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Factors associated with sexually transmitted infections: a population based survey in the city of São Paulo, Brazil

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Abstract *We determined the prevalence of sexually transmitted infections (STIs), the factors associated with infection and types of counseling received by men and women from health professionals in the City of São Paulo. The investigation consisted of a cross-sectional study conducted with men and women aged between 15 and 64 years living in the City of São Paulo. Of 4,057 individuals who had engaged in sexual activity, 6.3% reported previous history of a STI: 4.3% of women and 8.2% of men. The factors associated with STI were being aged over 34 years and not using a condom during first sexual intercourse, among men, and being aged over 25 years among women. Protective factors included not having had sexual intercourse with someone from the same sex, among men, and having initiated sexual activity after the age of 15 years and not having a casual sex partner over the last 12 months, among women. Counseling about the importance of HIV and syphilis testing was received by 72.1% and 64.7% of women, respectively, while fewer than half of the men received this type of counseling (40.2% and 38.6 %, respectively). The prevalence of previous history of a STI was high among the population of the City of São Paulo. The findings of this study informed the development, implementation, and evaluation of STI policies, including those directed at HIV, leading to a reduction in the barriers that hinder access to and use of condoms and the creation of STI prevention app.*
Key words *STD, STI, Prevention, HIV*

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Introduction

Sexually transmitted infections (STIs) are a public health concern, in view of the magnitude of the problem and the lack of access to adequate treatment. In 2012, it is estimated that there were 357.4 million new cases of curable STIs among people aged between 15 and 49 years worldwide, the majority of which occurred in developing countries[1].

In developing countries, STIs are among the 10 diseases that are most likely to cause people to seek healthcare services and have serious health, social, and economic consequences[2]. The lack of access to effective and reliable health care services has led to an increase in STIs in several countries[3]; which is particularly worrying considering that these infections account for up to 17% of economic losses due to ill health[4,5].

Besides increasing the risk of HIV transmission[9,10], the lack of effective treatment for STIs may also lead to complications such as a pelvic inflammatory disease (PID), ectopic pregnancy, male and female infertility, cancer[6-8], miscarriage, premature birth, stillbirth, neonatal mortality, and congenital infections[2].

The true epidemiological situation of STIs and their complications in Brazil remains poorly understood due to the lack of population-based studies and to the fact that for the majority of STI notification is not compulsory.

The City of São Paulo has a population of 12 million, 52.5% of which are women[11]. Data gaps still exist that hinder estimates of the magnitude of the problem among men and women living in the city.

This study aims to estimate the prevalence of STIs among people aged between 15 and 64 years living in the City of São Paulo and determine the factors associated with infection and the types of counseling received by patients during treatment.

Methodology

This cross-sectional study is part of a population survey entitled "Study of Knowledge, Attitudes and Practices among Individuals Aged between 15 and 64 Years Living in the City of São Paulo" (*Pesquisa sobre Conhecimento, Atitudes e Práticas dos indivíduos de 15 a 64 years residentes no Município de São Paulo* - PCAP), whose aim was to determine the level of knowledge, attitudes and practices in relation to STIs, HIV and viral hepatitis among the population of the municipality. Data was collected between November 2013 and January 2014.

The sample size was calculated based on the assumption used by the 2008 PCAP that 20% of people use condoms on a regular basis with permanent partners and using a confidence interval of 95%, sampling design effect of 1.8, and 5% significance level. The resulting minimum sample size was 443 interviews for each domain. This number was increased by 20% – considered an acceptable sample loss adjustment factor – thus resulting in a final sample of 530 for the domains sex and age.

Cluster sampling was conducted in two stages based on the census sectors of the 2010 Census and adopting the following domains: the city's five Regional Health Coordination Offices (*Coordenadorias Regionais de Saúde* - CRS) - Center-West, Southeast, South, East, and North; sex; and age group of the urban population of São Paulo.

Eighty census sectors were selected as primary sampling units using systematic random sampling, whereby the first unit is selected at random and then every *k*th unit thereafter, where the sampling interval is calculated as the ratio between population and sample size. The random sampling of the respective sectors was proportional to the population size of each administrative region (Center-West, Southeast, South, East, and North). It is important to highlight that the total number of sectors selected in this process represented the diversity among the administrative regions.

The selection of households and household members in each sector continued until the quota requirements for each variable (sex, age group, and marital status) were met. Thus, one individual from each group was interviewed in each sector, resulting in a total sample size of 4,318 interviews.

Data collection

Data was collected using face-to-face interviewing and self-completion questionnaires. The former was used to obtain sociodemographic characteristics, knowledge about communicable diseases, sexually transmitted infections, HIV and hepatitis testing, discrimination, and access to condom; while the latter was used for questions and topics that could potentially cause embarrassment, inhibition, refusal to answer questions or falsification of information (sexual

behavior and drug and/or alcohol use).

