ORIGINAL ARTICLE

Prevalence of genital *Chlamydia trachomatis* among women of reproductive age attending outpatient clinic at Kisumu County Referral Hospital, Kenya, 2021

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Abstract

Background. *Chlamydia trachomatis* is a common a sexually transmitted infections (STI). Asymptomatic Chlamydia is undetectable because it is asymptomatic. In Kenyan women ages 18 to 49, the disease is poorly understood.

Methods. This cross-sectional study was conducted at Kisumu County Referral Hospital, Kenya. 385 women consented and completed the electronic questionnaire. The women then provided vaginal swab samples which were tested for *Chlamydia trachomatis* using Chlamydia rapid diagnostic test kit.

Results. A total of 29 (7.5%) patients tested positive and were given medication. 65.2% of 385 participants were 18-25, with 5.7% prevalence. Women preferred self vaginal swab collection over health worker collection (0.3%). Multiple sexual partners, coinfection with other STIs, and upper tract infections are linked to genital Chlamydia. 92% of participants didn't know Chlamydia's effects.

Conclusions. The study's prevalence of genital *Chlamydia trachomatis* was within previous estimates. Populations and screening methods vary. Patient and community education about genital Chlamydia infection is needed. Multiple sexual partners, marital status, education, and STI history are risk factors. Most women preferred self vaginal swab collection.

Keywords: Chlamydia Rapid Diagnostic Test, Sexually-active women, Kenia.

INTRODUCTION

Majority of developing countries like Kenya, clinicians use the syndromic approach in the screening of genital Chlamydia infections. However, this may not be entirely effective for *Chlamydia trachomatis* due to its asymptomatic nature. About 70% to 80% of women are asymptomatic (1). There is a high possibility of failure to detect the Chlamydia trachomatis infections, leading to severe consequences such as ectopic pregnancy, infertility and Pelvic Inflammatory Diseases (PID) (2).

Nucleic Acid Amplification tests (NAATs) have largely replaced non-amplified probe tests and culture, the historical gold standard of Chlamydia diagnosis. This is because of high accuracy, ease and convenience management of specimen, and screening (3). However, NAATs diagnostics requires a patient to re-visit a facility for results. This may cause treatment delay, and in some circumstances no treatment if the patient fails to re-appear. This may contribute to higher prevalence rates.

With the availability of newer diagnostic techniques, particularly a rapid immunoassay-based Chlamydia Rapid Diagnostic Test Kit (RDT). The RDT detects *Chlamydia trachomatis* antigen in vaginal swab specimens, allows testing and providing same-day results. The patients are then given treatment in case they test Chlamydia positive. The kit is effective, and can diagnose Chlamydia infection with specificity (99.6%) and sensitivity (87%) (4).

Chlamydia trachomatis infection treatment is easy and efficient, and in prevention of complications. A single dose of azithromycin (1g) is recommended or 100 mg twice daily for seven days of doxycycline (5). The cure rate of azithromycin is 97% (5). Apart from reducing the total burden of disease, screening and treating women also serves as a primary prevention strategy for men.

Knowledge, awareness, epidemiology, and reproductive health education of genital Chlamydia infections among sexually active women in Kisumu County Referral Hospital and Kisumu County, in general, are minimal. Therefore, this study will use a point-of-care (POC) approach to bridge the gap of knowledge and awareness, investigate the prevalence of chlamydia infections, and assess predisposing factors associated with genital chlamydia infections among sexually active women attending outpatient clinics at Kisumu County Referral Hospital, Kenya.

MATERIALS AND METHODS

Ethics Consideration

Ethical approval to conduct the study was sought from the joint University of Ibadan and University College Hospital Ethics and Review Board, Nigeria (UI/EC/21/0153), and from Jaramogi Oginga Odinga Teaching and Referral Hospital Institution Ethics Review Committee, Kenya (IERC/JOOTRH/407/21), Pharmacy and Poisons Board; and National Commission for Science, Technology and Innovation (NACOSTI/P/21/10689), Kenya. Written informed consent was sought from the study participants before the commencement of the data collection process. Unique code identifiers were used instead of participant names for confidentiality. No other personally-identifying information was collected. The participant's name only appeared in the consent forms that were under lock and key accessible only by authorized personnel. The electronic gadget was password-protected.

