



A Cross-Sectional Study on the Seroprevalence of Chlamydia trachomatis at the Cité-Verte District Hospital, Yaoundé Cameroon

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Abstract: -

Background: *Chlamydia trachomatis* (CT) is a prevalent sexually transmitted infection, with an estimated 128 million new cases annually. While its high global prevalence, particularly in young people, and its often-asymptomatic nature are well-known, localized data, especially in high-risk populations, remains scarce. This study aimed to determine the seroprevalence of CT and its associated risk factors among patients at the Cité-Verte District Hospital in Yaoundé, Cameroon.

Methods: From March to July 2025, we conducted a cross-sectional study of 210 patients seeking care for urogenital issues or undergoing STI screening. Anti-Chlamydia trachomatis IgG antibodies were detected in blood samples using an ELISA kit to indicate past or chronic infection. Sociodemographic and clinical data were collected, and statistical analyses were performed using SPSS 25.0 to identify associations.

Results: The seroprevalence of *C. trachomatis* was high, with 23% (49/210) of participants testing positive. While a broader analysis of risk factors on a subsample of 74 participants didn't yield significant associations, an exploratory multivariate regression revealed a strong link between inconsistent condom use and CT positivity. Specifically, those who never used condoms had an 11-fold higher risk of infection (adjusted odds ratio [AOR] = 11.00; 95% CI: 1.50–17.00) compared to those who always used them. A history of a diagnosed STI also showed a suggestive association (AOR = 2.90; 95% CI: 0.40–16.10). The study also noted a higher prevalence in males (33.3%) than females (28.3%).

Conclusion: The high CT seroprevalence highlights a significant public health burden in this hospital-based population. The strong association with inconsistent condom use underscores the critical need for targeted public health campaigns promoting consistent condom use. Future research with larger sample sizes is needed to confirm these findings and better understand the behavioural determinants of CT infection.

Keywords: *Chlamydia trachomatis*, Anti-Chlamydia IgG, risk factors, Yaoundé, Cameroon.

Article History

Received: 17.03.2026

Accepted: 20.05.2026

Published: 10.06.2026



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Cite this article:

Makemgue, L. S., Mbaga, D. S., Ndengué, J. D. M., Essindi, J. O., Njiki-Bikoï, A. U., Njiki-Bikoï, J., (2026). A Cross-Sectional Study on the Seroprevalence of Chlamydia trachomatis at the Cité-Verte District Hospital, Yaoundé Cameroon. *ISAR Journal of Medical and Pharmaceutical Sciences*, 4(6), 1-8.

Introduction

Chlamydia trachomatis is a leading cause of sexually transmitted infections (STIs) globally, with the World Health Organization (WHO) estimating an annual incidence of 128 million new cases [1]. *C. trachomatis* is also the most common notifiable bacterial STI in many developed countries, including Australia [2]. This prevalence is particularly high among young people, especially those under 25, due to their sexual activity patterns [3]. Furthermore, *C. trachomatis* is the bacterium responsible for trachoma, the world's primary infectious cause of blindness [4].

A significant challenge in controlling *C. trachomatis* infections is their often-asymptomatic nature. The majority of infections in women (up to two-thirds) and about half of those in men present without symptoms, creating a large reservoir of unrecognized infected individuals who can unknowingly transmit the pathogen [5,6].

When left untreated, *C. trachomatis* can lead to severe complications. In women, these can include pelvic inflammatory disease (PID), chronic pelvic pain, ectopic pregnancy, and infertility [2,3]. Up to a third of ectopic pregnancies and two-thirds of cases of tubal infertility may be directly linked to *C. trachomatis* infection [2]. Infections during pregnancy can also result in adverse outcomes such as miscarriage, stillbirth, prematurity, and low birth weight. Transmission from mother to newborn during delivery can cause conjunctivitis and pneumonia [6]. While the role of *C. trachomatis* in male infertility is still debated, it can impair sperm motility [5]. The economic impact of *C. trachomatis* is also substantial; in the U.S. alone, the lifetime medical costs from infections acquired in 2018 by young adults were estimated at around \$0.5 billion, with women incurring approximately 91% of this cost [3].

