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COMMENTARY | CHLAMYDIA

Genital Chlamydia Trachomatis Infection: Prevalence, Risk Factors and Adverse Pregnancy and Birth Outcomes in Children and Women in sub-Saharan Africa

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ABSTRACT

Genital *Chlamydia trachomatis* (CT) has adverse health outcomes for women and children. In pregnant women, the infection causes adverse obstetric outcomes including pelvic inflammation, ectopic pregnancy, and miscarriage. In children, it causes adverse birth outcomes such as skin rash, lesions, limb abnormalities, conjunctivitis, neurological damage, and even death. This article discusses genital CT prevalence, risk factors, and adverse pregnancy and birth outcomes among women and children in sub-Saharan Africa as well as challenges associated with the mitigation of the disease. A comprehensive search of databases including PubMed, ResearchGate, and Google Scholar was conducted using keywords such as genital chlamydia trachomatis, adverse pregnancy outcomes, adverse birth outcomes, and sub-Saharan African. We found that genital CT prevalence rates in some sub-Saharan Africa countries were higher than others and that risk factors such as the lack of condom use, having multiple sexual partners, and low educational levels contribute to the transmission of the infection. We also found that negative cultural practices, illiteracy among women, and the lack of access to screening services during pregnancy are some of the challenges associated with CT mitigation in sub-Saharan Africa. To reduce genital CT transmission in sub-Saharan Africa, efforts must be made by country governments to eliminate negative cultural practices, promote female literacy, and provide access to screening services for pregnant women.

Keywords: • Genital Chlamydia Trachomatis • Adverse Pregnancy Outcomes • Adverse Birth Outcomes • Sub-Saharan Africa

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1. Introduction

In May 2016, the World Health Assembly adopted the Global Health Sector Strategy on Sexually Transmitted Infections (STIs). The overall aim of the strategy was to rapidly scale-up evidence-based interventions and services to eliminate STIs including gonorrhoea and syphilis as a public health issue among adults by 2030 and to also establish a

global baseline for STI incidence.¹ That same year, the World Health Organization (WHO) in recognition of the effects of chlamydia, developed guidelines for the treatment of genital *Chlamydia trachomatis* (CT). The guidelines provide recommendations for the treatment of common CT infections in various populations including pregnant women, using recent evidence.² Despite these global efforts, genital CT

continues to persist, and especially in sub-Saharan Africa.³ In sub-Saharan Africa, about 105 million new genital CT cases occur annually, with about 100 million of those cases occurring in adults,⁴ including pregnant women.

We conducted an ecological study on the relationship between genital CT prevalence, risk factors, and adverse pregnancy and birth outcomes among women and children in sub-Saharan Africa. We searched PubMed, ResearchGate, and Google Scholar using a combination of keywords such as genital CT, adverse pregnancy outcomes, adverse birth outcomes, and sub-Saharan Africa. Of the reviewed 75 English articles published between 1988 and 2020, 47 met our paper's inclusion criteria. This commentary discusses genital CT prevalence, risk factors, and adverse pregnancy and birth outcomes among women and children in sub-Saharan Africa. It also discusses some challenges associated with the mitigation of the disease in sub-Saharan Africa.

2. Prevalence of Genital Chlamydia Trachomatis

The rate of genital CT prevalence varies among women in sub-Saharan Africa. In Tanzania, Ramadhani et al. documented a prevalence rate of 36.2% among infertile women in Mwanza City,⁵ and in Uganda, Kirayira et al. recorded a prevalence rate of 18.2%.⁶ In Rwanda, Vicky et al. found a high prevalence rate of dual genital CT among women after calculating a baseline prevalence of 8.1% at the beginning of their study,⁷ and in Ghana, Abubakari et al. observed that of the 100 asymptomatic female commercial sex-workers screened, 19 tested positive for genital CT.⁸ Among women aged 15 to 49 years attending a gynecology clinic in Ethiopia, Tadesse et al. noted a genital CT prevalence rate of 18.9%.⁹ In South Africa, researchers found that 21.3% of pregnant women living with the human immunodeficiency virus (HIV) were also co-infected with genital CT.¹⁰ In Kenya, researchers reported that 51% of newborns delivered at the Kenyatta National Hospital, tested positive for genital CT.¹¹ The high prevalence of genital CT among women of reproductive age in certain parts of sub-Saharan Africa may be responsible for the elevated number of newborns with genital CT. Unlike most countries in sub-Saharan Africa, researchers found