Setting and population

This is a cross-sectional study that was conducted in Kisumu County Referral Hospital Kenya, Kenya. The study aimed to assess the knowledge and awareness, predisposing factors, and prevalence of genital Chlamydia infection in sexually active females of reproductive age. The study population was selected among sexually active women attending the outpatient clinic. The study period was from 3rd May to 3rd June 2021.

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Women were informed about the study by the investigator at the waiting bay. Participants were excluded if they were on chronic antibiotic treatment, on their menstrual period, declined to consent, virgin or pregnant. A total of 385 women aged 18 to 49 years were enrolled after signing the informed consent (Figure 1).

Sample Collection and analysis

Electronic questionnaires were administered to participating women to collect socio-demographics, sexual history, STI history, antibiotic/antifungal drug use. Vaginal swab sample was collected either by health worker or self-collection depending on the participant's choice. Chlamydia testing was conducted by the principal investigator using Chlamydia Rapid Test Device, a rapid immunoassay test manufactured by Quingdo Hightop Biotech Co., Ltd. Shandong, 266112, China. The test had an in-built procedural control. Known positive and negative control samples (supplied with each kit) were run concurrently with test samples.

With the help of trained health personnel, the participants were provided with gloves and directed to a private room with a stool. She undressed to expose only the vaginal area and got in a comfortable position (putting one leg on a stool) for self-collection procedure. A vaginal swab was collected using a sterile plastic shaft cotton-tipped swab stick. The swab was inserted into the vaginal canal ensuring most of the tip was not seen. The swab was firmly rotated for 15–20 seconds and then withdrawn from the vaginal canal. The swab was immersed into the mixing tube and capped, and then handed over to the investigator. The same procedure was applied when the health provider collected the sample.

Chlamydia trachomatis testing

The health provider added six drops of extraction solution A (0.2 M sodium hydroxide) into the mixing tube. After the extraction of the sample for 2 minutes, six drops of extraction solution B (0.2 M hydrochloric acid) were added and mixed. The swab then was squeezed against the side of the tube to expel as much liquid as possible. The swab was discarded, and a cap placed on the mixing tube. Three drops of the extracted sample from the mixing tube were added to the Chlamydia test card (sample well). The swab was tested using Chlamydia rapid test kit. The test results were read after 15 minutes. In the absence of a band in the control region, the test result was considered invalid. A positive result showed two bands at the test and control regions. A negative result showed one band at the control region.

Data management and statistical analyses

Data analysis was imported from Google Forms as a comma-separated version Excel file. Preliminary data cleaning processes, the creation of dummy variables, and data curation was carried out before any analysis was carried out. The analyses were performed using Stata version 15 (Lakeway Drive, College Station, TX, USA). We computed descriptive statistics such as mean, median, interquartile range, and minimum and maximum values to assess distributions and overall data quality.

We used the Pearson's Chi-square test to test for independence of proportions for categorical variables and logistic regression to test for predisposing factors associated with genital Chlamydia infection. We carried out bivariate analysis for logistic regression, and characteristics associated with the outcome. Variables that had significance of p-value <0.05 in the bivariate analysis were included in the final multivariate model. For the final tests and inference, p-values < 0.05 were considered statistically significant. Results were presented in tables and figures alongside explanatory text.

RESULTS

Participants demographic and clinical characteristics

Patients were recruited for one month, May, 2021. A total of 400 women were approached, and 391 (97.8%) fulfilled the eligibility criteria. Nearly all 385/391 (98.5%) women participated in the study as 6 women could not participate because some were in a hurry while others were not ready and promised to participate next time. We attained 100% of the sample size with the 385 who participated (Figure 1). The minimum age of participants was 18 years, and the maximum age of 49 years.

The age group that had the highest attendance in the hospital was 22-25 years' group 38.2% (147/385) as compared to 18-21 years 27.0% (104/385), 26-35 years 21.6% (83/385), and 36-49 years 13.3% (51/385). Single participants, 35.3% (136/385), were the most enrolled as compared to the married monogamy 33.0% (127/385), married polygamy (22.3% 86/385), divorced 5.9% (23/385), and widowed 3.4% (13/385).