Several factors increase the risk of acquiring *C. trachomatis* infection. Behavioral risk factors include having a new or multiple sexual partners, unprotected sex, and a history of other STIs. Biological factors such as being female and young (under 25) also significantly increase susceptibility. Additionally, socioeconomic factors like poverty and lack of access to healthcare and education can contribute to higher rates of infection. The asymptomatic nature of the infection itself is a major risk factor for continued transmission, as infected individuals are unaware of their status and may not seek treatment, thereby continuing to spread the bacteria [4,5,7-10].

Given the high prevalence and asymptomatic nature of *C. trachomatis* infections, screening is crucial for disease control and prevention [10]. Economic evaluations have consistently shown that screening for genital *C. trachomatis* is a cost-effective public health intervention due to its ability to prevent severe morbidity [10].

The development of non-invasive nucleic acid amplification tests (NAATs) has been a significant advancement, allowing for widespread screening in non-clinical settings using easily collected specimens like urine, cervical, or vaginal swabs [7,11]. These molecular tests have shown excellent sensitivity and specificity and can be effectively implemented through self-sampling, making them highly accessible in low-resource settings [1,9].

For surveillance purposes, particularly for trachoma, serological testing for *C. trachomatis* antibodies is a promising approach [4].

The longevity of these antibody responses allows for the assessment of population-level transmission trends over time [4]. This method can help in optimizing public health strategies and differentiating between districts that are above or below trachoma elimination thresholds [4].

Despite these advances, challenges remain. Repeat infections are common after treatment [2]. Antenatal screening for *C. trachomatis* is not yet a standard of care in most developing countries due to a lack of laboratory infrastructure and financial resources, though point-of-care molecular tests could be a scalable solution [6]. This study aimed to determine the seroprevalence of *Chlamydia trachomatis* and its associated risk factors among patients at the Cité-Verte District Hospital in Yaoundé, Cameroon.

Methodology

Study Design and Setting

This cross-sectional study was conducted from March to July 2025, allowing for efficient and concentrated data collection. Ethical approval was obtained from the Centre Regional Ethics Committee for Human Health Research (CEN°007496CRERSHC/2025) and the administrative staff of the Cite-verte District Hospital.

Study Population and Sampling

Target Population

The target population comprised patients visiting the hospital for urogenital issues and those undergoing a screening for sexually transmitted infections (STIs).

Sample Size and Sampling Technique

The minimum sample size was calculated using the formula of Snedecor and Cochran $n = \frac{Z^2 \times P \times (1-P)}{d^2}$ [12] for estimating a proportion in a population with a specified precision and confidence level. With n: sample size, Z: normal distribution value for a 95% confidence level (1.96), P: estimated prevalence of Chlamydia was 15.1% in South African clinic/community-based populations [13], d: maximum acceptable error (0.05). Based on this calculation, the minimum required sample size was 197 patients.

Data and Sample Collection

A standardised form was used to collect sociodemographic information (age, sex, occupation, education level) and relevant clinical data (reason for consultation, history of STIs).

Blood Collection

This included Vacutainer® holders, sterile single-use needles or syringes, tourniquets, alcohol swabs or disinfectant wipes, single-use medical gloves, and adhesive bandages. Dry tubes with or without a separator gel for serum collection. Sharps containers for the safe disposal of needles, compliant with biosafety standards. Blood samples were collected by qualified healthcare professionals (nurses, laboratory technicians) following standardised procedures and aseptic and biosafety protocols. Patient identity was verified, the procedure was explained, and the patient was positioned comfortably. A tourniquet was applied, a suitable vein was identified and disinfected, and sterile gloves were put on. The needle was inserted bevel up at an angle of less than 30° into the vein. A sufficient volume of blood (approximately 5 mL) was

collected into the appropriate tubes, followed by the release of the tourniquet. The needle was removed, a sterile compress was applied, and the needle was immediately and safely disposed of in a sharps container. Tubes were labelled with patient information and transported to the laboratory under appropriate temperature conditions.

