

Genital Carriage of *Neisseria Gonorrhoeae* and *Chlamydia Trachomatis* in Asymptomatic Adults in Abidjan, Ivory Coast

Timothée Ouassa^{1,2,*}, Zinzendorf Nanga Yessé^{1,3}, Kouassi-Agbessi Thérèse^{1,3}, Richmond Djatchi^{1,2},
Agathe Dotia-Koné^{1,3}, Marcelle Kacou-N'Guessan², Arsher Cablan^{1,3}, Joseph Lathro^{1,3},
Sandrine Tahou-Apete^{1,3}, Anne-Aymone Krizo¹, Hervé Menan², Guillaume Loukou^{1,3}

¹Department of Bacteriology and Virology, Faculty of Pharmacy, University Félix Houphouët-Boigny, Abidjan, Ivory Coast

²Center for Diagnostic and Research on AIDS and other Infectious Diseases, University Hospital of Treichville, Abidjan, Ivory Coast

³Department of Medical Biology, National Laboratory for Public Health, Abidjan, Ivory Coast

*Corresponding author: timouassa@yahoo.fr

Received October 07, 2018; Revised November 29, 2018; Accepted December 28, 2018

Abstract Sexually transmitted infections (STIs) are considered to be responsible for a major health and economic burden worldwide with many cases due to *Neisseria gonorrhoeae* and *Chlamydia trachomatis*. In Ivory Coast, a few information about the burden of bacterial STIs are available. The aim of this study was to determine the prevalence *C. trachomatis* and *N. gonorrhoeae* in the genital tract of asymptomatic adults with a non-invasive sampling and by using a nucleic acid amplification test. Thus, asymptomatic adults was consecutively recruited during a cross-sectional study conducted from July 2018 to October 2018 in Abidjan, Ivory Coast. Then, first void urine was collected and tested with the Xpert CT/NG. During the period of study, 439 subjects were tested including 203 (46.2%) male and 236 (53.8%) female. The age of patients ranged from 15 to 84 years with a median of 30 years. Prevalence of *N. gonorrhoeae* and *C. trachomatis* were 21/439 (4.8 %) and 3/439 (0.7 %) respectively and in two cases (0.5 %), subjects were infected by both bacterial species. *N. gonorrhoeae* was only detected in subjects under age 30 with a higher prevalence below the age of 20. Also, neither *N. gonorrhoeae*, nor *C. trachomatis* were detected in subjects more than 40 years. The prevalence of *N. gonorrhoeae* and *C. trachomatis* were not statistically different between male and female. According to occupation, *N. gonorrhoeae* was only detected in students and no infection was found in retired, people without any occupation and housewives. The results of this study which was the first one consisting in an active screening of *N. gonorrhoeae* and *C. trachomatis* in adults in Ivory Coast showed that these pathogens are present even in asymptomatic people and that young people are at greater risk of being infected.

Keywords: *Neisseria gonorrhoeae*, *Chlamydia trachomatis*, urine, adults, asymptomatic, Abidjan, Ivory Coast

Cite This Article: Timothée Ouassa, Zinzendorf Nanga Yessé, Kouassi-Agbessi Thérèse, Richmond Djatchi, Agathe Dotia-Koné, Marcelle Kacou-N'Guessan, Arsher Cablan, Joseph Lathro, Sandrine Tahou-Apete, Anne-Aymone Krizo, Hervé Menan, and Guillaume Loukou, "Genital Carriage of *Neisseria Gonorrhoeae* and *Chlamydia Trachomatis* in Asymptomatic Adults in Abidjan, Ivory Coast." *American Journal of Microbiological Research*, vol. 6, no. 5 (2018): 193-196. doi: 10.12691/ajmr-6-5-3.