Participants who had their educational level of secondary school had the highest attendance of 38.2% (147/385) when we compared to primary level 34.3% (132/385), tertiary level 26.2% (101/385), and participants who had no primary education 1.3% (5/385).

Participants who had multiple sexual partners in the past three months showed higher attendance of 53.8% (207/385) than those with one partner 46.2% (178/385). Condom use among participants was as follows: not using condoms 60.8% (234/385), using condoms sometimes 32.0%, and using condoms 7.0% (27/385).

Prevalence of *Chlamydia trachomatis*

A total of 29 (7.5%) participants were positive for *C. trachomatis* out of the 385 patients who were tested.

The age range, 18-21 and 22-25 had the highest positive cases 10.6% (11/104) and 7.5% (11/147) in the study respectively, followed by age range 26-35 presenting with 6% (5/83) positives and 3.9% (2/51) positives for the age range of 36-49. However, cumulatively the prevalence of the disease in among the Kisumu County Referral Hospital outpatient clinics is 7.5%. In general, the prevalence of the *Chlamydia trachomatis* did not vary by age group (p-value=0.456).

In relation to marital status, married polygamy had the highest number of positives, 14/86 (16.3%) in this study, this was closely followed by the singles 12/136 (8.8%), and then married monogamy 3/127 (2.4%). Divorced and widowed participants had zero positive cases. In general, the prevalence of the *Chlamydia trachomatis* in relation to marital status was statistically significant (p value=0.001).

All participants who tested positive for *Chlamydia trachomatis*, had education level 29/280 (7.6%); 16/132 (12.1%) positive for primary level, 12/147

(8.2%) for secondary level and 1/101(1%) for tertiary level. In general, the prevalence of the *Chlamydia trachomatis* in relation to marital status was statistically significant (p value=0.014).

Of the total positive participants, 28/207(13.5%) had more than one sexual partner in the last three months. Only one participant who tested positive 1/178 (0.6%) had one sexual partner during the previous three months. The prevalence of the *Chlamydia trachomatis* was higher among women who had more sexual partners (p-value <0.001).

In relation to condom use, participants who tested positive for the disease were as follows, 14/123 (11.4%) only used condoms sometimes, 12/234 (5.1%) did not use condoms at all while 3/27 (11.1%) used condoms consistently. In general, the prevalence of the *Chlamydia trachomatis* in relation to marital status was not statistically significant (p value =0.080). (Table 1)

Factors associated with *Chlamydia trachomatis* infection

howsbivariate analysis, having multiple sexual partners' odds ratio (OR) 27.7, (95% confidence interval (CI): 3.7, 205.7), using condoms sometimes compared to no condom use OR 2.4, (95% CI: 1.1, 5.3), women living with HIV OR 3.7, (95% CI: 1.5, 9.5), Gonorrhea OR 3.9, (95% CI: 1.2, 12.6), Syphilis OR 2.8, (95% CI: 1.1, 7.1), or upper tract infections OR 5.5(95% CI: 2.4, 12.8), and having multiple STIs compared to none were associated with *Chlamydia trachomatis* infection. Factors independently associated with *Chlamydia trachomatis* infection were; having 2-5 sexual partners compared to only one adjusted odds ratios (aOR) 15.7, (95% CI: 2.1,120), women living with HIV aOR 4.0, (95% CI: 1.3,12.5), and having upper tract infections aOR 4.3, (95% CI: 1.8,10.7).

Knowledge and awareness of Chlamydia trachomatis

Out of the total women who participated, 47.5% had the knowledge what Chlamydia is, 41.3% had no idea, 11.2% thought Chlamydia would be either a vaginal infection, post-delivery complication or a pregnancy complication. Participants who had knowledge about the symptoms of chlamydia infection were 34.5%, those who didn't have any idea

were 36.9% while those who were not sure were 28.6%.

Participants who had knowledge on how one can acquire Chlamydia were 35.6%, those who didn't have any idea were 35.3%, other participants 29.1% were not sure how the disease can be acquired (they thought it could be through family planning, toilet, hugging or kissing).