Laboratory Analysis

A centrifuge for serum separation and micropipettes (automatic or variable volume) with sterile single-use tips. A Commercial Human Anti-Chlamydia trachomatis antibody (IgG) ELISA Kit - LS-F10228 was used based on their validated sensitivity and specificity, in accordance with international standards. The serological tests were conducted by experienced laboratory technicians at the Cite-Verte District Hospital in strict adherence to the manufacturer's instructions for the ELISA kit. Blood tubes were centrifuged at 3000 rpm for 10 minutes to separate the serum. All kit reagents were brought to room temperature (20–25°C). Patient serum samples and kit-provided positive and negative controls were added to the microplate wells. The plate was incubated for 60 minutes at 37°C, allowing patient antibodies to bind to the antigens. The wells were washed five times to remove unbound antibodies. An enzyme-labelled secondary antibody (HRP-labelled anti-human IgG) was added to each well. The plate was incubated for another 60 minutes at 37°C. The wells were washed three times to remove excess conjugate. A chromogenic substrate was added, and the plate was incubated for 10–15 minutes in the dark. A stop solution was added to halt the reaction and stabilise the colour. The absorbance of each well was measured at 450 nm using a microplate reader.

Interpretation of Serological Results

Results were interpreted based on the optical density (OD) values compared to a cut-off threshold determined by the kit manufacturer. OD of the sample was greater than or equal to the cut-off value, indicating the presence of anti-C. trachomatis antibodies. OD of the sample was less than the cut-off value, indicating the absence of antibodies. The presence of IgG indicates a past or chronic infection.

Statistical Analysis

All data were entered into a spreadsheet (Microsoft Excel®) and analysed using SPSS 25.0 statistical software. Figures were created with Excel®. The normality of quantitative variable distributions was assessed using the Shapiro-Wilk and Kolmogorov-Smirnov tests. Both univariate and multivariate regression analyses were performed to identify associations between variables. A p-value < 0.05 was considered statistically significant.

Result

Characteristics of the Study Population and prevalence of *Chlamydia trachomatis*

The study involved a population of 210 participants. The average age of this group was approximately 30.6 ± 10.2 years, with a minimum age of 13 and a maximum age of 71. The median age was 28 years. Based on the pie chart, the results show that out of a total of 210 participants tested for chlamydia, the majority, 161 individuals (77%), tested negative. In contrast, a smaller portion, 49 individuals (23%), tested positive for the infection (figure 1).