1. Introduction

Sexually transmitted infections (STIs) are considered to be responsible for a major health and economic burden worldwide [1]. Many bacterial, viral and parasitic pathogens have been identified as sexually transmissible. According to the World Health Organization (WHO), more than 1 million STIs are acquired every day worldwide and an estimated 357 million new cases of four of the curable STIs (Chlamydia, Gonorrhea, Syphilis and Trichomoniasis) occur each year [2]. In 2012, an estimated 130.9 million new cases of Chlamydia and 78.3 million cases of Gonorrhea occurred in adult ages 15-49 years. At this point, there

were 127.4 million adults infected with Chlamydia and 26.8 million with Gonorrhea [3].

In Ivory Coast, a few studies has been undertaken in some groups where prevalence of infections due to *Neisseria gonorrhoeae* and/or *Chlamydia trachomatis* were estimated. It was the case for female or male sex workers [4,5] or women attending gynecological clinics [6]. Most of these studies took place more than ten years ago and used either invasive methods for samples collection or conventional methods for detection and identification of microorganisms such as microscopy and culture.

Recent development of diagnostic methods made available nucleic acid amplification tests (NAAT) known to display better performance. One of these assays, the Xpert CT/NG using the Gene Xpert platform was evaluated and showed

excellent performance associated with a short turnaround time and ease of use [7,8].

The aim of this study was to determine the prevalence of *C. trachomatis* and *N. gonorrhoeae* in the genital tract of asymptomatic adults with a non-invasive sampling and by using a NAAT.

2. Material and Method

The study was held at the Center for Diagnostic and Research on AIDS and other infectious diseases (CeDReS), located into the teaching hospital of Treichville in Abidjan, Ivory Coast (West Africa).

During a cross sectional study conducted from July 2018 to October 2018, adults without any symptom of STIs were consecutively recruited at the CeDReS. First void urine were collected and then tested with the Xpert CT/NG assay (Cepheid, Sunnyvale, California, USA). The Xpert test which was performed according to the manufacturer's instructions is an automated in vitro diagnostic test for qualitative detection and differentiation of DNA from *C. trachomatis* and *N. gonorrhoeae*. The assay was performed on the Cepheid Gene Xpert GX4 Instrument Systems running with the version 4.3. This Instrument Systems automate and integrate sample purification, nucleic acid amplification, and detection of the target sequences in samples using real-time PCR and RT-PCR assays.

The primers and probes in the Xpert CT/NG assay detect chromosomal sequences in the bacteria. One target is detected for *C. trachomatis* (CT1) and two different targets are detected for *N. gonorrhoeae* (NG2 and NG4). Both NG targets need to be positive for the Xpert CT/NG Assay to return a positive *N. gonorrhoeae*. The targets for *N. gonorrhoeae* were two highly conserved noncontiguous targets that are unique to *N. gonorrhoeae* and not found in other *Neisseria* species, and both targets for *N. gonorrhoeae* and *C. trachomatis* were located on the chromosome [7]. To perform the test, a volume of 3 ml of first void urine was required. During the process of analysis, DNA is extracted, purified and concentrated and then, targeted nucleic acid sequences are identified and detected.

Results included a specimen adequacy control result and an amplification control result. The adequacy control is quite important, as it ensures that there is sufficient human DNA in the sample [7]. Results were reported as positive or negative for *C. trachomatis* and/or positive or negative for *N. gonorrhoeae*. In some cases (invalid, error, or no result), the specimen was retested with new Xpert cartridge (s).

Statistical analysis

All the data were collected and analyzed with the Epi Info Ver 7.2.1. Proportions were compared by performing Chi 2 test or exact Fisher test.

3. Results

During the 4 month period of study, 439 subjects were included with 203 (46.2%) male and 236 (53.8%) female (sex ratio = 0.86). Age of patients ranged from 15 to 84 year with a median of 30 years.

A total of 446 tests were performed of which 7 gave error messages. None of the 439 results obtained was indeterminate.

Prevalence of *N. gonorrhoeae* and *C. trachomatis* were 21/439 (4.8 %) and 3/439 (0.7 %) respectively.

According to occupation, *N. gonorrhoeae* was only detected in students when the prevalence of *C. trachomatis* was higher in the same group. Finally, no infection was detected in retired, people without any occupation and housewives. All the other characteristics of the study population can be observed in Table 1.

