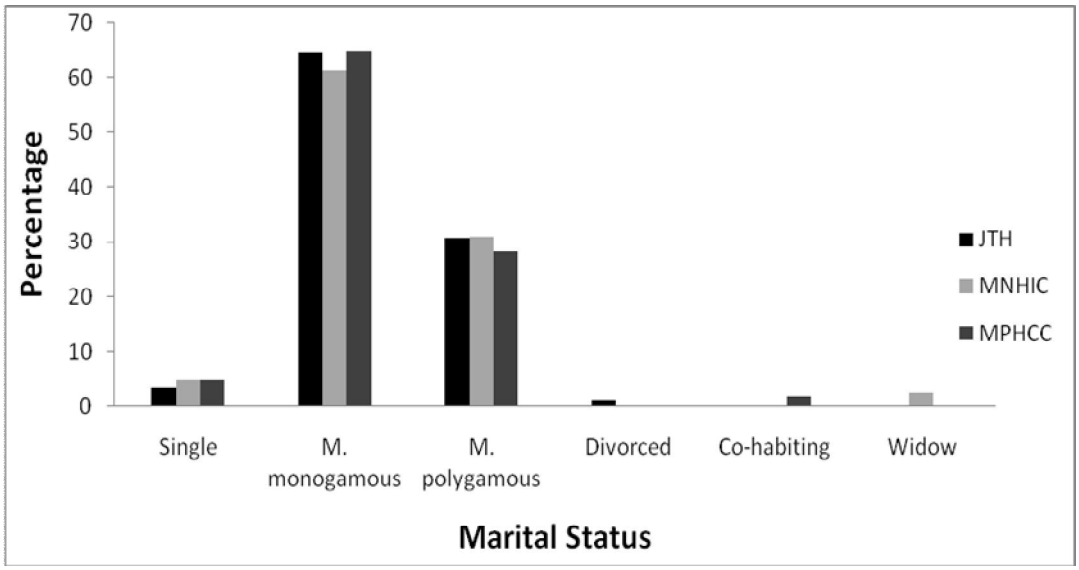

Figure 4.3: Marital status of study participants in the three antenatal clinics of JTH, MHNIC and MPHCC in Juba Southern Sudan

The participants reported the following symptoms for last illness, Headache (78.8%) being the most common reported, Fever (65.8%), Joint pains (26.8%) and Skin rash is (6.1%) some symptoms were mutually exclusive (figure 4.4).

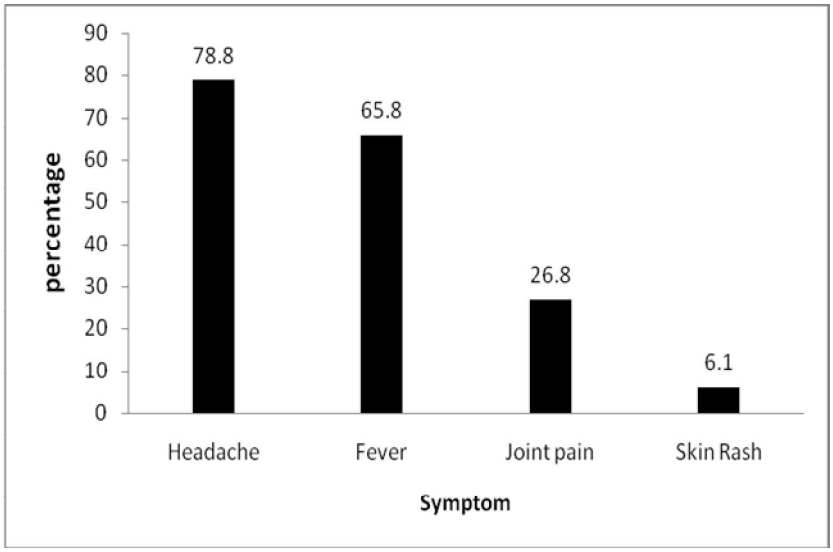

Figure 4.4: Symptoms for last illnesses of study participants attending selected ANCs in Juba southern Sudan, 2009.

Participants also reported different diagnosis for their last illnesses, which were Malaria (73.6%), urinary tract infection (9.1%), syphilis (5.2%) and typhoid fever (36.7%) (Figure 4.5). Other participants reported diarrhoea, flue, Hepatitis and hypertension as the last illness, and about (28.6%) did not know the diagnosis of their last illness

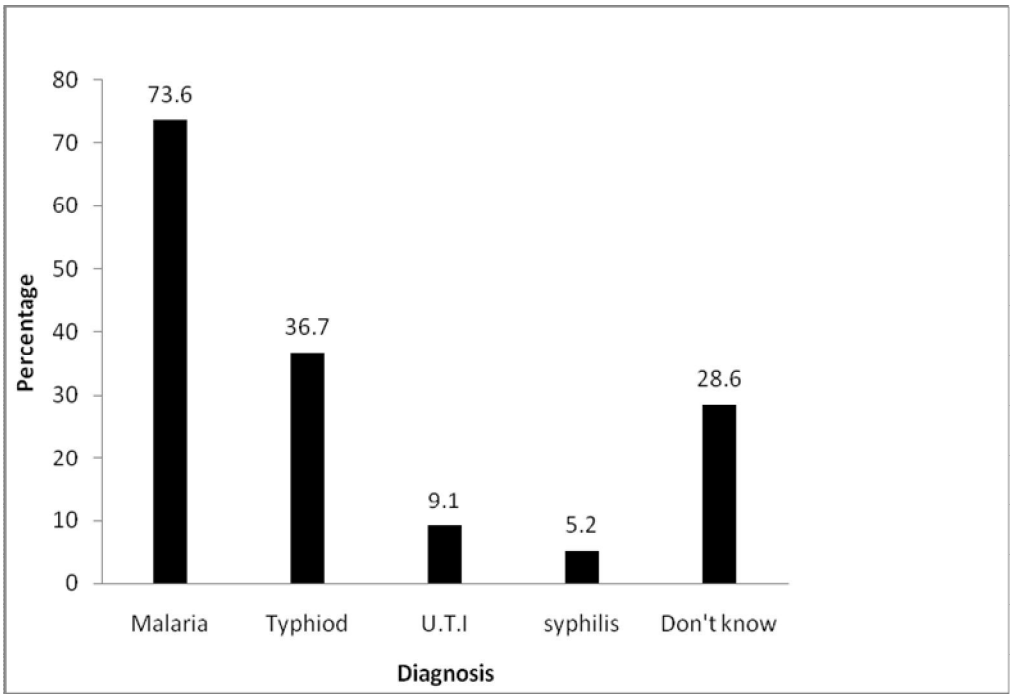

Figure 4.5: Diagnosis for last illnesses for study participants attending selected ANCs in Juba Southern Sudan, 2009.

