Original Article

Risk factors for sexually transmitted infections in women in rural Northeast Brazil

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Abstract
Background: Sexually transmitted infections (STIs) are highly prevalent in northeast Brazil, but factors associated with the presence of an STI have rarely been studied systematically.
Methodology: We performed a population-based study to assess factors associated with STIs in women of reproductive age (12 to 49 years) in a rural setting in northeast Brazil. A total of 734 women were eligible; 592 (80.7%) had initiated sexual life and were included. Women were examined for the presence of an STI. Socio-economic variables, sexual history, and behaviour were assessed through a structured questionnaire. Laboratory testing included: polymerase chain reaction for human papillomavirus (HPV); ligase chain reaction for *Chlamydia trachomatis* and *Neisseria gonorrhoeae*; VDRL and FTA-ABS for *Treponema pallidum*; analysis of wet mounts, gram stain and Pap smears for *Trichomonas vaginalis*; and ELISA for HIV.
Results: At least one STI was present in 112 (19.6%) of the women. In logistic regression analysis, a previous visit to a Pap smear clinic was protective against an STI (OR=0.26; IC 95%: 0.12-0.57). The following variables were independently associated with STIs: ≥3 partners in life (2.35; 1.32-4.17); first pregnancy <16 years of age (2.28; 1.09-4.78); not knowing if partner had another partner (3.56; 1.09-11.62).
Conclusions: The protective and risk factors identified can guide the implementation of gender- and age-specific control programs in rural northeast Brazil. Offering a simple preventive measure (Pap smear collection), usually done by a nurse in this setting, may be a useful opportunity for diagnosis and treatment of curable STIs, without considerable additional costs.
Key Words: Sexually transmitted infections; risk factors; population-based study; epidemiology; Brazil.

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Introduction

An estimated 340 million new cases of curable sexually transmitted infections (STIs) occur annually in men and women of reproductive age [1]. Syphilis, gonorrhoea, chlamydiasis and trichomoniasis are the predominant curable STIs. Due to biological, cultural and gender-related characteristics, women of reproductive age are particularly vulnerable to acquiring an STI [2,3]. If untreated, an STI may develop into chronic pelvic inflammatory disease, ectopic pregnancy and infertility [4]. About 15% of sexually active adults have had contact with one or more subtypes of genital human papillomavirus (HPV), the majority of high risk subtypes, which are closely related to cervical cancer [5].

The identification of risk factors for STIs is a prerequisite for the development and implementation of control measures by regional or national health authorities. Various factors have been associated with the acquisition of STIs in women, such as young age, urban residence, non-white ethnicity, number of sexual partners in life, pregnancy, no use of condoms, and low socio-economic status [5-7]. However, risk factors depend on the setting and may considerably vary, for instance, between urban and rural settings of the same country [8]. Whereas in Brazil several

studies have attempted to identify risk factors for STIs in women living in an urban environment or in high-risk groups (such as female prisoners, patients attending STI clinics and commercial sex workers), reliable data are scarce for women living in rural settings [9-12].

To better understand risk factors associated with the five major STIs (syphilis, gonorrhoea, trichomoniasis, chlamydiasis and HPV infection) in women of reproductive age in a rural community in northeast Brazil, we performed a cross-sectional study.

Materials & Methods

Study area

The study was done in the municipality of Pacoti, 100 km south-west of Fortaleza, the capital of Ceará State (northeast Brazil). Pacoti has a total of 11,500 inhabitants, 77% living in small hamlets [13]. The area is covered with Atlantic rainforest. Around the hamlets and the town centre, fruits and vegetables are cultivated, which are sold at the markets of Fortaleza. The population is assisted by four teams of the government Family Health Program (primary health care). There is no public transport between the hamlets and the centre of Pacoti.

Adult illiteracy is about 30%; the garbage is collected in 30% of households; and 58% of households have sewage disposal [14]. Health service facilities are restricted to a small hospital. Besides general and obstetric inpatients, the hospital outpatient services include the areas of primary health care, physiotherapy, and gynaecology. The gynaecological consultation is done weekly by a nurse and consists of the collection of Pap smears. If at this occasion any curable STI is suspected using a syndromic approach [15], the patients are treated immediately.

Study population

The current number of women of reproductive age was obtained from the local community health agents of the Family Health Program. All women from seven hamlets and the centre of Pacoti aged 12 to 49 years (976 individuals) were invited to participate in the study, independently from their sexual history. However, only women who had initiated sexual life were included in the analysis.

To minimize non-participation from the hamlets, free transport to the hospital at the centre of Pacoti, where the interviews and gynaecological examinations were done, was offered.

