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Brief Communication

Prevalence of cervical *Chlamydia trachomatis* infection in sexually active adolescents from Salvador, Brazil

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ABSTRACT

The incidence of sexually transmitted diseases among adolescents is increasing worldwide. Genital *Chlamydia trachomatis* infection is one of the most prevalent sexually transmitted diseases in young women, and undetected disease is highly associated with long-term complications in women. Our goal was to determine the prevalence of cervical *Chlamydia trachomatis* infection in a sexually active population of female adolescents from Salvador, Brazil, and to describe their socio-demographic, behavioral, and clinical characteristics. 100 sexually active adolescents (10-19 years) were included in this study, between 2008 and 2010. Endocervical samples were obtained during gynecological examination. In-house polymerase chain reaction of cervical specimens was used for *Chlamydia trachomatis* detection. The overall prevalence of cervical *Chlamydia trachomatis* infection was 31% (95% CI 22-40). There were no statistically significant differences in the age at first sexual intercourse, number of sexual partners, and frequency of condom use between *Chlamydia* infected and uninfected adolescents. The prevalence of cervical *Chlamydia trachomatis* infection among adolescents from Salvador was the highest in Brazil up to the present date. These results demonstrate an urgent need for continued and comprehensive prevention strategies along with proper screening for *Chlamydia* in high-risk populations in order to decrease the rates of infection.

Adolescence is defined as the period between the ages of 10 and 19 years. According to *The State of the Worlds Children 2011*,[1] around 11% of the Brazilian population is composed of adolescents. In Latin America, about 22% of adolescent females claimed to have had their sexual initiation before age 15.[1,2] This scenario presents sexually transmitted diseases (STDs) in this period of life as an increasingly urgent public health concern.[3]

Chlamydia trachomatis (CT) is one of the most prevalent pathogens related to sexually transmitted diseases both overall and among young females.[4,5] Chlamydial genital infections typically present with mild and non-specific

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signs and symptoms,[6] although the majority of them are asymptomatic.[5,7] In women, undetected infections are highly associated with harmful and costly complications, such as pelvic inflammatory disease (PID), infertility, and ectopic pregnancy.[4-8] At the present time, few studies have been conducted in order to estimate the prevalence of CT among Brazilian adolescent females.[5]

The aim of this study was to assess the prevalence of cervical CT infection in a population of female adolescents from the city of Salvador, northeastern Brazil, and to describe their socio-demographic, behavioral and clinical characteristics. A group of 100 adolescent females from the Adolescent Gynecology Clinic (Serviço de Ginecologia para Adolescentes – SEGIA) of the Escola Bahiana de Medicina e Saúde Pública (EBMSP – Salvador, Bahia, Brazil) were included in this study, between September 2008 and September 2010. This is a free outpatient unit that has provided comprehensive care to a total of 300 patients since 2008. Patients were sequentially enrolled at the moment of their medical appointment. Inclusion criteria were female gender, age between 10 and 19 years and sexual activity. Exclusion criteria were pregnancy or postpartum status, use of vaginally applied medication over three days prior to the gynecological examination. This study was approved by the Institutional Review Board of EBMSP. An informed consent form was signed by all the legally responsible persons for the adolescents prior to their participation in the study. Patients aged 18 years or older signed it themselves.

Demographic and clinical data were obtained by specific standardized data collection forms. Endocervical samples were collected with appropriate swabs, during gynecological examination. The DNA was extracted from cervical specimens using the Qiamp® DNA Mini Kit (Qiagen, Hilden – Germany). Then, in-house polymerase chain reaction (PCR) was carried out for genetic amplification, using the following primers: KL1-5TCCGGAGCGAGTTACGAAGA3 and KL2-5'AATCAATGCCCGGGATTGGT3. A fragment of 241 base pairs was amplified.

Standard descriptive analysis of all variables was performed, including: frequency distributions for ethnic groups; family income; conjugal status; education; alcohol, tobacco and illegal drug use; history of family violence; age at first sexual intercourse; sexual abuse; contraceptive use; condom use; and number of sexual partners. Mean and standard deviation were calculated for age and age at menarche. Prevalence with a corresponding confidence interval (95% CI) was also calculated. Qui-square and Fisher's exact tests were used to study associations between CT-positivity and socio-demographic, behavioral and clinical variables. A p-value of ≤ 0.05 was considered statistically significant. All data were analyzed using the Statistical Package for Social Sciences (SPSS) version 17.0 PC software (IBM SPSS – Chicago, IL, USA).

Socio-demographic and behavioral characteristics of the study population are outlined in Table 1. The mean age of participants was 16.6 ± 1.6 years, 91% were non-white, and 80% were married or living with a partner. About 44% had more than 9 years of education, and 49% belonged to families whose earnings were equal to one minimum wage or less. The

overall prevalence of cervical *Chlamydia trachomatis* infection was 31% (95% CI: 22-40). There were no significant differences in the age at first sexual intercourse and condom use between CT-infected and uninfected adolescents. About 10% of the CT-infected women have had five or more sexual partners in their lifetime, while 5.8% of uninfected patients reported the same. However, this difference was not statistically significant.