Knowledge of syphilis was assessed in this study. In Figure 4.6 of all the study participants in the three ANC 93% reported that by attending ANC will reduce the risk to the unborn. 83.5% said they have heard about syphilis, 71.8% also reported that they know that syphilis can be transmitted to the unborn child. But only 59.7% knew how syphilis can be transmitted.

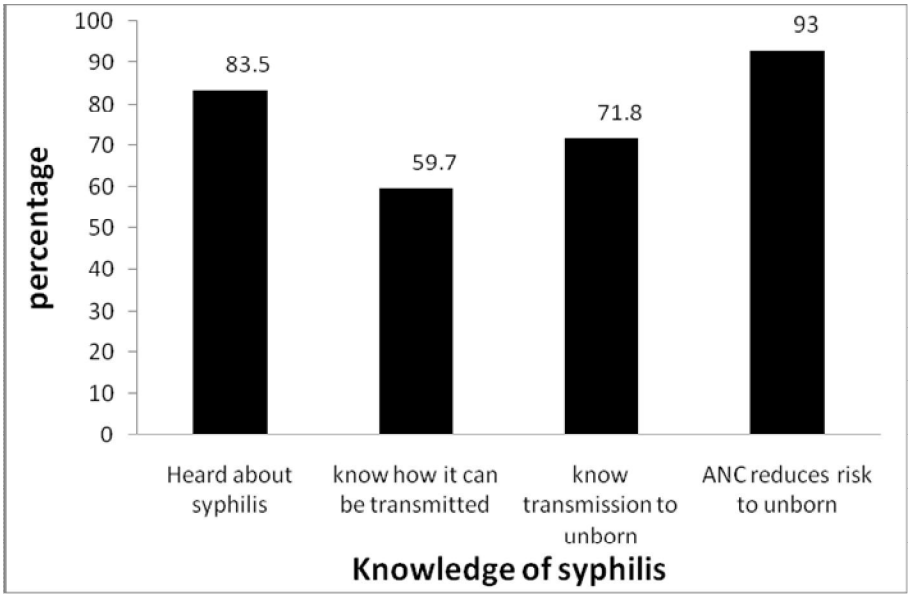

Figure 4.6: knowledge of syphilis for study participants attending selected ANCs in Juba Southern Sudan, 2009.

4.2 Prevalence of Syphilis According to Socio Demographic Information

Syphilis (RPR positive) was detected in 51/ 231 (22.1%) participants in this study. The detection ranged from a low of 0.9% in the 35-39 age group to high of 8.7% in the 25-29 years age group (Figure 4.7).

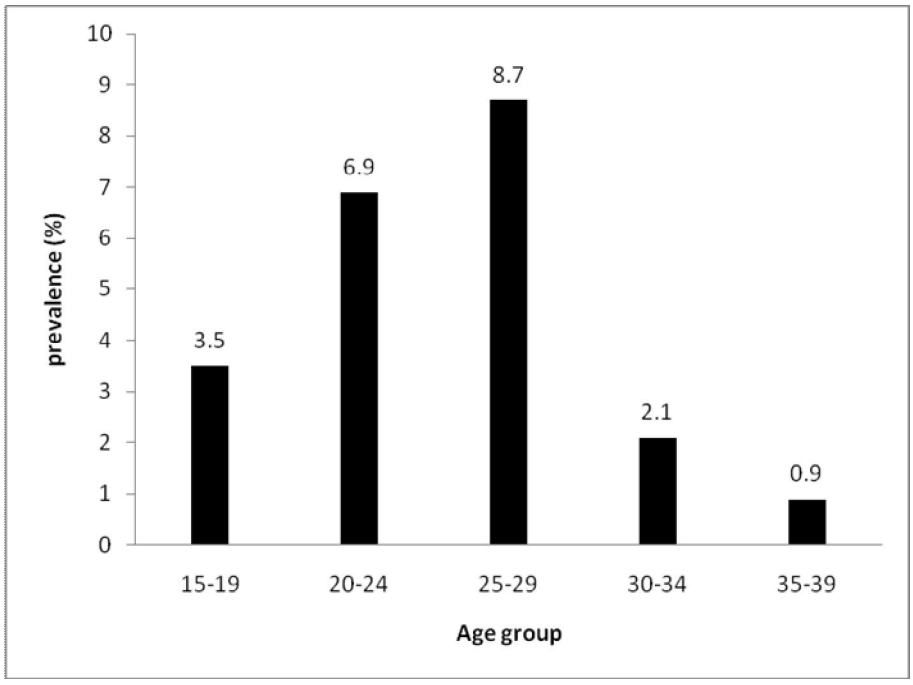

Figure 4.7: Prevalence of syphilis by age groups for pregnant women attending selected antenatal clinics in Juba, southern Sudan 2009

Syphilis prevalence was high in participants with no education (9.5%) and the prevalence reduces as the level of education increases with those having tertiary education had the lowest prevalence of (2.2%) (Figure 4.8).

