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CHLAMYDIA TRACHOMATIS INFECTION AMONG YOUNG ADULTS RESIDING AT THE UNIVERSITY OF PORT-HARCOURT HOSTELS IN RIVERS STATE NIGERIA.

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ABSTRACT

Chlamydia trachomatis is notorious for causing asexually transmitted infection (STI) known as Chlamydia. It can be asymptomatic for 12-18 months and is known to cause complications such as pelvic inflammatory disease, infertility, and ectopic pregnancy in females, as well as urethritis and epididymitis in males if left untreated. This study aimed to assess and determine the prevalence rate of *Chlamydia trachomatis* young adults residing at the University of Port-Harcourt (UNIPORT) hostels in Rivers State Nigeria. Research by various experts has shown that Chlamydia is the highest bacterial STI among young adults, especially among college-aged students and this birthed an investigation to determine the prevalence rate of this infection among hostel residents in UNIPORT. The participants in this research were sexually active males and females. Cervical swab samples were taken from the females and urine samples from the males. One hundred and three (103) samples were used to determine the result. LabACON Chlamydia rapid test cassette was used to determine the Chlamydia status of the participants. The overall prevalence rate of Chlamydia was 2.9%, with the female participants having a higher rate of 3.7% and the males having a prevalence rate of 2.0%. Only 45.6% of the participants had previous knowledge of this infection. The other 54.4% have never heard of Chlamydia. This study provided an updated record of prevalence among hostel residents of UNIPORT. It was also able to assess the student's knowledge of Chlamydia and recommend increased awareness, education, and screening efforts to reduce the prevalence of *Chlamydia trachomatis* among the general population.

Keywords: Chlamydia, Infection, Prevalence, Students, Young adults, Nigeria

INTRODUCTION

Chlamydia trachomatis is among the most common cause of bacterial sexually transmitted infections (STIs) worldwide. The organism is an obligate intracellular Gram-negative bacterium that is unique to humans (Kiguenet al., 2019). The bacteria have many serovars; serovars D through K cause bacterial STIs globally, while serovars L1 through L3 cause infections of the lymphatic system (Witkin et al., 2017). Different routes of sexual contact, such as oral, anal, and vaginal encounters, can spread *Chlamydia trachomatis* infections (Smith & Angarone, 2015).

According to the Centers for Disease Control and Prevention (CDC) (2021), Chlamydia infection stands as one of the most commonly reported sexually transmitted infections (STIs) particularly prevalent among sexually active adolescents and young adults, with a significant occurrence rate of approximately 58% in the age group of 18-25 (CDC, 2021). In 2020, the World Health Organization (WHO) estimated that 128 million people had chlamydial infection (WHO, 2020). According to other estimates, adults between the ages of 15 and 49 accounted for 273 million of the annual cases of STIs. Twelve million new cases of chlamydia are reported annually in the African continent (Unemo et al., 2017; WHO, 2022) amounting to a tremendous epidemic. According to WHO estimates, there are about 10 million new cases of *Chlamydia trachomatis* infections in sub-Saharan Africa each year (Hu et al., 2022). These infections are common, especially in low-resource nations (Newman et al., 2015; CDC, 2019) where STI rates are still high due to inadequate diagnostic tools and limited access to medical facilities (Aboud et al., 2023). In a study of patients attending an infertility and sexually transmitted disease (STD) clinic in Kano, Northwestern Nigeria, Nwankwo and Sadiq (2012) found a prevalence rate of 9.6%. In a study of 164 women attending a gynaecology clinic in Jos Plateau, Nigeria, Mawaket al. (2011) reported a prevalence of 56.1% with the age range of 25 to 29 having the highest occurrence. According to Arinze et al. (2014), a study carried out on female undergraduate students at the University of Port Harcourt revealed a prevalence of 30.2% for genital *Chlamydia trachomatis* infection. The study discovered that the highest incidence was reported in those who had their first coital exposure at the age of 14 or younger.

