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Demographic Variations in the Prevalence of *Trichomonas vaginalis* and *Neisseria gonorrhoeae* Infections among Females Attending Healthcare Facilities in Port Harcourt, Nigeria

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Authors' contributions

This work was carried out in collaboration between both authors. Both authors read and approved the final manuscript.

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ABSTRACT

Background: *Trichomonas vaginalis* and *Neisseria gonorrhoeae* are two pathogens of public health importance, which are sexually transmitted, highly prevalent, underdiagnosed and affecting millions of people globally. This study was aimed at finding out the prevalence of *T. vaginalis* and *N. gonorrhoeae* among females in Port Harcourt, Nigeria.
Methodology: This cross-sectional, retrospective study reviewed medical laboratory records of 351 females attending public and private healthcare facilities including walk-in patients in a medical laboratory facility. The records covered High Vaginal Swab (HVS) and endocervical swabs (ECS) and cultures, with complete information on demographic characteristics and microbiological isolates.

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Results: The overall prevalence of *Trichomonas vaginalis* and *Neisseria gonorrhoeae* was 1.7%; all the *Trichomonas vaginalis* were detected in HVS samples with a prevalence of 1.4%, while all the *Neisseria gonorrhoeae* were isolated from the ECS specimens at a prevalence of 3.4%. The highest prevalence among the age bracket was the 16-20 age group (3.9%), and the least prevalence was in the 31-35 age bracket (1.1%). The residents of low-density urban areas had a lower prevalence of 1.1% while the high-density areas had 1.9%, married women were observed with prevalence of 3.4%, and single females 2.1%.

Conclusion: The low prevalence of the *Trichomonas vaginalis* and *Neisseria gonorrhoeae* within the study area should spur policy makers to intensify efforts to eradicate the pathogens. There is need for increased awareness targeted at the youths due the high prevalence of infections among young adults. The social media and other such avenues are to be utilized in this regard.

Keywords: Pathogens; healthcare; patients; Trichomonas vaginalis; Neisseria gonorrhoeae.

1. INTRODUCTION

There are more than thirty pathogenic bacteria, viruses, protozoa and other parasitic organisms which can be sexually transmitted to persons through vaginal, oral, anal or other forms of intimate contact. The world health organization estimates that over one million curable sexually transmitted infections (STIs) are transmitted daily across the world especially among persons between the ages of 15 and 49 years. Most of the infected persons do not manifest symptoms [1]. The commonest sexually transmitted pathogens include curable ones such as *Neisseria gonorrhoeae*, chlamydia, *Treponema pallidum* (syphilis), *Trichomonas vaginalis;* and treatable ones without any known cures like the herpes viruses, human papillomavirus, and human immunodeficiency virus [2] By WHO estimates, there were 374 million new infections in people between the ages of 15 and 49 years with at least one of the following curable STIs: chlamydia, gonorrhea, syphilis and trichomoniasis globally in 2020 [1].

Trichomonas vaginalis (*T. vaginalis* or TV) is a highly prevalent sexually transmitted protozoan parasite with an estimated 156 million yearly new infections globally and prevalence of 5.3% and 0.6%, in females and males respectively [1,3]. It causes trichomoniasis, the commonest non-viral sexually transmitted infection globally [4]. It is transmitted primarily by sexual contact, especially with multiple partners.[4] The infection is associated with a number of risk factors such as poor urogenital hygiene, high-risk sexual practices, and bacterial vaginosis [5]. It more common in women living in rural areas than those in urban areas, older people are more likely to be infected than younger ones [6]. Trichomoniasis may manifest in a wide variety of symptoms, with about 75% of females being symptomatic while close to 80% of males are asymptomatic [7]. The most notable symptoms in females include inflammation and irritation of the vulva, local edema, erythema, dysuria, green, frothy, and malodorous vaginal discharge, sensation of vulvovaginal burning etc.; in men the symptoms are those of associated conditions such as nongonococcal urethritis, epididymitis, and prostatitis [5,7].

TV infection has been linked with a number of adverse health conditions in both males and females. In women, it has been associated with pelvic inflammatory disease, infertility, cervical neoplasia, perinatal morbidity vaginitis, urethritis, and cervicitis. preterm delivery, infertility, premature rupture of membranes, low-birth-weight, herpes simplex virus and human papillomavirus (HPV) infections, and cervical cancer. It is also with increased risk of human immunodeficiency virus (HIV) transmission. High prevalence of TV infection poses a significant burden on communities leading to decreased capacities, higher morbidity and mortality rates, and economic setbacks [4]. In men, it causes balanoposthitis and epididymitis, urethritis, epididymitis, and prostatitis [4,5,7].