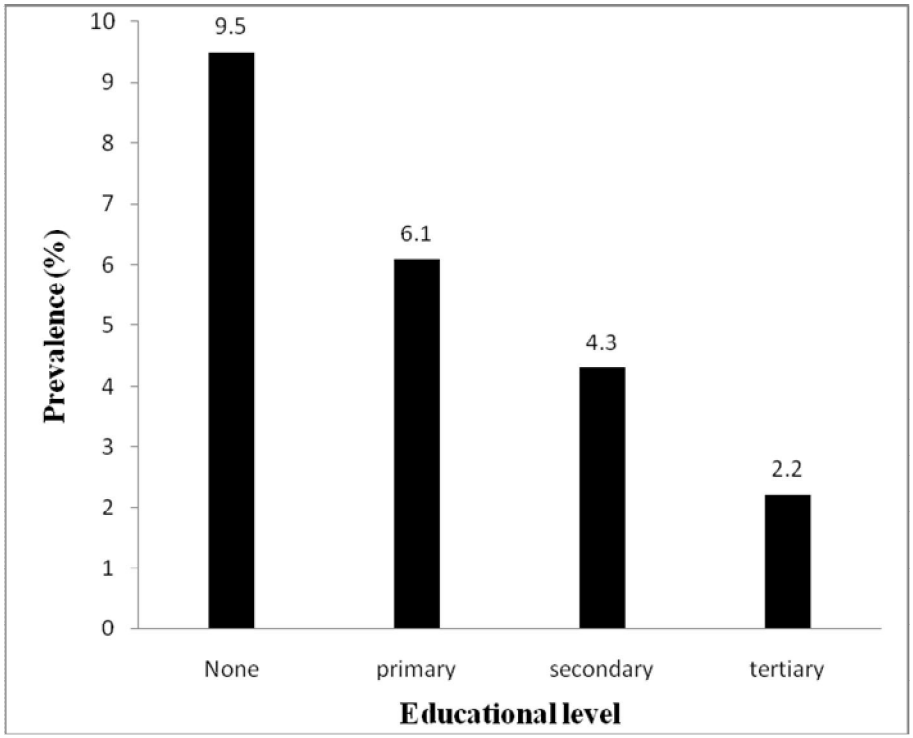

Figure 4.8: Prevalence of syphiis by level of education among pregnant women attending selected antenatal clinics in Juba, southern Sudan 2009.

Of the 51 syphilis test positive participants 74.5% were housewives, 23.5% were formally employed and 2.0% were informally employed (Figure 4.9).

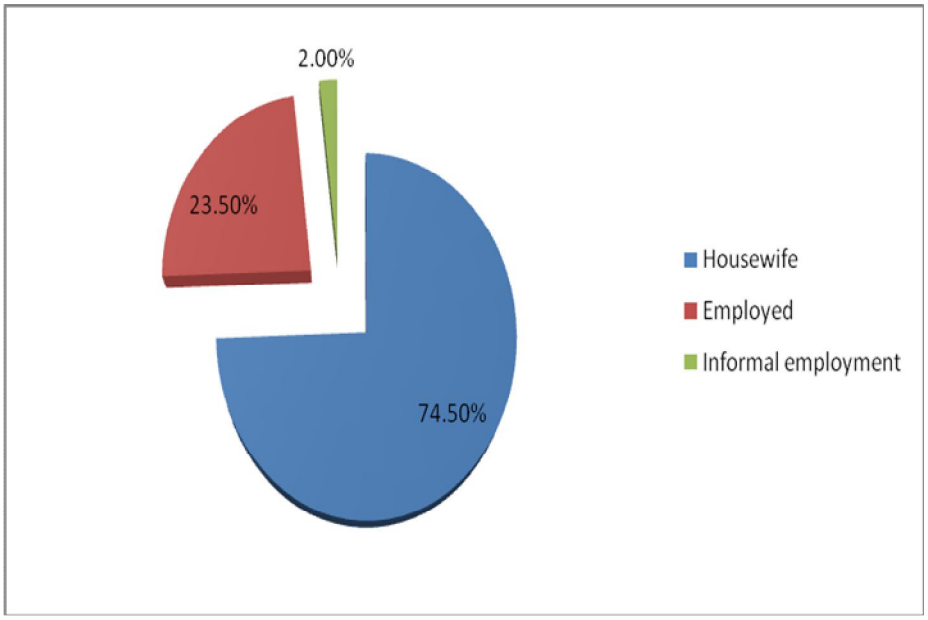

Figure 4.9: Distribution of syphilis positive by occupation among pregnant women attending selected antenatal clinics in Juba, southern Sudan 2009.

In this study prevalence of syphilis was high in monogamous marriages (14.7%). Polygamous marriage accounted for 6.5% of the prevalence, Syphilis was not detected in single or divorced pregnant women. Prevalence was less than 0.5 in the cohabiting and the widowed (Figure 4.10).

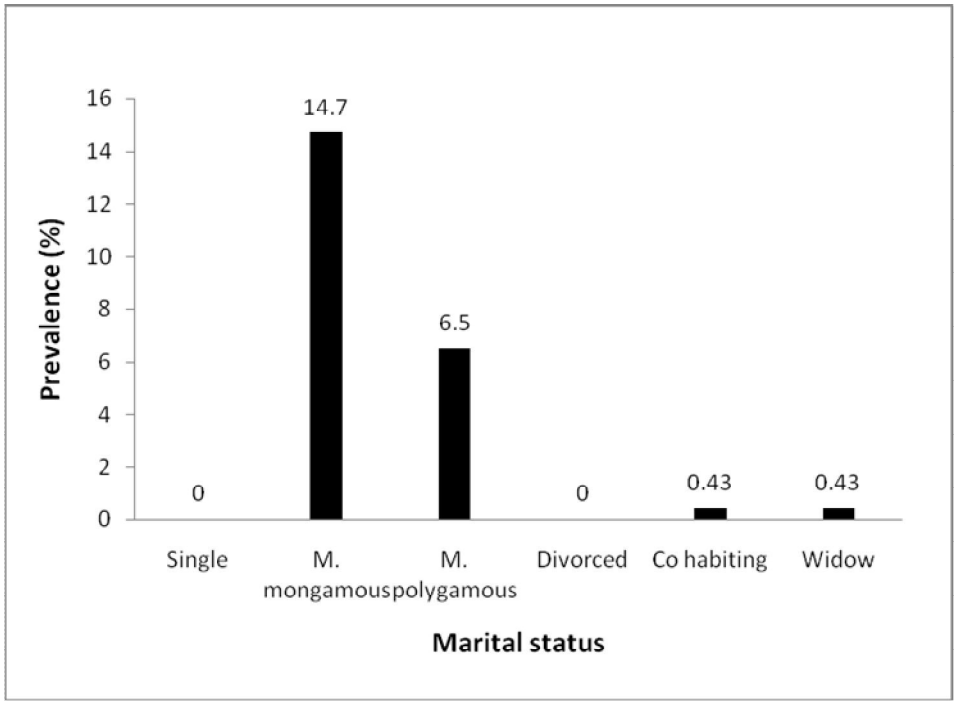

Figure 4.10: Prevalence (%) of syphiis by Marital status among pregnant women attending selected antenatal clinics in Juba, southern Sudan 2009.