Study design

Prior to data collection, meetings were held to explain the objectives of the study, to introduce the investigators, and to discuss possible concerns. Socio-economic and demographic data, as well as information on sexual history, sexual behaviour and gynaecological complaints were obtained through a pre-tested structured questionnaire, applied by one investigator. Thereafter, gynaecological examinations and specimen collections to investigate STIs (syphilis, gonorrhoea, trichomoniasis, chlamydiasis, HPV and HIV infection) were performed by an experienced gynaecologist. If during the interview a woman disclosed that she had not had initiated sexual life, only vaginal swabs were collected for the diagnosis of bacterial vaginosis or candidiasis, and these data were not included in the analysis.

Laboratory testing included polymerase chain reaction (PCR) for HPV; ligase chain reaction (LCR) for *Chlamydia trachomatis* and *Neisseria gonorrhoeae* (from vaginal lavage fluids); ELISA for HIV; VDRL and FTA-Abs for syphilis (from peripheral blood); and analysis of cervico-vaginal wet mounts, gram stain and Pap smears for trichomoniasis. Detailed data on gynaecological examination, specimen collection, laboratory methods, STI prevalence and gynaecological complaints have been published previously [16].

Statistical analysis

Data were entered twice using the EPI-INFO software package version 6.04d (Centers for Disease Control and Prevention, Atlanta, USA), checked for entry-related errors and transferred for analysis to STATA program version 8.0 (Stata Corporation, College Station, USA). Fisher's exact test was applied to compare relative frequencies. Odds ratios and 95% confidence intervals are presented. Multivariate logistic regression analysis was then performed using backward elimination, to calculate adjusted odds ratios for independent association between the outcome and those exposure variables that had shown a significance level of $p<0.2$ in the bivariate analysis.

Ethical aspects

Ethical clearance was obtained from the Ethical Review Board of the Federal University of Ceará (Fortaleza, Brazil). Prior to data collection, the objectives of the study were explained in community meetings. Informed written consent was obtained from all study participants or, in case of minors, from their care givers. All women received their laboratory results in written form, and results were explained during a consultation. If an STI was diagnosed, women were treated free of charge according to national guidelines; partners were also treated.

Results

Four hundred and twelve women, out of 550 from the town centre (75%), and 322 women, out of 360 from the hamlets (90%), were examined clinically. Of those 734 women, 592 (80.7%) had initiated sexual life and were included in data analysis.

The median age of the study participants was 31 (interquartile range: 24-38); the median of sexual partners in life 1 (1-2); and the median of partners in the last twelve months 1 (1-1). The median age of the first sexual intercourse was 18 (15-21) years, and of the first pregnancy 20 (17-23) years. Socio-economic, reproductive and sexual history characteristics are depicted in Table 1.

Results for all STIs under study were available for 570 (96.3%) women; these were included in the bivariate analysis (outcome variable: presence of at least one STI; Table 2). One or more STI was diagnosed in 112 (19.6%) women. There was no case of HIV seropositivity.

The following variables were significantly associated with the presence of at least one STI in the bivariate analysis, with decreasing order of odds ratios (Table 2): >1 partner in the last 12 months; ≥3 partners in life; first pregnancy <16 years of age; age at coital debut <16 years; age ≤19 years; and being single, divorced or widowed. A previous visit to a Pap smear clinic (any point in time before the study) showed an important protective effect against STIs. Thirty-two percent of women with coital debut <16 years of age had had three or more partners in life, while this proportion was 17% for women who had started sexual life later (p<0.001).

Table 1. Socio-demographic, reproductive and sexual history characteristics of women of reproductive age in Pacoti, Brazil (n=592).

	n (%)
Marital status	
Single/widowed/divorced	151 (25.5%)
Married/living together	441 (74.5%)
Level of education*	
None/some primary school	317 (54.7%)
Completed primary school or more	264 (45.3%)
Monthly family income*,†	
< 2 minimum wages	446 (76.8%)
2 minimum wages or more	135 (23.2%)
Age at coital debut	
< 16 years	147 (24.8%)
16 years and older	438 (74.0%)
Does not know	7 (1.2%)
Age at first pregnancy‡	
< 16 years	50 (10.0%)
16 years and older	452 (90.0%)
Condom use in the last 12 months§	
Never	375 (68.2%)
Sometimes	128 (23.3%)
Always	47 (8.5%)
Previous visit to Pap smear clinic	
Yes	517 (87.3%)
No	75 (12.7%)
Sexual partners in life	
< 3	469 (79.2%)
3 or more	123 (20.8%)
Sexual partners in the last 12 months	
< 2	565 (95.4%)
2 or more	27 (4.6%)
Partner has another sexual partner*,‖	
Yes	40 (7.9%)
No	360 (71.3%)
Does not know	105 (20.8%)

* data not available for all women
† one minimum wage ≈ 160 USD
‡ only women with current or previous pregnancy
§ only women with at least one sexual partner in the last 12 months
‖ only women with current partner.