Women who knew if Chlamydia affects fertility were 8.6%, 58.4% didn't know if the disease affects fertility while 33% said that Chlamydia does not affect fertility. Of all participants, 25.5% said that only women could have Chlamydia infection, 39.7% said that Chlamydia infection is for both genders, while 34.8% didn't know.

Participants who had knowledge that Chlamydia infection could be treated were 56.4%, 7.3% had knowledge that it could be treated while 36.4% were not aware. Slightly over half (51.4%) of women were aware that one could be infected with Chlamydia more than once in a lifetime (12.2%) were not aware while 36.4% didn't know. Women who were aware that condom use could prevent Chlamydia infection were 49.1%, 16.6% were not aware while 34.3% didn't know if condom use could prevent Chlamydia infection.

DISCUSSION

The prevalence (7.5%) of genital Chlamydia infection in this study is within the estimates (3% and 14.9%) of previously published reports in Kenya. The prevalence presented in this study was higher than an equivalent study that was conducted in Nairobi, Kenya 6% (6) and 3% (7), but lower than the prevalence reported by Maina et al., 2016, 13% (8). Even if the samples and screening methods vary in the studies, the prevalence we have reported in our study may indicate that incident rates are still high in the Kisumu population.

A similar survey carried out in Iraq using the One-Step Chlamydia test showed a prevalence of 2.7% (9). Although women aged 18-25 years old had the highest attendance rate (65.2%) than women aged 26-49 years (34.8%), women aged 26-49 years old had the highest prevalence 26-49 (5.2%) compared to 18-25 years old (4.8%).

This study showed no association between age and women testing positive cases (p value=0.456), but 75.9% (22/29) of women aged 18-25years old tested positive. However, the prevalence was highest among 18-25 years old, the same as the results found in Ghana (66.6%) (10).

In developing countries, unlike the developed countries, most studies do not focus on age. Researchers have reported that younger women, >25 years, are at a higher risk of genital Chlamydia infection (11). The same was also noted in this study. In this study population, we didn't include younger women, and we limited the women to those of reproductive age, thus excluding teenage girls below 18 years who are sexually active. Therefore, there is a possibility we missed women with higher risks of Chlamydia.

Patients who had more than one sexual partner in the last three months had a higher prevalence of genital Chlamydia infection than those who had only one. Our findings retell what has already been published that multiple sexual partners is a risk factor for genital Chlamydia (9). Most patients who tested positive for Chlamydia were married (polygamy) and single women, further highlighting the high risks associated with multiple sexual partners.

In Kenya, only one study has been published using Chlamydia RDK. The method is acceptable because it is non-invasive, and patients obtain results and treatment on the same visit. All (100%) patients who tested positive for genital Chlamydia trachomatis were given medication in this study. The majority (99.7%) preferred self-collection of cervical swabs samples as compared to the collection by the health worker (0.3%). Knowledge of Chlamydia infection may also be a gap since more than half of the women were not familiar with genital Chlamydia infection. This could be due to STIs education, and screening campaigns do not focus majorly on Chlamydia, and also its asymptomatic nature.

The findings in this report are subject to at least four limitations. First, the questionnaire was limited in the number of questions since the women could not be delayed unnecessarily. More questions would

enable us to gather more information on the predisposing risk factors and knowledge about Chlamydia infection. Second, the responses to questions asked in face-to-face interviews are subject to social desirability and may not reflect the real truth. Measuring this bias without corroborating the finds (e.g., with clinical information from charts) is difficult. Thirdly, treatment was only offered to the women who tested positive for Chlamydia trachomatis, and the partners were not involved. There may be high chances of reinfection because the partners might be infected as well. Finally, the study was not strengthened by patients charts review since the set-up was outpatient.

CONCLUSIONS

The overall prevalence of genital *Chlamydia trachomatis* in the study was within the estimates of previous studies. However, the study populations and screening methods vary. Multiple sexual partners, co-infection with other STIs, and upper tract infections were independently associated with Chlamydia trachomatis infection. There is a considerable gap in current awareness about genital Chlamydia infection. Therefore, there is a need for patient and community education on risk factors and encourage young women to be screened. These results provide important evidence that there is a need to launch active screening of sexually active women.