low genital CT prevalence rates (0.1%) in Southern Nigeria.¹²

3. Adverse Pregnancy and Birth Outcomes Due to Genital Chlamydia Trachomatis

While genital CT is acutely experienced by women in sub-Saharan African countries, the consequences of the infection have been found to be magnified in pregnant women as it can cause pre-term birth, low-birth weight, cervicitis, urethritis, pelvic inflammatory disease,¹³ as well as serve as potential health risks for conjunctivitis, and pneumonia in neonates and infants.¹⁴

3.1. Pre-term Birth

Pregnant women with genital CT are often asymptomatic, however, where there are systems, there is abnormal vaginal discharge, bleeding after sex, or itching and burning with urination. If left untreated, genital CT infection may lead to pre-term birth:¹⁵ the delivery of a live birth before 37 weeks of gestation.¹⁶ Studies suggest that chlamydial infections increase the risk for pre-term delivery and/or low birth weight. As such, pre-term births have been identified as one of the main causes of perinatal morbidity and mortality, accounting for about 27% of the nearly four million reported annual neonatal deaths.¹⁷ They also serve as a risk factor for chronic lung disease, infections, and neurologic disabilities including intracranial hemorrhage, cerebral white matter damage, and cerebral palsy in children.¹⁷ According to Vogel et al., genital CT is a leading contributor to neonatal and child mortality in sub-Saharan Africa.¹⁸ In their study on genital CT in South Africa and Cameroon, van Rensburg and Odendaal noted that pregnant women with genital CT infection were three times more likely to experience pre-term labor (OR 2.8, 95% CI 1.1–6.97) than their uninfected counterparts.¹⁹

3.2. Low-birth Weight

Genital CT places unborn children at risk for low birth weight (babies less than 5 pounds at birth). Low birth weight is a major risk factor for neonate and infant morbidity and mortality, especially in sub-Saharan Africa. While it is unclear how chlamydia

infection results in low birth weight, it is known that maternal infection contributes close to 40% of low birth cases.²⁰ A secondary analysis of 1,373 pregnant women in South Africa showed high rates of low birth weight (43%) and pre-term birth (29%) among women with high genital CT.¹⁷ Complications associated with low birth weight may cause babies to have difficulty eating, gaining weight, or fighting off infections.²⁰

3.3. Miscarriage

According to some researchers, genital CT is a potential trigger for miscarriage, accounting for about 15% of early miscarriages (<12 weeks of gestation) and up to 66% of late miscarriages (>12 weeks of gestation).²¹ In a study conducted to analyze serum, cervicovaginal swab specimens and placenta samples of 386 women, researchers found an increased risk of miscarriage among women who had been exposed to genital CT compared to women who had not been exposed to the infection.²² Researchers noted that during pregnancy, genital CT may infect the fetus, triggering the release of cytokine and thus resulting in miscarriage, premature rupture of membranes, or possibly a maternal inflammatory response.²³ In their study, Auult et al. hypothesized that maternal inflammatory responses to chlamydial heat shock protein (CHSP-60) could cause tubal damage leading to tubal infertility and ectopic pregnancy.²⁴