(Figure 4.11) is showing the percentage of syphilis prevalence in the three antenatal clinics (study sites). Prevalence of syphilis was above 5% in all of the three sites but was highest (9.5%) in Malakia ANC giving a percentage of (43.1%) and low in Juba Teaching Hospital 5% ANC with a percentage of (23.5%).

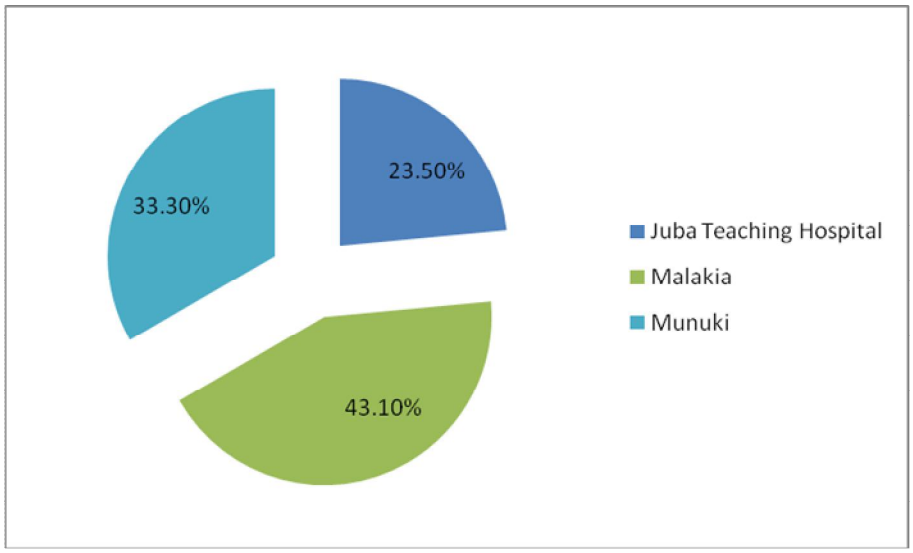

Figure 4.11: Distribution of syphilis prevalence in three antenatal clinics of Juba Teaching Hospital, Malakia Health Insurance Centre and Munuki Health centre in Juba, southern Sudan.

4.3 Factors Associated with Syphilis in Pregnant Women

Several exposure variables were analyzed in this study (Table 4.12) to assess for associations with syphilis. Association between various factors showed that of the total housewives, 83.5% had syphilis; knowledge about syphilis 86.1% had syphilis. History of partner travelling 74% was positive for syphilis. No education, 45% had syphilis and those who had given birth before 44.3% had syphilis. Polygamous married, 34.2% tested positive for syphilis, history of abortion or prenatal death, 31% had syphilis while of the participants who attended ANC for their previous pregnancy 45.9% had for syphilis and of those who reported staying with their partners only 5.1% had syphilis.

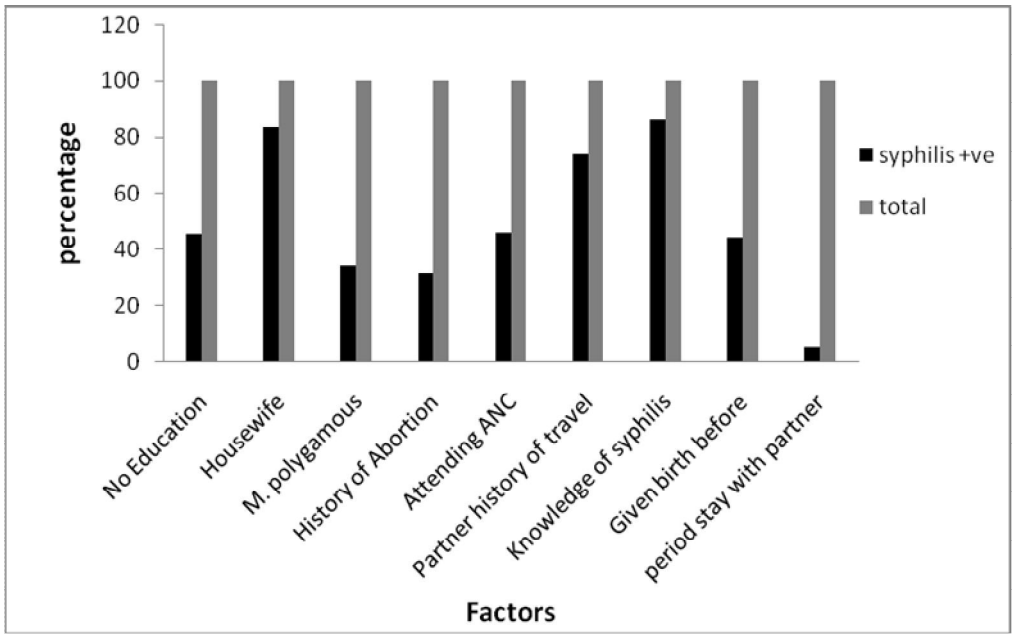

Figure 4.12: Potential factors associated with syphilis in pregnant women attending selected ANCs in Juba Southern Sudan.

Five variables showed significant association with exposure to syphilis at p<0.05 (Table 4.2). No education was associated with syphilis p= (0.006); being a housewife (p= 0.017), history of abortion (p= 0.04), attending ANC for previous pregnancy (p= 0.004) history of partner (p= 0.046). Other factors like polygamous marriages, knowledge of syphilis, and period of stay with partner were not significantly associated with having syphilis in pregnancy in this study.

Table 4.2: Potential Factors associated with syphilis among pregnant women attending selected antenatal clinics in Juba, Southern Sudan, 2009.