Current genitourinary characteristics of CT-infected and uninfected patients are specified in Table 2. Vaginal discharge was reported by more than half of CT-infected patients. The frequencies of genital itching (16.6%) and abdominopelvic pain (6.6%) were also greater for CT-positive individuals. There was a similar frequency of dysmenorrhea in the two groups, while dysuria was reported only among CT-uninfected individuals. Genital lesions and vaginal hyperemia were more often observed in CT-negative patients (10.1%). However, none of the previously described differences achieved statistical significance.

This study demonstrated a high prevalence of CT (31%) among sexually active adolescent females from Salvador, a city located in northeastern Brazil. The vast majority of these adolescents belonged to socioeconomically disadvantaged groups, were relatively less educated, and had very low family incomes, usually equal to one minimum wage or less. Additionally, more than one third of them had their sexual initiation before 14 years of age, and 80% were married or living with a partner.

Previous studies conducted in Brazil showed lower prevalences of genital *Chlamydia* infection, ranging from 12.2% to 22.2%.[5,7] The epidemiological profile of the adolescents did not seem to be important in determining these differences in the prevalence of CT infection. There were similarities between this study and the previous ones in relation to the level of education, age of sexual initiation, and number of sexual partners of participants.[5,7] However, there was heterogeneity regarding the diagnostic methods used and the age group evaluated. The highest prevalences were observed when endocervical samples were analyzed by molecular techniques.[5,9] The studies in which urine specimens were used showed CT prevalence ranging from 12.2% to 16%.[7,10] Despite the fact that both techniques are comparable in terms of specificity and sensitivity,[11] it has been demonstrated that the use of cervical samples is more accurate for CT detection in general.[12,13] Relatively high rates of CT infection in adolescent females were also observed in some worldwide studies,[3,8,14] ranging from 9.6% to 17.4%. Most of these studies screened low-income urban populations reporting high-risk behavior for STDs.[8,14]

The most common presenting symptoms among CT-infected adolescents were vaginal discharge and genital itching. Abdominopelvic pain was reported by less than 10% of adolescents. This clinical presentation is similar to those described in previous studies.[3,4] Genital chlamydial infections usually display a nonspecific pattern of signs and symptoms, and are highly associated with important complications when misdiagnosed or mistreated.[4-8] This is in spite of its well documented spontaneous resolution, whose rates ranges from 11% to 57%.[15]

Table 1 - Socio-demographic and behavioral characteristics of the study population (n = 100)

	n = 100	CT positive patient (n = 31)	CT negative patients (n = 69)	p-value
Age (years)	16.6 ± 1.6	16.8 ± 1.6	16.5 ± 1.6	0.44
Ethnic group				0.45
Non-white	91	27 (87)	64 (92.7)	
White	9	4 (12.9)	5 (7.2)	
Conjugal status				0.66
Married/living together	80	24 (77.4)	56 (81.1)	
Single	20	7 (22.5)	13 (18.8)	
Family income (minimum wages†)*				0.92
1	49	16 (51.6)	33 (48.5)	
2 to 4	47	14 (45.1)	33 (48.5)	
≥ 5	3	1 (3.2)	2 (2.9)	
Education*				0.46
< 9 years (primary/intermediate)	44	15 (50)	29 (42)	
≥ 9 years (secondary/higher)	55	15 (50)	40 (58)	
Alcohol, tobacco and illegal drug use	52	13 (41.9)	39 (56.5)	0.17
History of family violence*	22	10 (33.3)	12 (17.4)	0.08
Age at menarche (years)‡	12.3 ± 1.6	12.6 ± 1.7	12.2 ± 1.5	0.41
Age at first sexual intercourse (years)				0.48
≤ 14	34	9 (29)	25 (36.2)	
≥ 15	66	22 (71)	44 (63.7)	
Sexual abuse	3	2 (6.4)	1 (1.4)	0.22
Contraceptive use	41	12 (38.7)	29 (42)	0.75
Condom use				0.85
Never/sometimes	53	16 (51.6)	37 (53.6)	
Always/almost always	47	15 (48.3)	32 (46.3)	
Number of sexual partners*				0.43
1 to 4	92	27 (90)	65 (94.2)	
≥ 5	7	3 (10)	4 (5.8)	

Data are presented as mean ± SD (standard deviation) for continuous variables and n (%) for categorical variables. STD, sexually transmitted diseases; †approximately 330 US dollars; *data was available for 99 subjects; ‡the specific age at menarche was available for 59 subjects, considering it was ≤ for all participants.