3.4. Conjunctivitis

Earlier studies have shown that genital CT can be vertically transmitted from mothers to infants during delivery.^{25,26} Those same studies also predicted that approximately 50–70% of infants born to untreated mothers would become infected with genital CT and that 30–50% of those infections would cause conjunctivitis and 10–20% would cause pneumonia.^{25,26} Indeed, studies in sub-Saharan Africa have corroborated these predictions as similarly high rates of genital CT vertical transmission have been recorded among infants.²⁷ In their research in Cameroon, Buisman et al. found that 19.4% of the 449 infants they studied had conjunctivitis that was due to genital CT,²⁸ and upon studying 277 children in Kenya, Datta et al. reported that about 9% of the infants evaluated for conjunctivitis were also infected with genital CT.²⁹

Also known as “pink eye,” conjunctivitis is caused by a viral or bacterial infection of the conjunctiva. Babies often become infected with conjunctivitis during vaginal delivery. Symptoms of the infection include swelling of the eyelids, redness of the eye, and the discharge of pus,³⁰ which usually develops 5–14 days after birth.³¹ Consequences of untreated conjunctivitis in babies are vision loss (in rare cases), neovascularization of the cornea, and scarring.

3.5. Pneumonia

Often underdiagnosed in infants, chlamydial pneumonia tends to be a subacute, afebrile infection that typically occurs in infants between one and three months of age. In younger premature infants, chlamydial pneumonia can be severe, causing apnea and possible hospitalization. Although mortality from chlamydial pneumonia is rare in children, if left untreated, the condition can persist for several weeks and lead to poor feeding, diminished weight gain, asthma, and chronic lung disease at an advanced age. The results of studies conducted on infants in sub-Saharan Africa suggested that genital CT may be a frequent pathogen in lower respiratory tract infections including pneumonia among infants.^{26,32} In a study that evaluated genital CT in infants in Ethiopia, Kenya, and South Africa, researchers noted that genital CT was a frequent isolate (6–51%) from infants with lower respiratory tract infections including pneumonia.^{33–35} Per the Ethiopian study, genital CT was found to be the second most common infectious condition (15.8%) among infants less than 3 months presenting with pneumonia.³³

4. Risk Factors for Genital Chlamydia Trachomatis

Low educational levels, commercial sex, and the lack of condom use are the most common risk factors associated with genital CT prevalence among women in sub-Saharan Africa.

4.1. Low Educational Levels

Researchers attending an out-patient clinic for women of reproductive age at Ahmadu Bello University Teaching Hospital in Northern Nigeria found that low educational level was associated with a greater likelihood of acquiring genital CT.³⁶

In their study on the prevalence of genital CT infection among patients attending infertility and sexually transmitted diseases clinic in Kano, Nigeria, Nwankwo and Sadiq noted that 95.2% of patients including women, were completely ignorant about the infection and its risk factors.³⁷ They noted that women who were educated were more aware of how to prevent genital CT transmission than their illiterate counterparts.

4.2. Commercial Sex

Across sub-Saharan Africa, the demand for transactional sex outside marriage is met by commercial sex workers. In many cities, particularly those in East and Southern Africa, commercial sex workers usually have multiple clients whom they service on a weekly or daily basis. Sexual activities with multiple and repeat clients and higher prices for sex without the utilization of condoms, put commercial sex workers at higher risk for genital CT.^{38,39} Onoyo et al. documented a significant relationship (OR = 2.8, $P < 0.002$) between women with multiple sexual partners and genital CT in South Africa.⁴⁰ In their study in Tanzania, Uthman and Kongnyuy observed that transactional sex enabled commercial sex workers to meet their financial and subsistence needs (as food, rent or school fees) or to have access to lifestyle items such as fashionable clothes, jewelry, or cellphones.⁴¹

4.3. Lack of Condom Use

While condoms are an effective means of reducing the transmission of genital CT, gender power relations and cultural norms in many sub-Saharan African countries make it difficult for women to suggest or negotiate condom use with their partners. Such requests are often met with suspicions of infidelity and even the threat of divorce or violence. Orubuloye et al. concluded that social, cultural, political, and gender-power dynamics within Nigeria constrain women's ability to introduce condoms into their relationships.⁴² It is only in situations where women have more economic resources than their partners that they can negotiate condom use.⁴² The lack of communication among partners concerning condom use, moral values, and religious factors also put women at risk for genital CT.⁴³

5. Challenges with Mitigating Chlamydia Trachomatis Transmission

There are several challenges associated with the mitigation of genital CT among women in sub-Saharan Africa. The most prominent challenges are negative cultural practices, illiteracy, and the lack of access to screening services. Addressing these challenges will help to reduce the transmission both between adults and from mother to child.