Neisseria gonorrhoeae is an obligate human pathogenic bacterium, which causes the infection, gonorrhoea, that affects the mucosa of the genitourinary, anorectal. oropharyngeal systems and conjunctivae. Like many STIs, the infection impacts disproportionately on young adult populations, in many cases it is asymptomatic with infected persons, particularly women, being unaware, undiagnosed and untreated. leading to complications such as cervicitis, pelvic inflammatory disease, ectopic pregnancy and infertility [8,9]. WHO estimates put the yearly incidence of gonococcal infection

to be 78 million cases [10]; while the number of new gonococcal infections among persons from 15 to 49 years in 2016 is 87 million [11]. The rates of gonorrhea infection are increasing globally with gay, bisexual, and men who have sex with men, racial/ethnic minorities, indigenous populations, and sex workers apparently bearing a disproportionate burden. The spread of gonorrhea, including resistant strains, is also on the rise across international borders due to International travels [11].

Trichomonas vaginalis and *Neisseria gonorrhoeae* are commonly under-diagnosed pathogens. *Neisseria gonorrhoeae* has specific growth requirements, making it easy to be missed in laboratory cultures [12]. It is apparent that *T. vaginalis* does not have a cyst form and do not survive for long in external environments, though it has been shown to survive outside the human body in a wet and warm environment for more than three hours [13]. If is thus common to miss these pathogens when the sample is not examined within a short time after collection. These may be part of the reasons for the paucity of data on the epidemiology of these two important pathogens in Port Harcourt.

This study was designed to determine the prevalence of *Trichomonas vaginalis* and *Neisseria gonorrhoeae* among females attending public and private healthcare facilities in Port Harcourt, Nigeria. This will help in the planning and deployment of resources for programs aimed at infection control.

2. MATERIALS AND METHODS

2.1 Study Design

This is a cross-sectional retrospective study involving a review of medical laboratory records of 351 females attending public and private healthcare facilities and walk-in patients from across Port Harcourt. The specimens included in the study were those with complete records of the ages, residence, marital status, and microbial isolates. The review focused on cultures of High Vaginal Swab (HVS) and endocervical swab (ECS) specimens carried out at Diagnostix and Scientifique Laboratories, Port Harcourt, Nigeria between January and December 2019. The persistence and increasing occurrence of these pathogens, reinforce their public health importance and deserving of researchers' attention.

2.2 Records of Isolation and Identification of Organisms

The standard operating procedure (SOP) manual of the laboratory indicate that the wet preparations of the HVS and ECS specimens were examined microscopically immediately they were collected. They were then, cultured on blood agar, Chocolate agar, Sabouraud dextrose agar and MacConkey agar (Oxoid, Hampshire, England); then incubated under aerobic conditions; (suspected *N. gonorrhoeae* specimens were also incubated under humid atmosphere with increased carbon dioxide, in candle extinction jars) at 37°C for 24 hours. The culture plates were examined visually for growths and the colonial morphologies were recorded; followed by gram-staining and biochemical testing.

2.3 Data Analysis

Data were clarified using Excel spreadsheet 2016, and analyzed using IBM SPSS Statistics version 25. Descriptive and inferential statistics were employed in results presentation and interpretation. Associations between possible risk factors namely, specimen types, age, residence, marital status, and prevalence of *T. vaginalis* and *N. gonorrhoeae* were determined using Pearson's Chi-Square test of independence and Fisher exact test at significance level below 0.05

2.4 Statistical Analysis

Pearson's Chi-square test of independence and Fisher's exact test were used to ascertain the existence of associations between the age, marital status, residence, and specimen types on one hand and the prevalence of trichomoniasis and gonorrhoea on the other side. The associations between age, marital status and residence were found not be statistically significant, given that the p values were not less than 0.05, we therefore fail to reject the null hypothesis which states that the variables are independent. In other words, there was no sufficient evidence to conclude that a significant association exists between these factors and the sexually transmitted pathogens obtained from females attending healthcare facilities in Port Harcourt, Nigeria.

On the other hand, the associations between specimen types and the prevalence of trichomoniasis and gonorrhoea were found to be statistically significant, given that the p values

were less than 0.05, we therefore reject the null hypothesis which states that the variables are independent. In other words, there was sufficient evidence to conclude that a significant association exists between these factors and the sexually transmitted pathogens.

3. RESULTS

In this retrospective study, the medical laboratory records of 351 females between the ages of 16 and 71 years were reviewed to ascertain the prevalence of *Trichomonas vaginalis* and *Neisseria gonorrhoeae.* The mean age was 30.26 ±7.899, the media was 29 years and the mode 28; the 351 specimens consist of 292 high vaginal swabs (HVS) and 59 Endocervical swan (ECS) specimens. There were 208 married women and 143 singles females, 253 persons live in high density urban areas, while 88 reside in low density urban areas.