Untreated *Chlamydia trachomatis* infection can result in severe consequences, such as pelvic inflammatory disease (PID), infertility, ectopic pregnancy, and chronic pelvic pain in women (Aboud et al., 2023), and urethritis and epididymitis in men (Lee et al., 2013). Therefore, emphasizing the necessity of early detection and treatment is crucial to alleviate the burden of *Chlamydia trachomatis* infections and prevent associated complications (Huai et al., 2018). A concerning aspect is that a significant number of affected individuals are asymptomatic (Huai et al., 2018). Such patients who go undiagnosed or untreated may add to the growing reservoir of STIs (Dudareva-Vizule et al., 2014), forming clusters and facilitating the spread of the infection. This lack of awareness regarding one's infection status can inadvertently contribute to the spread of Chlamydia, as those unaware may engage in unprotected sexual activities, elevating the risk of transmission to their partners. The risk of transmission is increased by the possibility for certain sexually transmitted infections (STIs) to result in mucosal inflammation or genital ulcers. The chances of contracting another STI increase after acquiring one. For example, gonorrhoea or syphilis infection was associated with an increased risk of concurrently contracting chlamydia (Workowski & Bachmann, 2022). Hence, basing diagnosis solely on symptom-based clinical testing, asymptomatic concurrent infections might go unnoticed because certain STIs have negligible or no symptoms at all. Because *C. trachomatis* infections are not frequently screened for in most parts of Nigeria, data regarding infection frequencies

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are rarely provided. Hence, this study aimed to determine the prevalence of *C. trachomatis* amongst young adults residing at the University of Port-Harcourt hostels in Rivers State Nigeria.

MATERIALS AND METHODS

Study Design

This was a cross-sectional study carried out among students resident in the university hostel in Port Harcourt, Nigeria. A random sampling technique was used in which students who met the inclusion criteria were recruited consecutively during the period of study.

Study Population

The study population were male and female students of UNIPORT who reside in the university's hostels. This section provides a more comprehensive overview of the study population, including their characteristics and relevance to the research objectives.

Inclusion Criteria

The inclusion criteria for this research require participants to be registered students of the University of Port Harcourt, residing in one of the university's hostels. Eligible individuals must provide informed consent, be aged 17-28, and be sexually active. These criteria aim to ensure a focused and relevant study population. A written informed consent was provided to the participants after which a structured questionnaire was applied to them. This questionnaire contained a set of standardized questions related to participants' demographics, sexual behaviour, and potential risk factors for Chlamydia infection. The questionnaire's structured format ensured consistency in data collection and allowed for quantitative analysis of responses.

Exclusion Criteria

Exclusion criteria disqualified individuals not registered at the University of Port Harcourt, those not residing in university hostels, those lacking informed consent, those outside the age criteria, and sexually inactive individuals. These criteria ensure accuracy and uphold ethical standards in the study.

Sample Collection and Processing

A swab provided in the test kit was inserted into the endocervical canal until the tip of the swab was almost invisible. The swab was then rotated at 360^{o}. This permitted the acquisition of columnar or cuboidal epithelial cells which are the main reservoir of the Chlamydia organism. A sterile urine container was used to collect about 30ml of early morning urine. Early morning urine was preferable as it has the highest concentration of Chlamydia antigen. The urine sample was mixed by inverting the container. Ten (10) ml of the urine specimen was transferred into a centrifuge tube, 10ml distilled water was also added and centrifuged at 3000 rpm for 15 minutes. The supernatant was discarded carefully, the tube was kept at an inverted position and the remnant supernatant was discarded from the tube by blotting onto an absorbent pad. The Chlamydia antigen was extracted according to specimen type (female cervical swab or male urine). For the urine, 6 drops of reagent 2 were added to the urine pellet in the centrifugation tube and then shaken vigorously until the suspension was homogenous. The entire solution in the centrifuge tube was transferred to the extraction tube and allowed to stand for 1 minute. Then, 5 drops of reagent 1 were added to the extraction tube/solution. The tube was properly mixed and allowed to stand for 2 minutes. For the female cervical swab, 5 drops (approximately 300µl) of reagent 1 was added to the extraction tube. The swab was inserted into the tube, compressed at the bottom of the tube, and rotated 15 times. It was then allowed to stand for 2 minutes. This was followed by the addition of 6 drops of reagent 2 to the extraction tube and the solution turned turbid. The bottle was compressed and the swab was rotated 15 times until the solution turned clear with a slight green or blue tint. Three (3) drops of the extracted solution were added to the specimen well of the test cassette and allowed