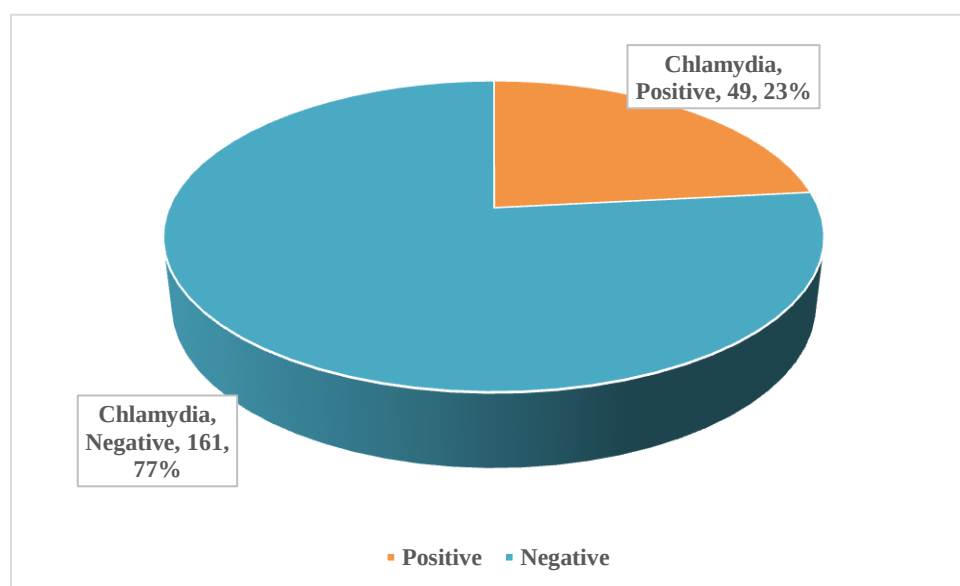


Figure 1: Prevalence of *Chlamydia trachomatis* among study participants

Demographic and behavioural characteristics of study participants

These demographic and behavioural characteristics analysis involved 74 participants, with a mean age of 29.2 ± 10.9 years and a median age of 24.5 years. The age range spanned from 17 to 59 years. Most participants were female (71.6%) and single (77.0%). The largest age group was 17-26 years (58.1%). Regarding

socioeconomic status, a majority of the participants had a higher education level (70.3%) and were unemployed (63.5%).

Sexual practices and STI risk factors

The analysis of sexual practices and risk factors for sexually transmitted infections (STIs) revealed several key findings. The mean age of sexual debut was 18.6 ± 2.8 years. Among the sexually active participants, the mean number of partners in the last

12 months was 1.4 ± 0.9 , with a range of 0 to 5. A majority of participants (70.3%) reported having one partner in the last year. Condom use varied among the participants: 48.6% reported using them "sometimes," while 25.7% reported "always" and "no" use, respectively. A small percentage of participants had a history of diagnosed STIs (13.5%) or reported symptoms suggestive of an STI (28.4%) (table 1).

3.2.2. Other health-related behaviours

Other behaviours and medical histories were infrequent among the participants. The prevalence of tattoos or piercings was 1.4%. The history of blood transfusions (6.8%), surgery (9.5%), and scarification (4.0%) was also very low (table 1).

Table 1: Medical and behavioural history

<i>Characteristics</i>	<i>Categories</i>	<i>n</i>	<i>(%)</i>
<i>Age class</i>	[17-26]	43	58.1
	[27-36]	13	17.6
	[37-46]	10	13.5
	[47-56]	7	9.5
	[57-66]	1	1.3
<i>Sex</i>	Female	53	71.6
	Male	21	28.4
<i>Education level</i>	High school	22	29.7
	Higher education	52	70.3
<i>Occupation</i>	Employed	27	36.5
	Unemployed	47	63.5
<i>Marital status</i>	Married	17	23.0
	Single	57	77.0
<i>Age at first intercourse</i>	< 18	26	35.1
	≥ 18	48	64.9
<i>Number of partners in the last 12 months</i>	0	3	4.0
	1	52	70.3
	≥ 2	19	25.7
<i>Condom use</i>	Always	19	25.7
	No	19	25.7
	Sometimes	36	48.6
<i>Diagnosed STI history</i>	No	64	86.5
	Yes	10	13.5
<i>Symptoms of an STI</i>	No	53	71.6
	Yes	21	28.4
<i>Partner STI</i>	No	64	86.5
	Yes	10	13.5
<i>Blood transfusion</i>	No	69	93.2
	Yes	5	6.8
<i>Surgery</i>	No	67	90.5
	Yes	7	9.5
<i>Tattoo/piercing</i>	No	73	98.6
	Yes	1	1.4
<i>Scarification</i>	No	71	96.0
	Yes	3	4.0