Exposure variable	odds ratio	95% CI	P-value
No Education	2.192	1.242-3.868	**0.006**
Housewife	2.272	1.43-4.517	**0.017**
M. polygamous	1.316	0.734-2.350	0.355
History of Abortion	1.882	1.012-3.499	**0.04**
Attending ANC	0.434	0.243-0.776	**0.004**
Partner history of travel	1.846	1.004-3.393	**0.046**
Knowledge of syphilis	1.395	0.654-2.977	0.386
Given birth before	1.575	0.902-2.750	0.1088
period stay with partner	0.454	0.14-1.40	0.161

Out of the 231 participants, only 23 responded to the sexual information, 20 had one partner in life and 3 had more than 2 partners in life. All respondents had their first sex at 20years and above.

4.3.1 Multivariate Analysis

In the Bivariate analysis shown in (Table 3), variables were subjected to multivariate analysis in (Table 4), whereby the four significant independent factors remained to be associated with syphilis were, being a housewife, history of abortion and history of partner travelling were risk factors for getting syphilis, while attending antenatal clinic for previous pregnancies was associated with having no syphilis. Having no education was found to be a confounder as it was significant in the earlier bivariate analysis in table 3 and dropped in the multivariate analysis.

Table 4.3: Final Model for Factors Associated with Syphilis in Pregnant Women Attending Selected Antenatal Clinics in Juba, Southern Sudan, 2009.

Term	Odds Ratio	95%	C.I.	P-Value
Housewife	2.8082	1.2592	6.2625	0.0116
History of abortion	2.6548	1.2442	5.6648	0.0116
Attending ANC for pervious pregnancy	0.2814	0.1403	0.5643	0.0004
History of partner travelling	2.1491	1.0833	4.2633	0.0286

4.4 Performance of Rapid Plasma Reagin Test

In this study (RPR) test was used as a screening test to test for active infection; while *Treponema Pallidum* Haemagglutination Assay (TPHA) was used for confirmation and to test for specific antibodies which reveals exposure to syphilis before in life (Table 4.4). Out of 231 samples 51 tested positive for RPR while 79 tested positive for TPHA. TPHA was used as the gold standard for obtaining sensitivity and specificity of 62.0% and 98.7% respectively PVP 96% AND PVN 83.3%.

Table 4.4: Performance of RPR test for testing samples of pregnant women attending selected antenatal clinics in Juba, Southern Sudan 2009.

	n = 231	**TPHA TEST**		
		Positive test	**Negative test**	
RPR TEST	**Positive test**	49	2	51
	Negative test	30	150	180
		79	152	231

Sensitivity 49/79*100 = 62% PVP 49/51 = 96%

Specificity 150/152*100 = 98.6% PVN 150/180 = 83.3%

CHAPTER FIVE

5. DISCUSSION

Syphilis is a chronic infectious disease caused by the spirochaete *T. pallidum.* It has significant long-term morbidity for mothers, and can cause severe complications in pregnancy, which may result in spontaneous abortion, stillbirth and other negative outcomes including congenital syphilis. Congenital syphilis results in serious sequelae in live born infected children (Genc and Ledger, 2000).

The overall prevalence of syphilis using (RPR) among pregnant women in selected antenatal clinics in Juba was 22.1%. This is similar with the South Sudan sentinel surveillance report of 2007 which found a prevalence of syphilis ranging from 12% to 21% (Surveillance report, 2007). Syphilis prevalence data from the rest of Africa has been reported to range from a low of 2.5% in Burkina Faso, 13.7% in North West Ethiopia (Azeze *et al.,* 1995), 17.4% in Cameroon (WHO, 1999) and a high of 42% in Mozambique (Folgosa *et al.,* 1996). Recently a similar study done in Khartoum the capital of Sudan by Abdel-bagi *et al.,* (2008), reported maternal syphilis to be 9% among the antenatal care attendees. These differences could be due to good health system in place, as opposed to Southern Sudan which is yet to establish a good health system to support maternal and child health (MCH). The finding from this study is also similar to a study done in Kinshasa, Zaire which gave a prevalence of 16% among pregnant women (Goeman *et al.,* 1995).

The prevalence results from this current study are at variance with those found by other workers who recorded very low rates ranging from a low of 0% in Kabul, Afghanistan where Todd, *et al.,* (2008) recorded the prevalence was only among pregnant women attending government hospitals. This could be due to the role of religion and culture, as Afghanistan, a Muslim country with strict Islamic laws, women are mostly restricted in their movements, and have less promiscuous sexual behaviour. Meanwhile the prevalence was 0.9% in a suburban community in Northern Sudan among women (Kafi *et al.,* 2000), and 1.03% in South Africa (Mullick *et al.,* 2005).

Other low prevalence rates of syphilis in pregnant women have been found in Entebbe, Uganda 4% (Kizito *et al.,* 2008). These variations from different countries or sites might be due to studies done after interventional programs which might have reduced the prevalence of maternal syphilis in those areas as many countries have also adopted the screening and treating pregnant in ANCs. This high prevalence of syphilis found in Juba (22.1%) in this study could be due to lack of intervention programs set in place to reduce the prevalence and interrupt maternal negative outcomes associated with syphilis, as the country is just emerging from a long civil war, with systems yet to be set in place. Southern Sudan, especially Juba, is experiencing an influx of returnees (internally displaced people) and refugees from the neighbouring countries, where the health status of these individuals is unknown, as people are coming from different cultures altogether.

Syphilis prevalence was normally distributed between all the age groups in this study; that is the lower age group (15-19years) and the higher age group (35-39 years) had lower prevalence as opposed to the age group (25-29 years) which had the highest prevalence. This high prevalence might be due to the majority of the participants were under this age group (25-29years). This observation is similar to study by Mulu *et al.,* (2007) who also found a high prevalence to be among the same age group. But the finding differs from the findings by Swai *et al.,* (2006) who instead reported high prevalence of maternal syphilis to be among age group (35-39 years) in South Africa. The majority of population in Juba and in this study had none or only basic education, which might explained the early pregnancy as opposed to pregnant women in South Africa who had higher level of education and late pregnancy.

Prevalence of syphilis was high in pregnant women with a gestation period of 18-24 weeks which is the second trimester of pregnancy. This finding could be attributed to a possible common behaviour or practice where pregnant women tend to utilize antenatal care clinics in their second trimester of pregnancy, however this findings differs with Azeze *et al.,* (1995) who instead reported that majority of pregnant women were in their third trimester of pregnancy which is 32-40 weeks.