to run for 10 minutes. An antibody-coated particle of Chlamydia in the test cassette reacts with the extracted antigen solution during testing. The combination moves along the membrane to react with the chlamydia antibody, creating a red-coloured line in the test region of the cassette. If this coloured line is present in the test line zone, the result is interpreted as positive; if it is absent, the result is negative.

Data Analysis

The data generated was entered into Microsoft Excel. Descriptive analysis was performed to calculate frequencies and percentages. The prevalence rate was calculated as a percentage of individuals positive for *Chlamydia trachomatis* infection divided by the total number of people in the defined population.

RESULTS

The participants' ages ranged from 17 to 28 years. Females comprised the majority, constituting 51.5% of participants, while males accounted for 48.5%. A significant majority of participants were single (97.0%), with a minority (3.0%) being married, all in monogamous relationships. The overall prevalence of *Chlamydia trachomatis* in this study stood at 2.9%, with a striking 97.1% of participants testing negative. The highest prevalence was in the 21-24 age group (5.0%), followed by the age group which had participants who were less than 20 years old (3.4%). The prevalence among the singles was 3.0% and the married had a prevalence rate of 0%. Based on sex, the females had a prevalence rate of 3.7% and the males had a prevalence rate of 2.0%. Amongst the participants, 84.0% reported no prior history of sexually transmitted infection (STI), while 16.0% acknowledged a history of STI, having received treatment before this research (Table 1).

Table 1: Prevalence of *Chlamydia trachomatis* and Demographic Characteristics of the Study Participants

Demographic Factors	Category	Number tested (%)	Number positive (%)	χ-Value	p-value
Age group	17-20	28.2	3.4	1.67	0.43
	21-24	38.8	5.0		
	25-28	33.0	0		
Sex	Male	48.5	2.0	0.28	0.59
	Female	51.5	3.7		
Marital status	Singles	97.0	3.0	0.09	0.76
	Married	3.0	0		
Tribe	Igbo	20.4	0	0.31	0.58
	Hausa	3.9	0		
	Yoruba	17.5	0		
	Ikwerre	13.6	7.1		
	Ogoni	12.6	7.7		
	Ibibio	13.6	7.1		
	Others	18.4	0		
Total		103.0	2.9		

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Table 2 represents the relationship between sexual history and prevalence. The spectrum of STIs included syphilis, gonorrhoea, and bacterial vaginosis. Remarkably, those with a previous STI exhibited a prevalence rate of 0%, contrasting with a 3.5% prevalence rate among those who had never experienced an STI. Examining sexual behaviour, 69.9% reported 1-2 sexual partners in the past 12 months, 16.5% had 3-4 partners, and 13.6% engaged with more than 4 partners. Notably, prevalence rates varied with 1.4% for those with 1-2 partners, 5.8% for 3-4 partners, and 7.0% for those with more than 4 partners. Furthermore, 71.7% of participants practised safe sex through barrier methods, while 28.3% did not. Intriguingly, those using barrier methods exhibited a prevalence rate of 2.7% compared to the 3.3% prevalence rate among those engaging in unprotected intercourse (Table 2).

Table 2: Prevalence of *Chlamydia trachomatis* with sexual history

Sexual History	Category	Prevalence (%)	p-value
Infection history	Previous infection of any STI	0	0.43
	Never infected with STI	3.5	
	Negative	96.5	
Number of sexual partners in the past 12 months	1-Feb	1.4	0.45
	3-Apr	5.8	
	Above 4	7	
Method of sexual intercourse	Negative	85.8	0.58
	Barrier	2.7	
	Unprotected	3.3	
	Negative	**94**	
Total		**100**	

The participants who were aware of Chlamydia infection made up 45.6% while 54.4% had never heard about Chlamydia infection. The prevalence rate among those who were aware of Chlamydia infection was 2.1%, whereas those without any knowledge of Chlamydia infection exhibited a prevalence rate of 3.5% (Table 3).