STI: Sexual transmitted infections

Association Analysis

An association analysis was conducted on the 74 participants to explore the links between Chlamydia positivity and various sociodemographic and behavioural characteristics. The distribution of Chlamydia positivity showed that 28.3% of females and 33.3% of males tested positive. The sociodemographic and behavioural characteristics revealed no statistically significant associations with *Chlamydia trachomatis* positivity, with all p-values exceeding 0.05. Although not statistically significant, certain trends were

observed. For instance, participants with a history of a diagnosed STI had a higher prevalence of Chlamydia (50%) compared to those without (26.6%). Similarly, individuals who reported never using condoms showed a higher Chlamydia positivity rate (42.1%) than those who always used them (10.5%). The smallest confidence intervals and the most suggestive p-values were noted for condom use and a history of a diagnosed STI, indicating these variables may warrant further investigation in a larger cohort (table 2).

Table 2: Distribution of Chlamydia test positivity according to participants' sociodemographic and behavioural characteristics

Characteristics	Category	Chlamydia			
		Negative n(%)	Positive n(%)	95% CI	P-value
Sex	Female	38 (71.7)	15 (28.3)	(17.2-42.6)	0.7
	Male	14 (66.7)	7 (33.3)	(15.5-56.9)	
Education level	High school	17 (77.3)	5 (22.7)	(8.7-45.8)	0.4
	Higher education	35 (67.3)	17 (32.7)	(20.7-47.2)	
Occupation	Employed	19 (70.4)	8 (29.6)	(14.5-50.3)	1
	Unemployed	33 (70.2)	14 (29.8)	(17.8-45.1)	
Marital Status	Married	13 (76.5)	4 (23.5)	(7.8-50.2)	0.5
	Single	39 (68.4)	18 (31.6)	(20.3-45.4)	
Age at First Intercourse	< 18	19 (73.1)	7 (26.9)	(12.4-48.1)	0.8
	≥ 18	33 (68.8)	15 (31.2)	(19.1-46.4)	
Number of Partners in the last 12 months	≥ 2	12 (63.2)	7 (36.8)	(17.2-61.4)	0.7
	0	2 (66.7)	1 (33.3)	(1.8-87.5)	
	1	38 (73.1)	14 (26.9)	(16-41.3)	
Condom Use	Always	17 (89.5)	2 (10.5)	(1.8-34.5)	0.06
	No	11 (57.9)	8 (42.1)	(21.1-66)	
	Sometimes	24 (66.7)	12 (33.3)	(19.1-51.1)	
Diagnosed STI History	No	47 (73.4)	17 (26.6)	(16.7-39.3)	0.1
	Yes	5 (50.0)	5 (50.0)	(23.7-76.3)	
Symptoms of an STI	No	39 (73.6)	14 (26.4)	(15.7-40.6)	0.4
	Yes	13 (61.9)	8 (38.1)	(19-61.3)	
STI partner	No	44 (68.8)	20 (31.2)	(20.6-44.2)	0.7
	Yes	8 (80.0)	2 (20.0)	(3.5-55.8)	
Blood Transfusion	No	49 (71.0)	20 (29.0)	(19-41.3)	0.6
	Yes	3 (60.0)	2 (40.0)	(7.3-83)	
Surgery	No	48 (71.6)	19 (28.4)	(18.3-40.9)	0.6
	Yes	4 (57.1)	3 (42.9)	(11.8-79.8)	
Tattoo Piercing	No	52 (71.2)	21 (28.8)	(19.1-40.7)	0.3
	Yes	0 (0.0)	1 (100.0)	(5.5-100)	
Scarification	No	49 (69.0)	22 (31.0)	(20.8-43.2)	0.5
	Yes	3 (100.0)	0 (0.0)	(0-69)	

Univariate Regression

Univariate regression analysis was performed to identify associations between risk factors and Chlamydia infection. The forest plot visualises the adjusted odds ratio (AOR) for each factor. "No" condom use was associated with an AOR of 6.20 (95% CI: 1.20–16.30) and "Sometimes" use with an AOR of 4.20 (95% CI: 0.90–19.60). A history of diagnosed STIs had an AOR of 2.80 (95% CI: 0.60–11.10). Other factors such as profession (unemployed), marital status (single), number of partners (≥ 2), symptoms of an STI, blood transfusion, surgery, tattoo/piercing, and scarification all had AORs greater than 1, but with wide confidence intervals that included 1 (figure 2).