N. gonorrhoeae was detected only in subjects under age 30 with a higher prevalence under 20. Also *N. gonorrhoeae* and *C. trachomatis* were not detected in subjects more than 40 years. Prevalence of *C. trachomatis* was higher in people between 20 and 29 years old (Figure 1).

Table 1. Baseline characteristics of the patients

Characteristics	Number (%)	Prevalence (% [CI 95%])	
		<i>N. gonorrhoeae</i>	<i>C. trachomatis</i>
Age			
< 20 years	38 (8.7%)	2 (5.3 [1.5-17.3])	1 (2.6 [0.5-13.5])
20-29 years	182 (41.5%)	1 (0.6 [0.1-3.1])	16 (8.8 [5.5-13.8])
30-39 years	118 (26.9%)	0 (0.0 [0.0-3.2])	4 (3.4 [1.3-8.4])
40-49 years	42 (9.6%)	0 (0.0 [0.0-8.4])	0 (0.0 [0.0-8.4])
50-59 years	26 (5.9%)	0 (0.0 [0.0-12.9])	0 (0.0 [0.0-12.9])
≥ 60 years	33 (5.7%)	0 (0.0 [0.0-10.4])	0 (0.0 [0.0-10.4])
Sex			
Male	203 (46.2%)	1 (0.5 [0.1-2.7])	11 (5.4 [3.1-9.4])
Female	236 (53.8%)	2 (0.9 [0.2-3.0])	10 (4.2 [2.3-5.6])
Occupation			
Managers/Professional	50 (11.3%)	0 (0.0 [0.0-7.1])	3 (6.0 [2.1-7.2])
Technicians and associated professionals	112 (25.5%)	0 (0.0 [0.0-3.3])	4 (3.6 [1.4-8.8])
Elementary occupations	49 (11.1%)	0 (0.0 [0.0-7.3])	2 (4.1 [1.1-13.7])
Students	182 (41.5%)	3 (1.7 [0.6-4.7])	12 (6.6 [3.8-11.2])
Retired/No occupation/Housewives	46 (10.5%)	0 (0.0 [0.0-7.7])	0 (0.0 [0.0-7.7])
Marital status			
Married	222 (50.6%)	1 (0.5 [0.1-2.5])	6 (2.7 [1.2-5.8])
Single	164 (37.4%)	2 (1.2 [0.3-4.3])	11 (6.7 [3.8-11.6])
Fiancé	21 (4.8%)	0 (0.0 [0.0-15.5])	2 (9.5 [2.7-28.9])
Number of children			
None	257 (58.7%)	3 (1.2 [0.4-3.4])	16 (6.2 [3.9-9.9])
1-5	139 (31.7%)	0 (0.0 [0.0-2.7])	3 (2.1 [0.7-6.2])
> 5	10 (2.3%)	0 (0.0 [0.0-27.8])	0 (0.0 [0.0-27.8])

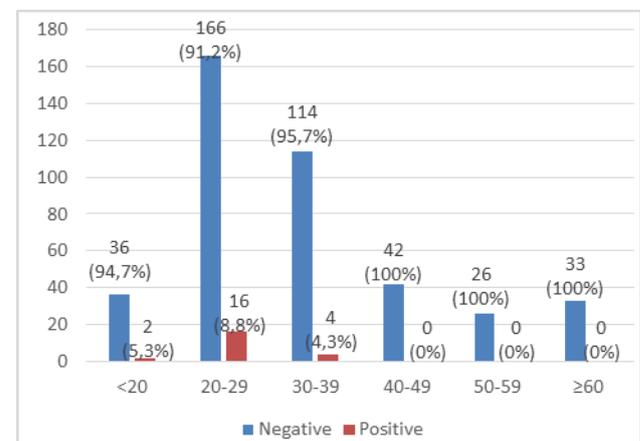


Figure 1. Global prevalence of STIs according to age in years

When considering raw results of the system, *N. gonorrhoeae* and *C. trachomatis* was detected alone in 1 (0.2%) and in 19 (4.3%) cases respectively. In 2 cases (0.5 %), the subjects were infected by both *N. gonorrhoeae* and *C. trachomatis* (Table 2).