Table 3: Analysis of participants knowledgeable of *Chlamydia trachomatis*

Categories	Number tested (%)	No. (%) Positive	No. (%) Negative	P-value
Aware	47 (45.6)	1 (2.1)	46 (97.8)	
Unaware	56 (54.4)	2 (3.5)	54 (96.4)	0.66
Total	103 (100.0)	3 (2.9)	100 (97.1)	

Table 4 represents the relationship between risk factors and prevalence of *Chlamydia trachomatis*.

Table 4: Analysis of participants based on risk factor

Risk Factor	YES		NO	
	Number	%	Number	%
Tribal marks/tattoo/scarification/body piercing	70	68	33	32
Received blood transfusion	28	27.2	75	72.8
Received surgical procedure in a health facility	9	8.7	94	91.3

Local circumcision	0	0	103	100
Local-belubelu-uvulectomy or/and tonsillectomy	0	0	103	100
Delivery of child at home	0	0	103	100
Dental procedures in health facility	11	10.7	92	89.3
Blood oaths	0	0	103	100
Intravenous drug user (IDU)	0	0	103	100
Living with and Sharing facilities and materials with IDU	0	0	103	100
Sharing of sharp objects	36	35	67	65
Needle stick injury	4	3.9	99	96.1
Exposure to blood, body fluids or tissues	10	9.7	93	90.3
Sharing of toothbrush/chewing stick	0	0	103	100
Local hair shaving	0	0	103	100
Local manicure/pedicure	0	0	103	100

DISCUSSION

This study was carried out to determine the prevalence level of *C. trachomatis* infection among students residing in the hostels of the University of Port Harcourt. The findings of this study revealed an overall prevalence of 2.9%. Earlier studies had reported higher prevalence values of 6.6%, 9.6% and 9.0% by Nwachukwu et al. (2023), Nwankwo and Sadiq (2014) and Wang et al. (2022). The prevalence of Chlamydia infection has been known to vary depending on the population studied. Several other authors have reported varying prevalence levels of 6.9% in Southern Africa, and 7.3% in Ibadan, Nigeria, respectively (Ajani et al., 2019; Khanal et al., 2019). Previous studies showed wide margin with prevalence levels of 51% (Okoror et al., 2000), 18.2% (Alayom, 2009), 40.7% (Okoror et al., 2007), in 38.3% (Tukur et al., 2006) and 13.3% (Isibor et al., 2005), respectively, across different parts of Nigeria. These levels were high compared to the 2.9% observed in this present study. A similar prevalence level of 2.0% was reported by Ankuma et al. (2020) though amongst pregnant women. Increased awareness of chlamydial infection and other sexually transmitted diseases could be the plausible reason for decreased prevalence.

The age group with the highest prevalence rate in this study was 21-24 years (5.0%). This finding is similar to the report of Wang et al. (2022) who observed that individuals less than 25 years old were more likely to be infected with *C. trachomatis*. This finding is also in agreement with several previous studies which demonstrated that younger age was associated with having chlamydia and/or gonorrhoea infections (Ribeiro et al., 2019; van Liere et al., 2015). A major contributing factor to the high prevalence among this age group is the "hookup culture," a popularized term to describe casual sexual relationships (Johnson & Jackson,2021). Similarly, it has been reported that persons between 15 and 24 years have the highest rates of infection (Ajani et al., 2019; Torrone et al., 2014). This finding is of public health significance, as these young persons may serve as reservoirs for CT infection and when left untreated, may transmit to sex partners.

Sex distribution revealed a higher prevalence among females (3.7%) in contrast with the male (2.0%). Chlamydia affects 4.0% of women of reproductive age and 2.8% of men (Newman et al., 2012). It could be that more females harbour this infection than males because of the nature of their urinogenital organ since most of them were more positive for *Chlamydia trachomatis* than their male counterparts (Mohseni, 2023).