Several potential factor associated with syphilis were also noted in this study for statistical association. The initial bivariate analysis indicated that having low education, being a housewife, history of abortion and history of partner travel were risk factors for having syphilis; meanwhile attending antenatal clinic for previous

pregnancy was found to be associated with having less syphilis ($p < 0.05$). These findings are similar to several studies carried out in Nairobi (Termmamine *et al.*, 2000) and in China (Zhou *et al.*, 2007) who significant association between these same factors.

Study participants who reported history of frequent travel of their partner were more likely to be positive for syphilis than those with no history of travel for their partner. There is a high tendency for the partners to travel to other towns and states in Southern Sudan as they are more often than not the sole breadwinners for their families and have to seek employment out of town. This practice might lead both partners to be involved in risky sexually behaviour in the absence of the other. This single observation has also been reported in China by Zhou *et al.*, (2008) who reported history of partner travelling was risk factor for syphilis in pregnant women.

Being a housewife as occupation was associated with syphilis in pregnant women in this study, and this could be explained because the majority of the study participants were housewives. In Juba Southern Sudan housewives are mainly occupied by house work and taking care of their children. This association might be due to the women paying less attention to syphilis as the disease can be asymptomatic for many years. Like a study by Cheng *et al.*, (2006) who found that an informal job as occupation was a risk factor for syphilis in pregnancy, these could explain the earlier association between syphilis and no education, women who are less educated are more likely to be housewives and informally employed though it was not an independent risk factor.

History of abortion/prenatal death was associated with having syphilis in this study; syphilis can cause many negative outcomes in pregnancy including spontaneous abortion. This might explained the fact that the abortion could have happened due to infection with syphilis. Currently most of the causes for the spontaneous abortions happening in Juba can hardly be determined. Similar findings were reported by Kebede *et al.,* (2000) and Yahija-Malima *et al.,* (2008) who recorded that a history of abortion was associated with having syphilis in pregnant women.

Attending antenatal care clinic for previous pregnancy was found to be associated with having less syphilis in pregnant women in this study. This finding could be explained by the fact that pregnant women who utilized the antenatal clinic received or abided by some basic education from the ANC staff. As it is a normal practice in the ANC, whereby staff do encourage pregnant women to have syphilis test, obtain treatment in case they are positive so as to avoid maternal negative outcomes associated with syphilis. The selected antenatal clinics do not have syphilis screening programmes in pregnant women. A study by Brown *et al.,* (2008) in Kwale district in Kenya showed that syphilis negative outcomes was less in those who attended ANC regularly in their pregnancy.

Marital status was not associated with syphilis in this study, although the majority of the study participants were monogamously married. Other studies found significant association between being single (Swai *et al.,* 2008), and polygamous marriage (Yahija-Malima *et al.,* 2008) as risk factors for syphilis in pregnant women. In this

study knowledge of syphilis was not associated with syphilis (it was statistically insignificant). Giving birth before was also not associated with syphilis in this study.

Rapid Plasma Reagin test has been used as a syphilis screening test in many antenatal clinics and health facilities in the developing world (West *et al.,* 2002). To define active syphilis, the RPR and the TPHA positive test were compared. The sensitivity 62% and specificity 98.7% of the RPR test was found. The low sensitivity of RPR could be explained as the test detects only the active infection as opposed to TPHA which detects both the past and the recent infection with syphilis. The PVP (96%) and PVN (83.3%) of the RPR were high as observed in this study. Van Dyck *et al*., (1993) did not recommend the use of RPR as a field test due to its low sensitivity as he thought it was not reliable under field conditions. Many clinics which provide screening and treatment for syphilis do not have the capability to perform confirmatory treponemal tests TPHA) as it is expensive and complicated. Interventional study in Mozambique recommended the use RPR / TPHA test to target active syphilis in pregnant women for treatment. They recommended RPR test for screening pregnant women in antenatal clinics because it can be performed by any trained person in the ANC setting (Bique *et al.,* 2000). The purpose of using RPR in ANC setting is to target the pregnant women with active infection so that they can be treated. The confirmatory treponemal test is frequently done off-site to confirm false positive and false negative but in this case it was difficult to rule out because the false negative in this study could be due to past exposure to syphilis or

long-term; Cross reaction or false positive for RPR are associateted with increased age, pregnancy, drug addition, malignancy, and autoimmune diseases, such as systemic lupus erythematosus with the results being obtained after the patient has been treated and has left the clinic (Singh and Barbara, 1999). This sometimes results in unnecessary treatment for persons with false-positive nontreponemal test results (Fears and Pope, 2001).

TPHA test is capable of detecting past infections by detecting both immunoglobulins IgG and IgM. TPHA testing was used in this current study as a confirmatory test with very good results.

CHAPTER SIX

6. CONCLUSIONS AND RECOMMENDATIONS

6.1 Conclusions

The major conclusions that can be derived from this study are;

1. There was a high syphilis prevalence rate of 22.1% among pregnant women in the three antenatal clinics in Juba.

2. Women of reproductive age and those with no or having only basic education were more likely to have syphilis than those of an older age and educated women

3. Being a house wife, history of abortion, and history of partner travel were risk factors for syphilis.

4. Attending antenatal clinic for previous pregnancy was associated with having less syphilis in this study.

5. RPR and TPHA were good methods for testing active syphilis.

6. Therefore based on these findings, null hypothesis was reject and alternate hypothesis was accepted.

6.2 Recommendations

1. There is a very urgent need for interventional programmes such as screening and treating the infected women in antenatal clinics to reduce the prevalence of syphilis among pregnant women. Many African and other developing countries have adapted screening and treatment of pregnant women in the first antenatal visit, which have resulted in reduction of syphilis prevalence in pregnancy.

2. There is need for regular health education for pregnant women in antenatal clinics to inform them about their health, avoidance of risky behaviors and the risk of syphilis to both born and the un-born child.

3. Pregnant women should be encouraged to attend antenatal care clinics.

4. The Rapid Plasma Reagin test should be used as a screening test in the antenatal setting, as it is detects active syphilis infection and less expensive and easy to perform.