Bivariate analysis showed that the prevalence of *N. gonorrhoeae* and *C. trachomatis* were not statistically different between male and female as 11 subjects were infected by *N. gonorrhoeae* and/or *C. trachomatis* in each group. Also, there was no relationship between prevalence and marital status.

However, carriage of *N. gonorrhoeae* and *C. trachomatis* was strongly linked to age under 40 years (Table 3).

Table 2. Prevalence of Neisseria gonorrhoeae and Chlamydia trachomatis infection

Prevalence	All subjects (n=439)	Male (n=203)	Female (n=236)
NG	1 (0.2%)	0 (0%)	1 (0.4%)
CT	19 (4.3%)	10 (4.9%)	9 (3.8%)
CT/NG	2 (0.5%)	1 (0.5%)	1 (0.4%)

Table 3. Global prevalence of STIs according to sexe, age group and marital status

Item	Result of screening for STIs		P value
	Negative	Positive	
Age group			
15 - 39	316	22	0.0085
> 40	101	0	
Sex			
F	225	11	0.72
M	192	11	
Marital status			
Single	152	12	0.14
Fiancé	19	2	
Married	216	6	

4. Discussion

All the studies previously undertaken in Ivory Coast was related to symptomatic patients and one of the last ones conducted in women with leucorrhoea displayed prevalence of 2.9 % for *N. gonorrhoeae* and 13.7 % for *C. trachomatis* [8]. In the current study, the prevalence of carriage for both bacteria was lower, certainly because of the characteristics of the study population (asymptomatic adults). However, Kaida et al., reported in a youth population from South Africa, prevalence of 18.2% and 7.1% for *C. trachomatis* and *N. gonorrhoeae* in female when prevalence of the same pathogens in male were 7.8% and 1.3% respectively [9].

Bivariate analysis showed that, in our study population, infections was only detected in people from 15 to 39 years and the prevalence was higher in people from 20 to 29 and also in students. Moreover, gonorrhoea was not detected in people more than 29 years and its prevalence was higher in adolescents.

These results are consistent with those of previous studies that identified young age as a risk factor for being infected by *C. trachomatis* and/or *N. gonorrhoeae* [10,11,12].

Finally, even if no differences were observed according to marital status or occupation in our study, it has been previously demonstrated that risk factors for *C. trachomatis* and/or *N. gonorrhoeae* were being unmarried [13] or in

some cases married [14], living alone [15], being employed or self-employed [14].

5. Conclusion

The current study, which was the first one in asymptomatic people in Côte d'Ivoire reported prevalence of 0.7% and 4.8% for *N. gonorrhoeae* and *C. trachomatis* respectively. The main risk factor observed was young age (under age 30) and students. These results indicate the need to emphasize preventive actions against STIs in young people and the relevance of the availability of a sensitive, specific and non-invasive method for the diagnosis of current STIs.

Acknowledgements

The authors want to thank all participants to the study and all the lab technicians of the Center for Diagnostic and Research on AIDS and other infectious diseases.

Statement of Competing Interests

Authors have no competing interests to declare.