Based on marital status, singles had a prevalence rate of 3.0% and the married had a 0% prevalence rate. The finding of this study is in agreement with the report of Nyakambi et al. (2022) in a related study which found that the singles had the highest number of positive 12/136 (8.8%), and married 3/127 (2.4%).

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Individuals without a marital partner may partake in a greater frequency of casual or varied sexual relationships, thereby elevating their susceptibility to potential health risks.

Another variable in this study was the number of sexual partners each participant had in the past 12 months of this study. Those with 1-2 partners had a prevalence rate of 1.4%, those who have had 3-4 partners had a prevalence rate of 5.8% while those above 4 sexual partners had 7.0%. Arinze et al. (2014) found that having multiple sexual partners was significantly associated with *Chlamydia trachomatis* infection. The prevalence of the infection was higher among those with 3-4 sexual partners, and even higher among those with 5 or more sexual partners. This observation is a pointer that multiple sexual partners are a risk factor for contracting *C. trachomatis*. Having multiple sex partners has also been reported by Ruchika et al. (2013) to increase the likelihood of encountering an infected partner (Ruchika et al., 2013).

Those who practiced unprotected sex had a prevalence of 3.3% whereas those who used barrier methods for intercourse had a 2.7% prevalence. The incidence of *C. trachomatis* infection amongst the respondents who practiced unprotected sex was 3.3%, whereas the prevalence amongst those using barrier techniques during sexual activity was 2.7%. This finding supports the report of Qureshi (2019), that sexual contact without the use of a condom or barrier technique is typically the origin of *C. trachomatis* infection.

Those who had never had a previous history or infection of STI had a prevalence rate of 3.5% while those who had been previously infected with STI had a 0% prevalence rate. A study carried out by Nwankwo and Sadiq (2014) showed that those with a previous infection of STI had the highest prevalence rate of 75%. The variation in this study can be attributed to the fact that people previously infected with an STI took proactive measures during subsequent sexual intercourse to avoid a reinfection while those who had not been infected had a carefree attitude towards sexual intercourse. Those with a knowledge of *C. trachomatis* infection (45.6%) recorded a prevalence of 2.1% while those who have never been aware of Chlamydia (54.4%) had a prevalence rate of 3.5%. This is due to its asymptomatic nature, inadequate access to healthcare, and absence of regular screening.

CONCLUSION

This study revealed the prevalence rate of Chlamydia infection as 2.9% among the study population. This could be a result of safe sex practices such as the use of condoms carried out by the participants. A high prevalence was observed in the females (3.7%) compared to the male (2.0%). The findings from this study will provide valuable insights for public health authorities and educators, empowering them to design effective prevention initiatives tailored to meet university students' specific requirements and behaviour.

REFERENCES

Aboud, S., Buhalata, S.N., Onduru, O.G., Chiduo, M.G., Kwesigabo, G.P., Mshana, S.E., Manjurano, A.M., Temu, M.M., Kishamawe, C. & Changalucha, J.M. (2023). High prevalence of sexually transmitted and reproductive tract infections (STI/RTIS) among patients attending STI/outpatient department clinics in Tanzania. *Trop Med Infect Dis.*, 8: 62.

Ajani, T.A., Elikwu, C.J., Anadobe, C.G., Oluwasola, J.A. & Ajani, M.A. (2019). Prevalence and associated risk factors of *Chlamydia trachomatis* among gynaecology clinic attendees in a tertiary institution in Ogun State, Nigeria. *Ann Trop Pathol*.,10:136-40.

Alayom, A.M. (2009). Prevalence and awareness about chamydial infection in women undergoing infertility evaluation in Lagos, Nigeria. *Int J Health Res*, 2(2); 157

Ankuma, S.J., Joshua, A.R. & Opaluwa, S.A. (2017). Incidence of Chlamydia infection in pregnant women attending antenatal

clinic in Sir Yahaya Memorial Hospital Birnin-Kebbi, Northern Nigeria. *Nig J Biomed Sci*., 13(1):28-31.

Arinze, A.H., Onyebuchi, N. & Jeremiah, I. (2014). Genital *Chlamydia trachomatis* infection among female undergraduate students of University of Port Harcourt, Nigeria. Nigerian Medical Journal: *Journal of the Nigeria Medical Association.* https://doi.org/10.4103/0300-1652.128147.