3.1 The Prevalence Rates of *Trichomonas vaginalis* and *Neisseria gonorrhoeae*

The overall prevalence of *Trichomonas vaginalis* and *Neisseria gonorrhoeae* was 1.7%; all the *Trichomonas vaginalis* were detected in HVS samples with a prevalence of 1.4%, while all the *Neisseria gonorrhoeae* were isolated from the ECS specimens at a prevalence of 3.4%. The highest prevalence among the age bracket was the 16-20 age group (3.9%), and the least prevalence was in the 31-35 age bracket (1.1%). The residents of low-density urban areas had a lower prevalence of 1.1% while the high density areas had 1.9%, married women were observed with prevalence of 3.4%, and single females 2.1%.

3.2 The Prevalence Rates of *Trichomonas vaginalis*

Trichomonas vaginalis was the only of the two pathogens detected in HVS samples, with a prevalence of 1.1%; the prevalence of *T vaginalis* for ECS was zero. The pathogen was only found in four age brackets thus: 16-20 (3.9%), 26-30 (1.1%), 31-35 (1.1%), and 36-40 (1.3%). All the four *T vaginalis* isolates in this study were obtained from HVS specimens at prevalence rates of 1.4% and none from ECS specimens No *T. vaginalis* were found among those residing in low density areas, thus it was zero prevalence while all four isolates came from high density areas of Port Harcourt at prevalence rates of 1.5%. Married and single females contributed to the number at three and one respectively giving prevalence rates of 1.4% and 0.7% apiece (Table 2).

3.3 The Prevalence Rates of Neisseria *gonorrhoeae*

The prevalence of Neisseria *gonorrhoeae* as observed in this study was 0.6%. the two isolates of the organism were obtained from ECS specimens giving a prevalence of 3.4% for ECS and zero prevalence for HVS. The pathogen was recovered only from two age brackets namely, 21-25 (1.3%) and >40 years (2.5%), the other age brackets recorded zero prevalence. One isolate each was recovered from the low- and high-density areas, giving prevalence rates of 1.1% and 0.4% respectively. The two *N gonorrhoeae* isolates were obtained from only single females with prevalence of 1.4% and none from the married females (Table 3).

4. DISCUSSION

This study has contributed in dating the data on the prevalence of the sexually transmitted pathogens, *Trichomonas vaginalis* and *Neisseria gonorrhoeae* among females attending healthcare facilities in Port Harcourt, Nigeria. The overall prevalence of 1.7% obtained for both pathogens, and 1.1% and 0.6% respectively for *Trichomonas vaginalis* and *Neisseria gonorrhoeae* are quite low when compared to reported outcomes of studies elsewhere; such as a study among university students in Ethiopia which reported prevalences of *Neisseria gonorrhoeae* (7.4%) and *T. vaginalis* (4.8%) [14] It however compared closely with the prevalence rates of 3.0% and 0.8% reported for *Trichomonas vaginalis* and *Neisseria gonorrhoeae* among persons living with HIV inn China [15]. and 6.5% reported for *Trichomonas vaginalis* and 4.2% *for Neisseria gonorrhoeae* among female sex workers in Togo [16]. In a study of in Gambia, a general prevalence of 9.8% was reported for five curable STIs, with 7.6% and 0.2% respectively for *Trichomonas vaginalis* and *Neisseria gonorrhoeae* [17].

There appear to be much variations in the prevalence of the pathogens among cultures, countries regions and populations. While this study shares consensus with many of the studies elsewhere that *T. vaginalis* is more prevalent in many areas than *N. gonorrhoeae,* it is in also agreement with many studies that on the low prevalence of *N. gonorrhoeae* which in a number

of cases if found to be less than 1% [15,17]. The variations in reported prevalences could be attributable to sampling and testing methods, studies which used molecular methods will expectedly turn out higher prevalences than those using wet mount microscopy [6,17].

In this study, sexually transmitted infections were found in all the age groups, which aligns with the findings of several other studies [4,17,18]. While *N. gonorrhoeae* was isolated from samples of females 21-25 and > 40 years, *T. vaginalis* were detected among the 16-20, 26-30,31-35, and

Table 1. The prevalence of *Trichomonas vaginalis* and *Neisseria gonorrhoeae* among females attending healthcare facilities

Characteristics	No. Tested	Positive	Prevalence
Specimen types			
HVS	292	4	1.4
ECS	59	2	3.4
Age			
16-20	26	1	3.9
21-25	79	1	1.3
26-30	89	1	1.3
31-35	78	1	1.1
36=40	39	1	2.6
>40	40	1	2.5
Residence			
Low-density	88	1	1.1
High-density	263	5	1.9
Marital			
Married	208	3	1.4
Single	143	3	2.1
Total	351	6	1.7