Multivariate Regression

Multivariate regression analysis was also conducted. This analysis showed that "No" condom use had a strong association with Chlamydia infection, with an adjusted odds ratio (AOR) of 11.00 (95% CI: 1.50–17.00). Other factors, such as "Sometimes" condom use and a history of diagnosed STIs, also showed associations, with AORs of 4.40 (95% CI: 0.70–15.30) and 2.90 (95% CI: 0.40–16.10), respectively. The AORs for other variables like profession, marital status, and age at first intercourse were less than 2, with confidence intervals crossing 1. The AOR for scarification was 8.90 (95% CI : NA–7.50) (figure 3).

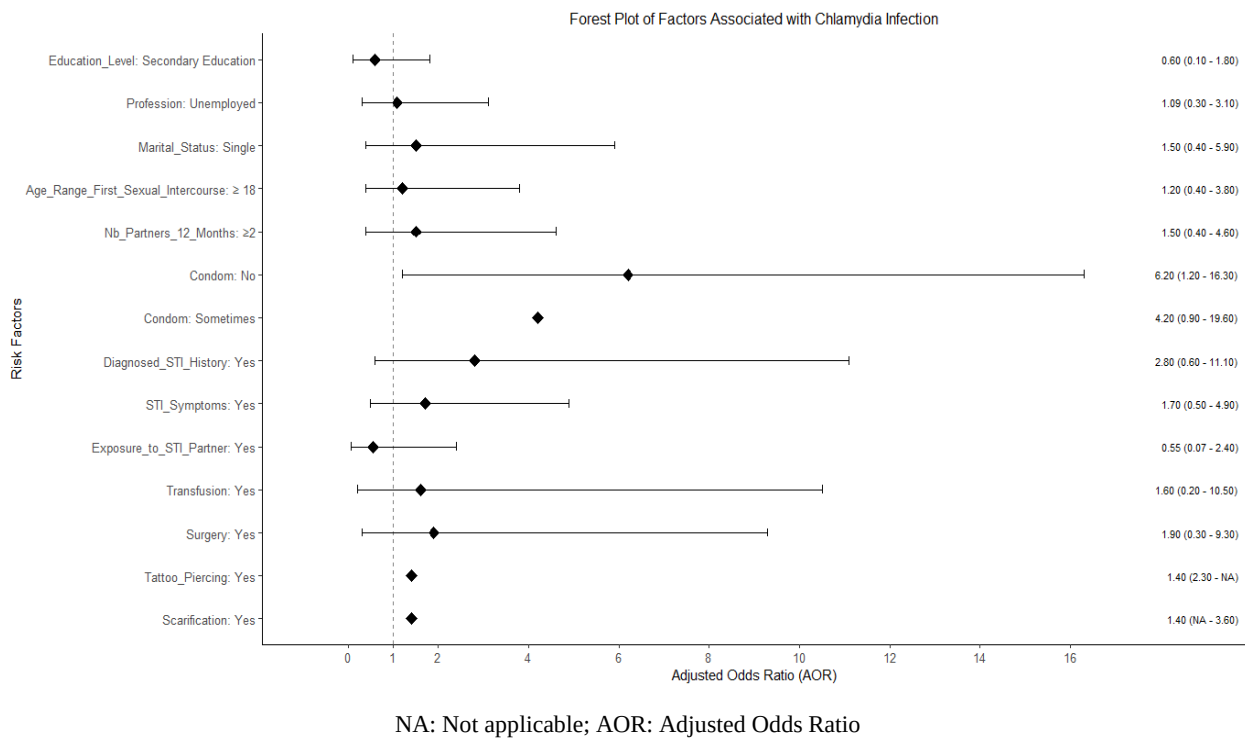


Figure 2: Univariate Regression

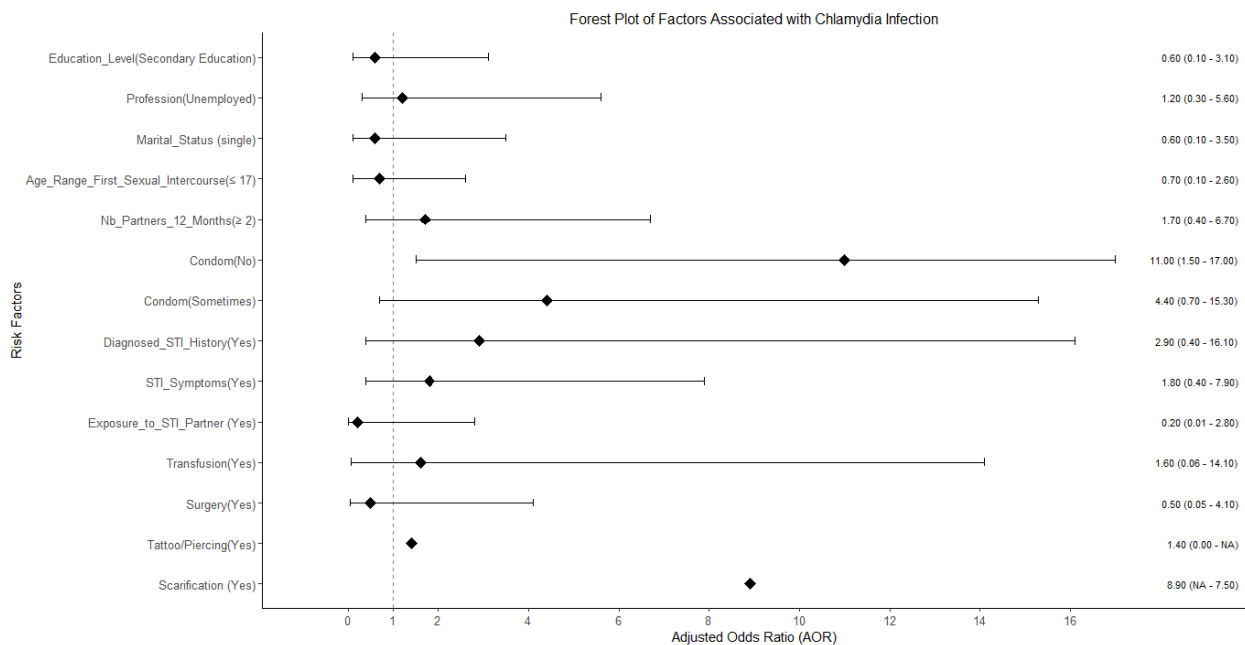


Figure 3: Multivariate Regression

Discussion

This study provides a comprehensive epidemiological analysis of *Chlamydia trachomatis* (CT) prevalence and its associated risk factors within a cohort of 210 participants. Our findings not only contribute to the understanding of CT epidemiology but also highlight the critical role of specific sexual behaviours in disease transmission. By contextualizing our results with the existing scientific literature, we identify key areas for public health intervention and future research.

Our investigation revealed a high prevalence of CT, with 23% (n=49/210) of participants testing positive. This rate is notably higher than that reported in general populations globally [14,15]. While the overall statistical analysis of risk factors was underpowered due to a limited sample size (n=74), exploratory univariate and multivariate regression analyses identified a powerful association between inconsistent condom use and CT infection. Specifically, individuals who reported never using condoms had an adjusted odds ratio (AOR) of 11.00 (95% CI: 1.50–17.00) for CT positivity in the multivariate model, indicating an 11-fold increase in risk compared to those who consistently used condoms.