Centers for Disease Control and Prevention. Sexually transmitted disease surveillance [Internet]. 2019, https://www.cdc.gov/std/statistics/2019/stdsurveillance-2019.pdf. (2019, accessed 20 April2023).

Dudareva-Vizule, S., Haar, K., Sailer, A., Wisplinghoff, H., Wisplinghoff, F. & Marcus, U. (2014). Prevalence of pharyngeal and rectal *Chlamydia trachomatis* and Neisseria Gonorrhoeae infections among men who have sex with men in Germany. *Sexually Transmitted Infections* 90:46–51.

Hu, H., Chen, Y., Shi, L., Liu, X., Xu, Z., Sun, L., Zhao, X., Zhou, Y., Lu, J., Zhang, Z., Liu, X. & Fu, G. (2022). Prevalence of Syphilis and *Chlamydia trachomatis* infection among men who have sex with men in Jiangsu province, China: A cross-sectional survey. *Front Public Health,* 10: 1006254.

Isibor, J.O., Ugbomoiko, D., Nwobu, G.O., Ekundayo, A.O., Enweani, I.B. & Okogun, G.R. (2005). Detection of Chlamydia antigen in cervical specimens from antenatal clinics attendees in Benin City, Nigeria. *African Journal of Clinical and Experimental Microbiology*, 6(3):208-211.

Johnson, A. & Jackson, J.B. (2021). Sexually Transmitted Infections among College Students. *Microbiol Infect Dis.*, 5(1): 1-4.

Khanal, B., Siwakoti, S., Uprety, D., Poudyal, N., Sharma, A. & Bhattarai, N.R. (2019). *Chlamydia trachomatis* in women with Pelvic Inflammatory Disease (PID): Report from a tertiary center in eastern Nepal. *Trop Doct.*, 49:101-4.

Kiguen, A.X., Marrama, M., Ruiz, S., Estofan, P., Venezuela, R.F. & Mosmann, J.P. (2019). Prevalence, risk factors and molecular characterization of *Chlamydia trachomatis* in pregnant women from Cordoba, Argentina: a prospective study. *PLoS One*, 14(5):e217245.

Lee, Y.S. & Lee, K.S. (2013) Chlamydia and male lower urinary tract diseases. *Korean J Urol*., 54(2):73–7.

Mawak, J.D., Dashe, N., Agabi, Y.A. & Panshak, B.W. (2011). Prevalence of Genital *Chlamydia trachomatis* Infection among Gynaecology Clinic Attendees in Jos, Nigeria. Shiraz E-*Medical J.*, 12:2.

Newman, L., Rowley, J., Hoorn, S.V., Wijesooriya, N.S., Unemo, M., Low, N., Stevens, G., Gottlieb, S., Kiarie, J. & Temmerman, M. (2015). Global estimates of the prevalence and incidence of four curable sexually transmitted infections in 2012 based on systemic review and global reporting. *PLoS ONE*, 10: e0143304.

Newman, L., Rowley, J., Hoorn, S.V., Wijesooriya, N.S., Unemo, M., Low, N., Stevens, G., Gottlieb, S., Kiarie, J., & Temmerman, M. (2015). Global estimates of the prevalence and incidence of four curable sexually transmitted infections in 2012 based on systematic review and global reporting. *PLoS ONE*, 10:e0143304.

Ngandjio, A., Clerc, M., Fonkoua, M.C., Thonno, J., Njock, F. & Pouillot, R. (2003). . Screening of volunteer students in Yaoundé (Cameroon, Central Africa) for *Chlamydia trachomatis* infection and genotyping of isolated *Chlamydia trachomatis* strains. *J ClinMicrobiol*., 41:4404–7.

Nwachukwu, N.O., Ulasi, A.E. & Ezeagwula, D. (2023). Detection of *Chlamydia trachomatis* infection in a semi-urban setting in Nigeria. *J Sci Soc.*, 50:197-200.