Table 2. The prevalence of *Trichomonas vaginalis* among females attending healthcare facilities

Characteristics	No. Tested	Positive	Prevalence
Specimen types			
HVS	292	4	1.4
ECS	59	0	0.0
Age			
16-20	26	1	3.9
21-25	79	0	1.3
26-30	89	1	1.1
31-35	78	1	1.3
36=40	39	1	2.6
>40	40	0	0.0
Residence			
Low-density	88	0	0.0
High-density	263	4	1.5
Marital Status			
Married	208	3	1.4
Single	143	1	0.7
Total	351	4	1.1

Table 3. The prevalence of *Neisseria gonorrhoeae* among females attending healthcare facilities

Characteristics	No. Tested	Positive	Prevalence
Specimen types			
HVS	292	0	0.0
ECS	59	2	3.4
Age			
16-20	26	0	0.0
21-25	79	1	1.3
26-30	89	0	0.0
31-35	78	0	0.0
36=40	39	0	0.0
>40	40	1	2.5
Residence			
Low-density	88	1	1.1
High-density	263	1	0.4
Marital			
Married	208	0	0.0
Single	143	2	1.4
Total	351	2	0.6

36-40 age brackets. A number of studies have found higher prevalence of STIs among certain age brackets, but most studies are consistent that all age groups are prone to infection with sexually transmitted pathogens. In this study, the highest prevalence of the STDs was found among the 1-20 age group, and the least was among the 31-35 bracket. It is therefore advised that efforts at prevention and control should be focused on all ages, while paying attention to specific drivers for each age bracket.

The prevalence of the STIs were higher among the high-density areas than low density areas, with all the four strains of *T. vaginalis* were detected among high density area dwellers. This is hardly surprising given that the high-density area resident's living condition is closer to that of the rural or suburban resident with respect to sanitary conditions, poor urogenital hygiene, high-risk sexual practices, among others [5,6]. Also the low-density dweller has more access to good healthcare facilities than her counterpart in the other area.

Though it was found to be statistically significant, the all the *N. gonorrhoeae* identified in this study were associated with unmarried women, vast majority of the *T. vaginalis* were from married men. Previous studies have reported that single women are more likely than married women to be infected with sexually transmitted pathogens [19,20]. While the results obtained for *N. gonorrhoeae* conforms with these previous findings, the findings about *T. vaginalis* may have been influence more by cofounding factors. This study shows that 1.7% of the females whose medical laboratory results were reviewed had at least one STI. According to WHO classification, a prevalence rate of 5% as an STI prevalence that is under control for a given population [21]. The rate in this study was 1.7%, which implies that he STIs are under control for the population of females attending healthcare facilities in Port Harcourt, Nigeria.

The strength of this study lies in the fact that it highlights a significant population of persons seeking for healthcare services, either because they have symptoms or have reasons to want to ascertain their health status. Healthcare facilities play key roles in the containment and prevention of sexually transmitted and non-sexually transmitted infections through testing, treatment, counselling and increasing the level of awareness among persons seeking for healthcare attentions.

This study is subject to a number of limitations. First, as a population-based study it was restricted to only females who attended conventional healthcare facilities in Port Harcourt, Nigeria, the convenience sampling technique may lead to bias against sections of the population who could not afford visits to

healthcare facilities or who patronize alternative medicine practitioners. The outcomes may thus not be easily stretched to cover the larger population on men and women who did not seek healthcare services within the study period. The is also the tendency to over-test since persons seeking medical assistance are those with symptoms or whose healthcare practitioners may have reasons to believe they may have infections. This may result in prevalence rates that are higher than what may be obtained from the larger population. The methods of testing could also be limiting factors; the wet preparation microscopy and culture methods for may lead to reports of lower prevalence rates for *T. vaginalis* and *N. gonorrhoeae* respectively especially if the specimens got to the laboratory late or there were delays in the processing of samples. The retrospective study design is also limiting given the few sociodemographic variables absence of interactions with the study subjects among others.

5. CONCLUSION

The prevalence of *Trichomonas vaginalis* and *Neisseria gonorrhoeae* as reported in this study is low and by WHO classification, infections with the sexually transmitted pathogens are under control for the test population. While this is commendable efforts must be intensified towards preventing a reversal of the successes made in controlling the infections and possibly eradicate the pathogens. The preventive and control measures should be able to target the young adults through social media and other such outlets, given the high prevalence of infections among young adults.

ETHICAL APPROVAL

As per international standards or university standards written ethical approval has been collected and preserved by the author(s).

DISCLAIMER (ARTIFICIAL INTELLIGENCE)

Author(s) hereby declare that NO generative AI technologies such as Large Language Models (ChatGPT, COPILOT, etc.) and text-to-image generators have been used during the writing or editing of this manuscript.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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