Other suggestive trends, though not statistically significant, were also observed. Participants with a self-reported history of a previously diagnosed STI had a higher prevalence of CT, with an AOR of 2.90 (95% CI: 0.40–16.10). Interestingly, our analysis revealed a higher prevalence in males (33.3%) than in females (28.3%), which deviates from many studies that report higher rates in women due to more frequent screening [16].

The high prevalence observed in our study (23%) aligns with rates found in high-risk populations, such as commercial sex workers and individuals attending STI clinics, rather than with those of general, less-selected populations [14,17]. This suggests that our sampling method may have inadvertently selected for individuals with a higher baseline risk of infection due to demographic or behavioural factors, such as a high proportion of unemployed, single participants.

Our most significant finding the strong association between inconsistent condom use and CT infection is consistent with a vast body of literature. The AOR of 11.00 we calculated provides compelling evidence, echoing the well-established role of condoms as a physical barrier against the transmission of STIs, including CT [18]. Our finding that a history of prior STIs is a risk factor for subsequent CT infection also supports the notion that these behaviours are often interconnected, predisposing individuals to multiple infections over time.

However, our study's inability to find statistically significant associations with factors like age and number of sexual partners contrasts with other studies [19]. This is likely a direct result of our small sample size, which limited the statistical power needed to detect smaller or moderate effect sizes for these variables.

The results of this study have several important public health implications. The high prevalence of CT highlights a significant public health burden within this specific population, underscoring the urgent need for targeted public health campaigns that promote consistent condom use. The data also suggest that risk-based screening, which focuses on individuals with a history of STIs or

inconsistent condom use, could be a more efficient strategy for disease control. The fact that CT is often asymptomatic [15] further reinforces the need for accessible screening, including home-based testing, which has been shown to increase uptake and case detection in asymptomatic individuals [20].

Despite these valuable insights, our study has several key limitations. The most significant is the limited sample size (n=74) for the risk factor analysis, which led to a lack of statistical power and wide confidence intervals. This limitation prevents us from drawing definitive conclusions on the causality of all observed associations. Additionally, the cross-sectional design of the study means we cannot establish a temporal relationship between risk factors and infection. The reliance on self-reported data for sexual behaviours also introduces the potential for recall and social desirability bias, which may have led to an underestimation of high-risk activities.

To address the limitations of this study, future research should prioritize larger-scale epidemiological investigations to confirm the trends we observed with greater statistical power. A prospective cohort study would be invaluable for establishing causality and understanding the true incidence of CT. Additionally, research exploring the underlying factors influencing inconsistent condom use within high-risk populations would be beneficial for developing more effective and targeted public health interventions. Finally, investigating the role of reinfection and the efficacy of partner notification strategies could provide critical data to improve CT management and control efforts.

Conclusion

The study concluded that the high prevalence of *Chlamydia trachomatis* found in the hospital population represents a significant public health issue. The strong link between inconsistent condom uses and CT infection underscores the urgent need for public health campaigns that promote consistent condom use as a key prevention strategy. Due to the small sample size for risk factor analysis, future research with larger epidemiological studies is needed to confirm these findings and to establish a temporal link between behaviour and infection.

Authors contributions

DSM, were responsible for the conception and design of the study. DSM, JOE participated collecting and processing data, IgG Chlamydia measurement. DSM, was responsible for statistical analysis and interpretation of results. DSM, JDMN and JOE, wrote the original draft. All authors reviewed the first draft and approved the final version of the paper for submission. DSM and JDMN oversee all steps.

Acknowledgments

We thank all participants for agreeing to participate in this work.

Funding

The authors report no financial support for the research, authorship, and/or publication related to this article.

Potential conflicts of interest

The authors report no competing financial interests.

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