In the multivariate regression analysis, not knowing if the partner had another partner, ≥3 partners in life, and first pregnancy <16 years of age remained significant risk factors for the presence of STIs (Table 3). A previous visit to the outpatient clinic for Pap smear collection remained significantly protective against STIs (Table 3).

Table 2. Factors associated with the presence of one or more STI in women of reproductive age in Pacoti, Brazil (n=570).

	n	STI n (%)	OR (95% CI)	p value
Area				
Town centre	342	64 (18.7%)	0.86 (0.57-1.32)	0.5
Hamlets	228	48 (21.1%)	Ref.	
Age				
≤ 19 years	67	20 (29.9%)	1.9 (1.08-3.36)	0.03
> 19 years	503	92 (18.3%)	Ref.	
Marital status				
Single/widow/divorced	143	38 (26.6%)	1.73 (1.10-2.70)	0.02
Married/living together	427	74 (17.3%)	Ref.	
Level of education*				
None/uncompleted primary school	300	64 (21.3%)	1.22 (0.80-1.86)	0.4
Primary school completed or more	259	47 (18.6%)	Ref.	
Monthly family income*,†				
< 2 minimum wages	426	92 (21.6%)	1.65 (0.97-2.83)	0.08
≥ 2 minimum wages	133	19 (14.3%)	Ref.	
Number of household members*				
≤ 5	387	74 (19.1%)	0.83 (0.55-1.35)	0.6
> 5	172	37 (21.5%)	Ref.	
Age at coital debut <16 years*				
Yes	140	40 (28.6%)	1.99 (1.28-3.12)	<0.01
No	425	71 (16.7%)	Ref.	
Age at first pregnancy <16 years‡				
Yes	50	16 (32.0%)	2.14 (1.13-4.06)	0.02
No	438	79 (18.0%)	Ref.	
Contraception in the last 12 months				
Yes	468	92 (19.7%)	1.0 (0.58-1.72)	1
No	102	20 (19.6%)	Ref.	
Used condom in all sexual relations in the last 12 months*,§				
Yes	44	10 (22.7%)	1.24 (0.59-2.59)	0.6
No	489	94 (19.2%)	Ref.	
Previous visit to Pap smear clinic				
Yes	499	86 (17.2%)	0.36 (0.21-0.62)	<0.001
No	71	26 (36.6%)	Ref.	
Presence of gynaecological complaints*,‖				
Yes	434	86 (19.8%)	1.08 (0.66-1.77)	0.8
No	134	25 (18.7%)	Ref.	
≥3 partners in life				
Yes	123	42 (34.2%)	2.79 (1.78-4.39)	<0.001
No	447	70 (15.7%)	Ref.	
>1 partner in the last 12 months				
Yes	27	11 (40.7%)	3.01(1.36-6.68)	<0.01
No	543	101 (18.6%)	Ref.	
Partner has another partner*,¶				
Yes	40	5 (12.5%)	Ref.	
No	349	55 (15.8%)	1.31 (0.48-4.47)	0.8
Does not know	101	29 (28.7%)	2.81 (0.96-10.07)	0.05

* data not available for all women
† one minimum wage ≈ 160 USD
‡ only women with current or previous pregnancy
§ only women with at least one sexual partner in the last 12 months
‖ abnormal vaginal discharge, genital pruritus, genital tumor, genital ulcer and/or pelvic pain
¶ only women with current partner.

Table 3. Factors independently associated with the presence of STIs in women of reproductive age in Pacoti, Brazil (n=434; logistic regression).

Variables	Adjusted OR (95% confidence interval)	p value
Does not know if partner has another partner	3.56 (1.09-11.62)	0.04
3 or more sexual partners in life	2.35 (1.32-4.17)	0.004
Age at first pregnancy <16 years	2.28 (1.09-4.78)	0.03
Partner does not have another partner	1.57 (0.50-4.91)	0.4
Lives in town centre	1.16 (0.68-1.97)	0.6
Previous visit to Pap smear clinic	0.26 (0.12-0.57)	0.001

Discussion

Our data show that a higher number of partners in life, young age at first pregnancy, and not knowing if the current partner had other partners were associated with STIs in women of reproductive age in a typical rural village in Northeast Brazil. Other studies from middle and high income countries, including Brazil, have consistently shown that a higher number of partners in life is associated with STIs [7,17-19].