5. There should be a more comprehensive population based study to establish the incidence and outcomes related to syphilis in pregnant women in Southern Sudan.

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APPENDICES

Appendix I: Consent Form

Introduction

Dear participant, my name is Sheila Konga, from the Ministry of Health Government of Southern Sudan. I am doing a study to determine the prevalence and associated factors for syphilis in pregnant women in Juba, and am here by requesting you to be part of this study which is also to pursue a Masters Degree in Jomo Kenyatta University of Agriculture and Technology. Syphilis is a chronic disease which is transmitted sexually or from mother to unborn child. Syphilis is associated with numerous negative effects on pregnancy like stillbirth, spontaneous abortion, congenital syphilis and so forth, therefore studies have shown how screening programmes are effective in reducing these effects.

Procedure

If you agree to participate, you will be asked questions which will take about 10 to 15 minutes of your time and 5ml blood sample will be drawn by qualified personnel. There will be a slight pain involve in the process of taking of the blood using syringe. No direct benefit to the participants. You are allowed to ask questions and stop from participating at any time during the process because it is a voluntary participation. This information you are to give will be confidential and the samples will not be given for any other use other than this study. The results will be made available in the clinic; numbers will be used instead of names.

Consent

I have read/understood about the study and now I give my full consent to participate in the study.

Signature or thumbprint…….

Date:…… Interviewer

…….

Appendix II: Questionnaire

QUESTIONNAIRES

Questionnaire No ☐☐☐ e: / /2009 ☐

Health Facility _____

DEMOGRAPHIC INFORMATION

State …… County ……

Payam…….. Present Residence…….

1). Age ☐☐ 2) Gestation period in weeks ☐☐

3). Level of Education

None ☐ Primary ☐ Secondary Tertiary ☐

4). Occupation

Housewife ☐ employed ☐ informal employmen☐

5). Marital status

Single ☐ Married monogamous ☐ Married polygamous ☐

Divorced ☐ Co habiting ☐ Widow ☐

CLINICAL INFORMATION

6). When were you last ill?

Less than a month ☐ Less than 2 month ago ☐

Less than a year ☐ I don't remember ☐

7) If ill what were the signs and symptoms

Fever ☐ Headache ☐ Vomiting ☐ Skin rashing ☐ Joint pain ☐

8) What was the diagnosis of the sickness? _____

Malaria ☐ syphilis ☐ bacterial infections ☐

9) Have you been tested for syphilis or HIV before?

Yes ☐ No ☐

10) If yes, when? _____

11) Have you ever given birth?

Yes ☐ No ☐

12) Have you ever lost a baby during pregnancy?

Yes ☐ No ☐

13) If yes what was the cause of the abortion? _____

14) If yes, have you ever given birth to a child who survived and died later?

Yes ☐ No ☐

15) If yes, How many? ☐☐

16) Have you been attending Antenatal care Clinic for the previous pregnancies?

Yes ☐ No ☐

17) Have your partner ever complain of any sickness like syphilis?

Yes ☐ No ☐ If yes, when?_____

18) Have you ever visited a doctor with your husband for any sickness?

Yes ☐ No ☐

19) If yes, what was the sickness?

Syphilis ☐ HIV ☐ Genital infections ☐

SOCIAL INFORMATION

20) For how long have you been with your partner?

6 months ☐ one year ☐ 2years and more ☐

21) Does your partner travel?

Yes ☐ No ☐

22) If yes, how frequent?

Twice a month ☐ once a month ☐ every two or three months ☐

23) What do you do most of the time?

Schooling ☐ Formal Job ☐ Resting ☐

Private Business/selling ☐ House work/childcare ☐

24) Your residential area? ……

25) And for how long have you been staying in that area? .....

KNOWLEDGE

26) Have you heard about syphilis, HIV or about STDs in general?

Yes ☐ No ☐ I don't know ☐

27) Do you know how these diseases can be transmitted?

Yes ☐ No ☐ I don't know ☐

28) Do you know that these diseases can be transmitted to born and unborn child?

Yes ☐ No ☐ I don't know ☐

29) Do you think by attending the ANC that reduces the chances of risk to your unborn child? ☐ Yes ☐ No I don't know ☐

SEXUAL INFORMATION

30) How old were you when you first had sex?

31) How many sexual partners did you have in life?

One ☐ Two ☐ Three or more ☐

LABORATORY RESULTS

32) RPR positive ☐ Negative ☐

33) TPHA Positive ☐ Negative ☐

Appendix III: Multivariate Analysis

LOGISTIC TPHA positive = housewife No Education polygamous marital

Q15 given birth before

Q16 have you ever lost a baby during pr

Q17 have been attending ANC for previous

Q20 does your partner travel

Unconditional Logistic Regression

Term	Odds Ratio	95% C.I.		P-Value
housewife (Yes/No)	2.7179	1.2068	6.1208	0.0158
No_Education (Yes/No)	1.7100	0.8805	3.3209	0.1132
polygamous_marital (Yes/No)	1.2696	0.6265	2.5730	0.5078
Q15givenbirthbefore (Yes/No)	1.6460	0.8081	3.3528	0.1697
Q16haveyoueverlostababyduringpr (Yes/No)	2.2227	1.0157	4.8638	0.0456
Q17havebeenattendingANCforprevious (Yes/No)	0.2222	0.1037	0.4760	0.0001
Q20doesyourpartnertravel (Yes/No)	1.9817	0.9746	4.0293	0.0589