Table 2 - Genitourinary signs, symptoms and diseases of the study population stratified by *Chlamydia trachomatis* (CT) infection status (n = 99)

	CT positive (n = 30)	CT negative (n = 69)	p-value
Vaginal discharge	16 (53.3)	32 (46.3)	0.58
Genital itching	5 (16.6)	4 (5.8)	0.12
Dysmenorrhea	3 (10)	7 (10.1)	1.00
Abdominal/pelvic pain	2 (6.6)	4 (5.8)	1.00
Dysuria	0	1 (1.4)	1.00
Genital lesions and/or vaginal hyperemia	2 (6.6)	7 (10.1)	0.71

Data are presented as n (%).

The small sample size of this study might limit inference of results to other similarly aged women in Brazil.[4,7] However, it was the first study carried out exclusively among adolescents in the northeast region of the country. As both CT-infected and uninfected groups exhibited comparable socio-demographic and behavioral characteristics, and the majority of participants were in stable relationships, it could be inferred that the epidemiological profile of their partners was partially or mainly responsible for the overall high rates of *Chlamydia*. Nevertheless, the partners of subjects were not investigated in this study, which could be identified as another limitation. Further studies should be conducted in order to estimate the countrywide prevalence of genital CT in both male and female adolescents.

The prevalence of cervical CT infection among adolescents from Salvador demonstrated in this study was the highest in Brazil to date. These results underscore the need to enhance current STD-preventive public health policies focused on this age group, and to provide free screening tests for *Chlamydia* in public outpatient settings. This could have an impact on women's future reproductive health and contribute to the prevention of other STDs.

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Conflict of interest

All authors declare to have no conflict of interest.

REFERENCES

1. Adolescence, an Age of Opportunity: The State of the World's Children 2011. New York, NY: United Nations Children's Fund; 2011.
2. Forhan SE, Gottlieb SL, Sternberg MR, et al. Prevalence of sexually transmitted infections among female adolescents aged 14 to 19 in the United States. Pediatrics. 2009;124(6):1505-12.
3. Hirsl-Hecej V, Pustisek N, Sikanic-Dugic N, et al. Prevalence of chlamydial genital infection and associated risk factors in adolescent females at an urban reproductive health care center in Croatia. Coll Antropol. 2006;30(Sppl. 2):131-7.
4. Miller WC, Ford CA, Morris M, et al. Prevalence of chlamydial and gonococcal infections among young adults in the United States. JAMA. 2004;291(18):2229-36.
5. Araujo RSC, Guimaraes EMB, Alves MFC, et al. Prevalence and risk factors for *Chlamydia trachomatis* infection in adolescent females and young women in central Brazil. Eur J Clin Microbiol Infect Dis. 2006;25(6):397-400.
6. Vuylsteke B, Vandenbruaene M, Vandenbulcke P, et al. *Chlamydia trachomatis* prevalence and sexual behaviour among female adolescents in Belgium. Sex Transm Infect. 1999;75(3):152-5.
7. Miranda AE, Szwarcwald CL, Peres RL, Page-Shafer K. Prevalence and risk behaviors for chlamydial infection in a population-based study of female adolescents in Brazil. Sex Transm Dis. 2004;31(9):542-6.
8. Williams KM, Wingood GM, DiClemente RJ, et al. Prevalence and correlates of *Chlamydia trachomatis* among sexually active African-American adolescent females. Prev Med. 2002;35(6):593-600.
9. Benzaken A, Sales D, Junior JP, et al. Prevalência da infecção por clamídia e gonococo em mulheres atendidas na clínica de DST da Fundação Alfredo da Matta, Manaus, Amazonas. J Bras Doenças Sex Transm. 2010;22(3):129-34.
10. Codes JS, Cohen DA, Melo NA, et al. Detecção de doenças sexualmente transmissíveis em clínica de planejamento familiar da rede pública no Brasil. Rev Bras de Ginecol e Obstet. 2002;24:101-6.
11. Haugland S, Thune T, Fosse B, et al. Comparing urine samples and cervical swabs for Chlamydia testing in a female population by means of Strand Displacement Assay (SDA). BMC Women's Health. 2010;10(1):9.
12. Poiares L, Sandrini F, Osório P, et al. Validação do método de detecção de *Chlamydia trachomatis* por Reação em Cadeia da Polimerase em tempo real Rev Bras Anal Clin. 2008;40(3):229-32.
13. Blake DR, Maldeis N, Barnes MR, et al. Cost-effectiveness of screening strategies for *Chlamydia trachomatis* using cervical swabs, urine, and self-obtained vaginal swabs in a sexually transmitted disease clinic setting. Sex Transm Dis. 2008 Jul;35(7):649-55.
14. Paul KJ, Garcia PJ, Giesel AE, et al. Generation C: Prevalence of and risk factors for *Chlamydia trachomatis* among adolescents and young women in Lima, Peru. J Womens Health. 2009;18(9):1419-24.
15. Geisler WM. Duration of untreated, uncomplicated *Chlamydia trachomatis* genital infection and factors associated with chlamydia resolution: a review of human studies. J Infect Dis. 2010 Jun 15;201 Suppl 2:S104-13.