In addition, we have shown that the presence of an outpatient clinic run by a nurse (aimed at Pap smear collection) may be an important opportunity to diagnose and treat curable STIs (syphilis, gonorrhoea, chlamydiasis and trichomoniasis), if a syndromic approach is applied. This finding is of particular interest, as there is a considerable number of similar gynaecological clinics focused on cervical cancer screening in rural Brazil, in areas where medical assistance is limited. Similar to the majority of small municipalities in Ceará State, the study population has a coverage of 100% of the government Family Health Program, and women have good access to the Pap smear collection clinic. Thus, implementing systematically a syndromic approach for diagnosis and treatment of curable STIs, this network could be used without the need for considerable additional funds. In fact, the Brazilian Ministry of Health recommends that gynaecological infections should be diagnosed and treated at this opportunity [20]. Interestingly, we have observed that in Pacoti, for many women, the

main reason to have a Pap smear done was the presence of gynaecological complaints, usually an abnormal vaginal discharge, rather than the opportunity to participate at a cancer screening programme free of charge (F. A. Oliveira, unpublished observation). The Pap smear, although not a recommended method for the diagnosis of vaginal infections, has a sensitivity of 60% for the detection of *Trichomonas vaginalis* infection and 88% for bacterial vaginosis [21,22].

The partner's sexual behaviour has an impact on the presence of STIs in women [23-25]. In general, in Brazil, male promiscuity is considered normal and socially acceptable, and is often accepted by the female partners [26]. However, many women are not aware of the risky behaviour of their partners, such as unprotected sex with multiple partners, sex with commercial sex workers, sex with other men or drug abuse [27]. In a study with American couples comparing risk behaviour and risk perception, the correct perception of sexual behaviour of the partner was very low as expressed by the women [28]. In our study, it is also possible that a considerable proportion of the women who answered "I do not know" when asked if their partner had another partner, in fact had knowledge about their behaviour. In rural Brazil, there are various reasons women should deny that their partners have extramarital relationships, such as being ashamed of admitting having an unfaithful partner. On the other side, women who answered that their partner had other sexual relationships may better negotiate the use of condoms (inside and outside the relationship), and consequently, have less exposure to acquiring an STI.

We did not find any independent association of younger age or younger age at sexual debut and the prevalence of STIs, unlike previous studies [18,23,29,30]. However, other studies from rural Nepal and Brazil also failed to show an independent association of young age and STIs [9,31]. In Pacoti, as well as in many other rural settings in Brazil, the period between age of first sexual intercourse and age at marriage (and consequently first pregnancy) is rather short. Thus, young age or young age at sexual debut may not capture the same risks found in settings where that interval is longer and where, as a consequence, pre-marital sex is more common [31,32]. In addition, the association of young age at first pregnancy and STIs may reflect a higher frequency of sexual intercourse in the time preceding the pregnancy, and less frequent use of condoms in those women, in comparison with women who became pregnant later in life.

Our data did not show a protective effect of consistent use of condoms in the last 12 months. However, in general, the frequency of consistent condom use in the study population was very low (8.5%). Similar findings were obtained from a national survey on condom use: only 11.7% of all sexually active women used condoms regularly, and lower frequencies were found among women of lower socio-economic status [33]. It is possible that condom use may be a "risk marker", as consistent condom use in this population was significantly more frequent among teenagers, as well as a higher prevalence of STIs (data not shown). The use of condoms may be more frequent by women who find themselves at a greater risk of contracting an STI [34].

Socio-economic variables, such as educational level and family income, were not associated with STIs. This may be due to the relative homogeneity of the study population that could not be detected by the study design. Similar findings were identified in studies with rural Nepali, Brazilian and Chinese women [9,30,31].

Although we did not detect any case of HIV, the findings of the present study, together with the important burden of STIs, show that those women are at a high risk of acquiring HIV infection and that urgent measures of prevention and control in such settings are needed [16]. In fact, in Brazil, the HIV epidemic is increasing among women of low socio-economic status and smaller municipalities [35,36].

Our study is subject to limitations. Due to the cross-sectional design, causal relationships between the exposure variables and STIs could not be clearly established. For example, it is possible that women who had visited the gynaecological outpatient clinic were more aware of STIs and showed different behaviour regarding their health, which in turn could make them less vulnerable for such infections. Obviously, the syndromic approach is applicable only for the four curable STIs assessed, and our data may have been modified by the inclusion of HPV infection in the analysis. However, we opted to include the four curable STIs and HPV infection in the data

analysis, as the other exposure variables are known to be similar for the five infections [8]. Inter-observer bias can be ruled out, as the examinations and interviews, respectively, were done in all cases by the same investigators.

In conclusion, risk factors for STIs known from other socio-cultural contexts have been confirmed for rural northeast Brazil by our data. The study further shows that paramedical gynaecological facilities may be a useful opportunity to reduce the burden of curable STIs in resource-poor settings.

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