INFORMATION

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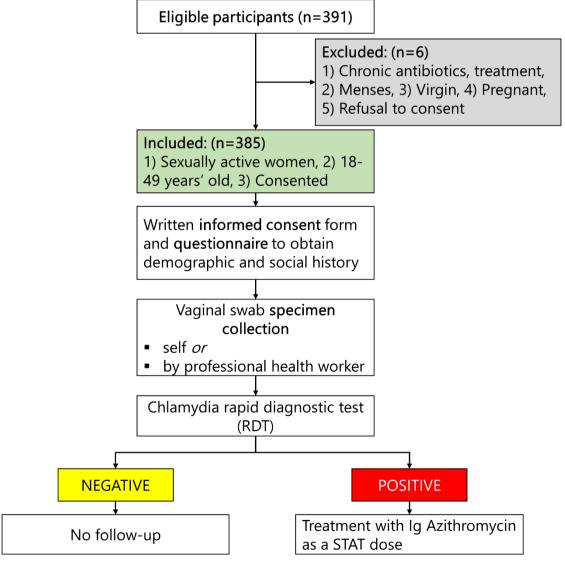
FIGURE 1: Participants recruitment, eligibility, inclusion, and exclusion criteria.

TABLE 1: Prevalence of genital Chlamydia infection among women 18-49 years old, Kisumu County Referral Hospital, Kenya 2021.

	Total No.	Positive n (%)	Negative n (%)	Chi-square *p*
All	385	29 (7.5)	356 (92.5)	(--)
Age				0.456
18-21	104	11 (10.6)	93 (89.4)	
22-25	147	11 (7.5)	136 (92.5)	
26-35	83	5 (6)	78 (94)	
36-49	51	2 (3.9)	49 (96.1)	
Marital status				0.001
Divorced	23	0 (0)	23 (100)	
Married (Monogamy)	127	3 (2.4)	124 (97.6)	
Married (Polygamy)	86	14 (16.3)	72 (83.7)	
Single	136	12 (8.8)	124 (91.2)	
Widowed	13	0 (0)	13 (100)	
Education				0.014
None	5	0 (0)	5 (100)	
Primary	132	16 (12.1)	116 (87.9)	
Secondary	147	12 (8.2)	135 (91.8)	
Tertiary	101	1 (1)	100 (99)	
Partners last 3 months				<0.001
1	178	1 (0.6)	177 (99.4)	
2 to 5	207	28 (13.5)	179 (86.5)	
Condom use				0.080
No	234	12 (5.1)	222 (94.9)	
Sometimes	123	14 (11.4)	109 (88.6)	
Yes	27	3 (11.1)	24 (88.9)	

TABLE 2: Predisposing factors and their association with *Chlamydia trachomatis* infection among women 18-49 years old, Kisumu County Referral Hospital, Kenya 2021.

Predisposing factors	N	*Chlamydia trachomatis* positive, n(%)	Odds Ratio (95%CI)	Adjusted Odds Ratio (95%CI)
Sexual partners in last 3 months				
1	178	1 (0.6)	ref.	
2 to 5	207	28 (13.5)	27.7 (3.7, 205.7)	15.7 (2.1,120)
Condom use				
No	234	12 (5.1)	ref.	
Sometimes	123	14 (11.4)	2.4 (1.1, 5.3)	
Yes	27	3 (11.1)	2.3 (0.6, 8.7)	
HIV				
No	350	22 (6.3)	ref.	
Yes	35	7 (20)	3.7 (1.5, 9.5)	4.0 (1.3,12.5)
Gonorrhea				
No	367	25 (6.8)	ref.	
Yes	18	4 (22.2)	3.9 (1.2, 12.6)	4.0 (0.9,17.4)
Syphilis				
No	342	22 (6.4)	ref.	
Yes	43	7 (16.3)	2.8 (1.1, 7.1)	2.6 (0.9,7.5)
UTI				
No	249	8 (3.2)	ref.	
Yes	136	21 (15.4)	5.5 (2.4, 12.8)	4.3 (1.8,10.7)
Multiple STIs				
None	180	3 (1.7)	ref.	
One	183	16 (8.7)	5.7 (1.6, 19.8)	
Two - three	22	10 (45.5)	49.2 (11.9, 202.7)	