5.1. Cultural Practices

Cultural practices such as widow inheritance, sexual cleansing, and polygamy make genital CT prevention in sub-Saharan Africa a challenge. While widow inheritance, the marriage of a widow to her deceased husband's brother, maintains the social and economic welfare of widows and children, it creates extended sexual networks that do not protect the reproductive health of women. Where sexual cleansing rituals for widows are practiced, women are often at high risk for genital CT as cleansers engage in unprotected sex and may perform many rituals throughout their lifetime.⁴⁴ Additionally, culturally sanctioned gender power relations place women in subordinate positions to men, making it difficult for women to refuse unsafe sex or to insist on condom use.

To address these cultural practices, governments and societies in sub-Saharan countries need to promote monogamy (even beyond spousal death), gender equity, uphold the reproductive health of women, implement strategies to reinforce women's right to self-determination, and severely punish perpetrators of acts that violate the reproductive rights of women.

5.2. Illiteracy

Sub-Saharan Africa has the highest illiteracy rate in the world and approximately 70% of the illiterate population are women.⁴⁵ Lack of education often results in a lack of skills and access to job opportunities, money, and assets. These socio-economic conditions push some women to engage in risky sexual behaviors.⁴⁶ In a study conducted to investigate genital CT among asymptomatic female commercial sex workers in Ghana, researchers found that 41% of the women had no formal

education.⁸ They also found that the women were reluctant to seek medical attention for genital CT due to ignorance and the disrespectful treatment they receive from healthcare providers.⁸

Giving women and girls access to education should be at the core of national developmental efforts in sub-Saharan Africa. Through education, women and girls will become informed and empowered to make informed decisions about their reproductive health. This is crucial to the reduction of genital CT acquisition and transmission as literacy has been found to be linked to increased adoption of protective health behaviors.⁴⁷

5.3. Lack of Screening

Most sub-Saharan African countries use the syndromic approach endorsed by the World Health Organization to test for genital CT.⁴ While a good approach, genital CT is often asymptomatic in women. Thus, the total reliance on this approach by health care providers hinders their ability to identify the infection early and to begin early treatment before irreparable damage is done. Additionally, the syndromic approach has the tendency to produce false positive and negative results,⁴ resulting in some women receiving the treatment they do not need and preventing those who need treatment from receiving it, thereby facilitating potential transmission.⁴

To tackle this challenge, health systems in sub-Saharan Africa need to combine the syndromic approach with genital CT screening for pregnant women or women looking to become pregnant, so they may be treated early if they test positive for the infection. This will help to reduce vertical and horizontal transmission.

6. Conclusions and Global Health Implications

The prevalence of genital CT among women in sub-Saharan Africa is high. This causes women who are infected to often experience adverse pregnancy and birth outcomes. Since genital CT is preventable, it is crucial for governments and health systems in sub-Saharan Africa to implement prevention strategies such as the banning of obsolete and harmful cultural practices that

facilitate the transmission of the infection, the elimination of female illiteracy, and the utilization of genital CT screening in addition to the syndromic approach, to stem existing challenges.

Compliance with Ethical Standards

Conflicts of Interest: The authors declare no competing interests.

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Key Messages

- ▶ Genital CT is high among women in sub-Saharan Africa.
- ▶ Factors associated with culture, illiteracy, and the lack of screening serve as challenges to the mitigation of genital CT among women in sub-Saharan Africa.
- ▶ Early diagnosis through screening is crucial for treatment and a good prognosis.

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