LOGISTIC TPHA positive = housewife No Education

Q15 given birth before

Q16 have you ever lost a baby during pr

Q17have been attending ANC for previous

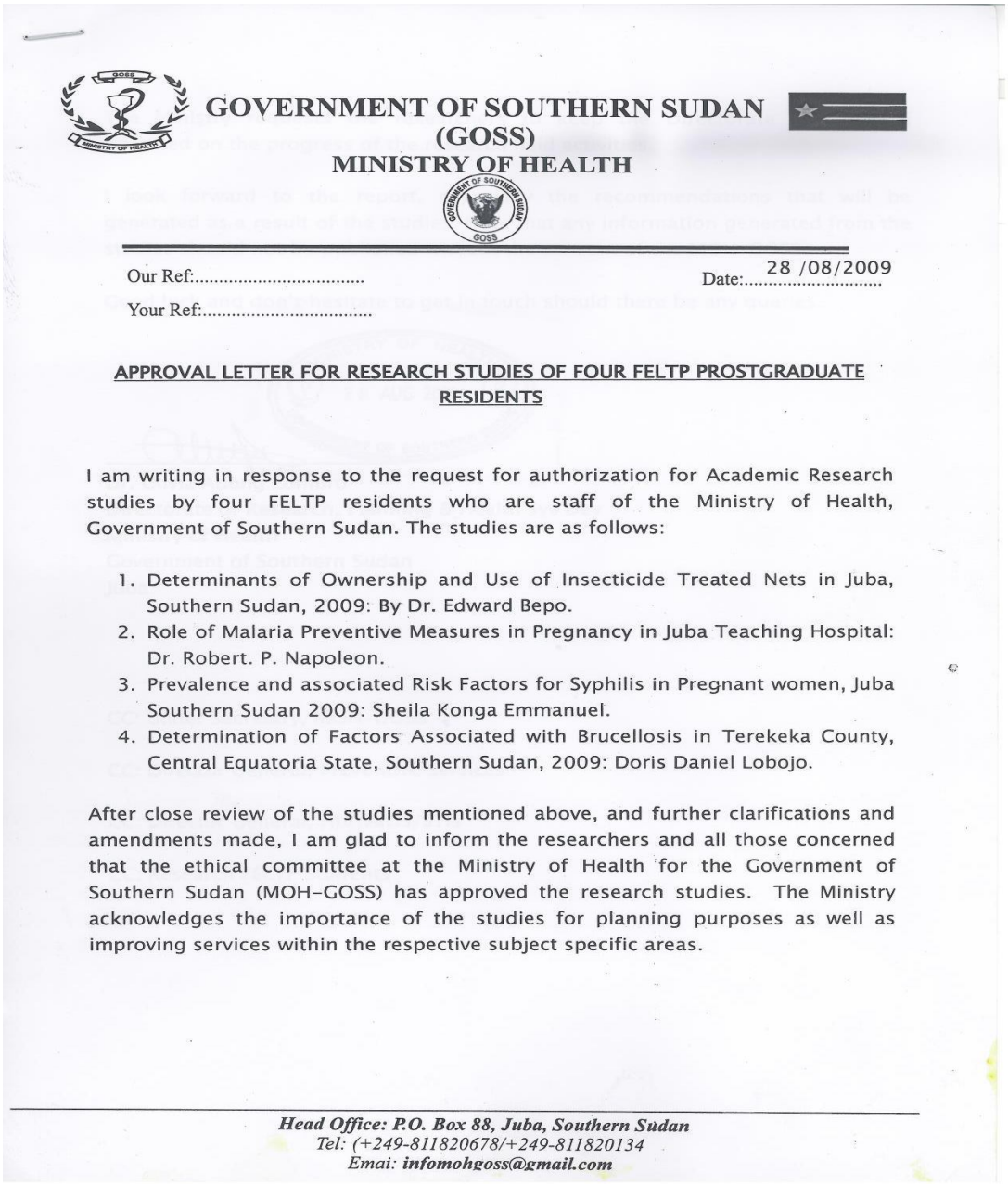
Q20 does your partner travel

Term	Odds Ratio	95%	C.I.	P-Value
housewife (Yes/No)	2.7563	1.2234	6.2097	0.0144
No Education (Yes/No)	1.7362	0.8958	3.3648	0.1022
Q15givenbirthbefore (Yes/No)	1.6364	0.8040	3.3306	0.1744
Q16haveyoueverlostababyduringpr (Yes/No)	2.2314	1.0205	4.8787	0.0443
Q17havebeenattendingANCforprevious (Yes/No)	0.2335	0.1109	0.4919	0.0001
Q20doesyourpartnertravel (Yes/No)	2.0723	1.0318	4.1621	0.0406

PVALUE=95%

Unconditional Logistic Regression

Appendix IV: Ethical Clearance



GOVERNMENT OF SOUTHERN SUDAN
(GOSS)
MINISTRY OF HEALTH

Our Ref:..... Date: 28 /08/2009

Your Ref:.....

APPROVAL LETTER FOR RESEARCH STUDIES OF FOUR FELTP PROSTGRADUATE RESIDENTS

I am writing in response to the request for authorization for Academic Research studies by four FELTP residents who are staff of the Ministry of Health, Government of Southern Sudan. The studies are as follows:

1. Determinants of Ownership and Use of Insecticide Treated Nets in Juba, Southern Sudan, 2009: By Dr. Edward Bepo.
2. Role of Malaria Preventive Measures in Pregnancy in Juba Teaching Hospital: Dr. Robert. P. Napoleon.
3. Prevalence and associated Risk Factors for Syphilis in Pregnant women, Juba Southern Sudan 2009: Sheila Konga Emmanuel.
4. Determination of Factors Associated with Brucellosis in Terekeka County, Central Equatoria State, Southern Sudan, 2009: Doris Daniel Lobojo.

After close review of the studies mentioned above, and further clarifications and amendments made, I am glad to inform the researchers and all those concerned that the ethical committee at the Ministry of Health for the Government of Southern Sudan (MOH-GOSS) has approved the research studies. The Ministry acknowledges the importance of the studies for planning purposes as well as improving services within the respective subject specific areas.

Head Office: P.O. Box 88, Juba, Southern Sudan
Tel: (+249-811820678/+249-811820134
Emai: infomohgoss@gmail.com

The Ministry requests the researchers to keep the Directorate of Research informed on the progress of the research field activities.

I look forward to the report, especially the recommendations that will be generated as a result of the studies. Note that any information generated from the studies should not be published without the consent of the MOH-GOSS.

Good luck and don't hesitate to get in touch should there be any queries.

Dr. Olivia Adong Lomoro
Directorate of Research, Planning & Health Sys Dev
Ministry of Health
Government of Southern Sudan
Juba

CC: Under Secretary, MOH-GOSS

CC: Director General, Preventive Services

CC: Director General, HIV/AIDS/STIs

CC: Research FELTP Students