Nwankwo, E.O. & Sadiq, M. N. (2014). Prevalence of *Chlamydia trachomatis* infection among patients attending infertility and sexually transmitted diseases clinic (STD) in

Scientia Africana, Vol. 23 (No. 4), October, 2024. Pp 97-106
© Faculty of Science, University of Port Harcourt, Printed in Nigeria *ISSN 1118 – 1931*

Kano, North Western Nigeria. *African Health Sciences*, 14(3), 672.

Nyakambi, M., Waruru, A. & Oladokun, A. (2022). Prevalence of genital *Chlamydia trachomatis* among women of reproductive age attending outpatient clinic at Kisumu County Referral Hospital, Kenya, 2021. *Journal of Public Health in Africa*, 13(3).

Okoror, L.E., Agbonlahor, D.E., Esumeh, F.I. & Umolu, P.I. (2007). Prevalence of Chlamydia in patients attending gynaecological clinics in southeastern Nigeria. *Afr Health Sci.*, 7 (1): 18-24.

Okoror, L.E., Omilabu, S.A., Fadojutimi, J. & Nsongkhai, V. (2000): Sero-epidemiological survey of Chlamydia in patients attending pre and post-natal clinic at the College of Medicine of the University of Lagos, Nigeria. In: Book of Abstract of the 24th annual conference of the Nigerian Society of Microbiology.

Qureshi, S. (2019). Chlamydia (Chlamydial Genitourinary Infections): Background, Pathophysiology, Etiology. *E-Medicine*. https://emedicine.medscape.com/article/214823.

Ribeiro, S., de Sousa, D., Medina, D., Castro, R., Lopes, Â. & Rocha, M. (2019). Prevalence of gonorrhoea and chlamydia in a community clinic for men who have sex with men in Lisbon, Portugal. *Int J STD AIDS*, 30(10): 951-959.

Ruchika, K., Walter, P.K., Timona, O., William, S. & Gunturu, R. (2013). Prevalence of genital chlamydia infection in urban women of reproductive age, Nairobi, Kenya. *BMC Res Notes*, 6: 44.

Smith, L. & Angarone, M. (2015). *Sexually transmitted infections*. *Urologic Clinics of North America*, 42(4):507–518.

Torrone, E., Papp, J. & Weinstock, H. (2014). Prevalence of *Chlamydia trachomatis* genital infection among persons aged 14-39 years – United States, 2007-2012. *MMWRMorb Mortal Wkly Rep.*, 63:834-8.

Tukur, J., Shittu, S.O. & Abdul, A.M. (2006). A case control study of active genital Chlamydia trachomatis infection among patients with tubal infertility in northern Nigeria. *Trop Doct.*, 36(1): 14-6.

Unemo, M., Bradshaw, C.S., Hocking, J.S., de Vries, H.J.C, Francis, S.C., Mabey, D., Marrazzo, J.M., Sonder. G.J., Schwebke, J.R. & Fairley, C.K. (2017). Sexually transmitted infections: challenges ahead. *The Lancet Infectious Diseases*, 17(8):e235–e279.

Van Liere, GAFS, van Rooijen, MS, Hoebe, CJPA, Heijman, T, de Vries, HJC & Dukers-Muijrers, N.T. (2015). Prevalence of and factors associated with rectal-only chlamydia and gonorrhoea in women and in men who have sex with men. *PLoS ONE*, 10(10): e0140297.

Witkin, S.S., Minis, E., Athanasiou, A., Leizer, J. & Linhares, I.M. (2017). *Chlamydia trachomatis*: the Persistent Pathogen. *Clinical and Vaccine Immunology*, 24(10).

Workowski, K.A. & Bachmann, L.H. (2022). Centers for Disease Control and Prevention's sexually transmitted diseases infection guidelines. *Clinical Infectious Diseases*, 74(2): S89–S94,

World Health Organization (2022). Global health sector strategy on sexually transmitted infections 2016-2021: toward ending STIs, in In Global health sector strategy on sexually transmit- ted infections 2016-2021: toward ending STIs, WHO. 2016, Available online at: https://www.who.int/publications/i/item/WHO-RHR-16.09 (accessed 17 August, 2024).