References

- [1] Chesson HW, Mayaud P, Aral SO. Sexually Transmitted Infections: Impact and Cost-Effectiveness of Prevention. In: Holmes KK, Bertozzi S, Bloom BR, Jha P, éditeurs. Major Infectious Diseases [Internet]. 3rd éd. Washington (DC): The International Bank for Reconstruction and Development/The World Bank; 2017 [cité 18 nov 2018]. Disponible sur: <http://www.ncbi.nlm.nih.gov/books/NBK525195/>.
- [2] Sexually transmitted infections (STIs) [Internet]. [cité 28 nov 2018]. Disponible sur: [http://www.who.int/news-room/fact-sheets/detail/sexually-transmitted-infections-\(stis\)](http://www.who.int/news-room/fact-sheets/detail/sexually-transmitted-infections-(stis)).
- [3] Newman L, Rowley J, Vander Hoorn S, Wijesooriya NS, Unemo M, Low N, et al. Global Estimates of the Prevalence and Incidence of Four Curable Sexually Transmitted Infections in 2012 Based on Systematic Review and Global Reporting. PloS One. 2015; 10(12): e0143304.
- [4] Vuylsteke BL, Ettiègne-Traore V, Anoma CK, Bandama C, Ghys PD, Maurice CE, et al. Assessment of the validity of and adherence to sexually transmitted infection algorithms at a female sex worker clinic in Abidjan, Côte d'Ivoire. Sex Transm Dis. avr 2003; 30(4): 284-91.
- [5] Vuylsteke B, Semde G, Sika L, Crucitti T, Ettiègne Traore V, Buve A, et al. High prevalence of HIV and sexually transmitted infections among male sex workers in Abidjan, Cote d'Ivoire: need for services tailored to their needs. Sex Transm Infect. juin 2012; 88(4): 288-93.
- [6] Abauleth R, Boni S, Kouassi-Mbengue A, Konan J, Deza S. [Causation and treatment of infectious leucorrhoea at the Cocody University Hospital (Abidjan, Côte d'Ivoire)]. Sante Montrouge Fr. sept 2006; 16(3): 191-5.
- [7] Gaydos CA, Van Der Pol B, Jett-Goheen M, Barnes M, Quinn N, Clark C, et al. Performance of the Cepheid CT/NG Xpert Rapid PCR Test for Detection of Chlamydia trachomatis and Neisseria gonorrhoeae. J Clin Microbiol. juin 2013; 51(6): 1666-72.
- [8] Guy RJ, Causer LM, Klausner JD, Unemo M, Toskin I, Azzini AM, et al. Performance and operational characteristics of point-of-care tests for the diagnosis of urogenital gonococcal infections. Sex Transm Infect. 2017; 93(S4): S16-21.
- [9] Kaida A, Dietrich JJ, Laher F, Beksinska M, Jaggernath M, Bardsley M, et al. A high burden of asymptomatic genital tract

- infections undermines the syndromic management approach among adolescents and young adults in South Africa: implications for HIV prevention efforts. *BMC Infect Dis.* 3 oct 2018; 18(1): 499.
- [10] Creighton S, Tenant-Flowers M, Taylor CB, Miller R, Low N. Co-infection with gonorrhoea and chlamydia: how much is there and what does it mean? *Int J STD AIDS.* févr 2003; 14(2): 109-13.
- [11] Peters RPH, Dubbink JH, van der Eem L, Verweij SP, Bos MLA, Ouburg S, et al. Cross-sectional study of genital, rectal, and pharyngeal Chlamydia and gonorrhea in women in rural South Africa. *Sex Transm Dis.* sept 2014; 41(9): 564-9.
- [12] Monteiro EF, Lacey CJN, Merrick D. The interrelation of demographic and geospatial risk factors between four common sexually transmitted diseases. *Sex Transm Infect.* févr 2005; 81(1): 41-6.
- [13] Asbill KK, Higgins RV, Bahrani-Mostafavi Z, Vachris JC, Kotrotsios SH, Elliot MC, et al. Detection of *Neisseria gonorrhoeae* and *Chlamydia trachomatis* colonization of the gravid cervix. *Am J Obstet Gynecol.* août 2000; 183(2): 340-4; discussion 345-346.
- [14] Ginindza TG, Stefan CD, Tsoka-Gwegweni JM, Dlamini X, Jolly PE, Weiderpass E, et al. Prevalence and risk factors associated with sexually transmitted infections (STIs) among women of reproductive age in Swaziland. *Infect Agent Cancer.* 2017; 12: 29.
- [15] Wessel HF, Herrmann B, Dupret A, Moniz F, Brito C, Bergström S. Genital infections among antenatal care attendees in Cape Verde. *Afr J Reprod Health.* avr 1998; 2(1): 32-40.