The interviews were conducted by people of the same sex as the interviewees using Tablets. For people who were illiterate, the answers to the self-completion questionnaires were recorded, ensuring the privacy and confidentiality of participants.

Information provided by 4,057 men and women who had started sexual activity, equivalent to 93.9% of the total sample, was analyzed.

The independent variables were: sociodemographic characteristics: age (between 15 and 24 years, 25 and 34 years, 35 and 49 years, and 50 and 64 years); level of schooling (up to primary school, secondary school completed and incomplete, and higher education completed and incomplete); race/color (self-defined) in accordance with the IBGE classification; marital status (living with a partner or not); economic status, based on the Brazilian classification and grouped into "A/B", "C" and "D/E"; behaviors (age of first sexual intercourse, use of a condom during first sexual intercourse, and having engaged in same-sex experiences at some point in life).

The dependent variable was previous history of a STI at some point during the participant's lifetime: urethral discharge (only men), sores, blisters, warts (men and women). Complaints of vaginal discharge were not included in the questionnaire since this is generally not a sign of a STI.

Analysis

The variables were analyzed to determine frequency and proportion using Pearson's chi-squared test and Fisher's exact test, while logistical regression was used to identify the factors associated with infection. Those variables found to have a p-value of < 0.20 in bivariate analysis were included in the multiple model. Those variables with a p-value of < 0.05 or that influenced another variable leading to a change of at least 10% in its value were included in the final model.

The analyses were performed using the STATA 10.0 statistical software package and adopting a 5% significance level.

This study was approved by the Research Ethics Committee of the Department of Health of the City of São Paulo (approval number 340.776).

Results

Overall, among the group of individuals who had started sexual activity (n = 4,057), 6.3% (255) reported having at least one episode of a STI during their lifetime: 4.3% of women and 8.2% of men, as shown in Table 1.

Urethral discharge was reported by 5.5% of men, while genital sores, warts and blisters were reported by 2.2%, 0.8%, and 1.8% of men, respectively, and 2.8%, 1.3%, and 0.8% of women, respectively (Table 1).

The majority (45.5%) of men were white, while 52.5% were aged over 34 years, and approximately 46% had completed up to 11 years of schooling. Over half (52.4%) lived with a female or male partner, as shown by Table 2. The bivariate analysis of sociodemographic characteristics showed that there was a positive association between STI and being aged over 34 years and a negative association between having completed nine or more years of schooling and STI (Table 2).

With regard to sexual behavior, the majority of men had initiated sexual activity before the age of 15 years (52.7%) and 58.8% did not use a condom during their first sexual intercourse. Over a third of men (39.0%) had had a casual sex

Table 1. Percentage of individuals that had initiated sexual activity and previous history of STIs by sex. São Paulo, 2014.

Previous history of STI	Men (n = 2,044)		Women (n = 2,013)		p
	n	%	n	%	
Discharge*	113	5.5	-----	-----	
Sores	45	2.2	57	2.8	0,2
Blisters	37	1.8	15	0.7	0,003
Warts	17	0.8	26	1.3	0,153
At least one symptom	168	8.2	87	4.3	< 0,001

* Complaints of vaginal discharge were not included in the analysis because this is generally not a sign of a STI.

Table 2. Sociodemographic characteristics and behaviors among men and factors associated with STI. City of São Paulo, 2014.(N = 2,044).

Variables	Total		STI				OR_{br} (95%CI) %	
			No		Yes			
	n	%	n	%	n	%		
Age group								
15-24 years	445	21.8	428	22.8	17	10.1	1	
25-34 years	526	25.7	497	26.5	29	17.3	1.47	(0.8-2.6)
> 34 years	1073	52.5	951	50.7	122	72.6	3.23	(2.0-5.2)
Schooling (years of study)								
< 8 years	619	30.3	546	29.1	73	43.4	1	
9-11 years	938	45.9	874	46.6	64	38.1	0.54	(0.4-0.8)
12 +	487	23.8	456	24.3	31	18.5	0.51	(0.3-0.9)
Race/color								
White	930	45.5	859	45.8	71	42.3	1	
Black	377	18.4	350	18.6	27	16.1	0.93	(0.6-1.4)
Brown	650	31.8	592	31.6	58	34.5	1.18	(0.8-1.7)
Other	87	4.3	75	4.0	12	7.1	1.93	(0.9-4.0)
Marital status								
Living with a partner	1070	52.4	987	52.6	83	49.4	1	
Not living with a partner	974	47.6	889	47.4	85	50.6	1.13	(0.8-1.6)
Economic status								
D/E	160	7.8	147	7.9	13	7.8	1	
C	890	43.6	809	43.1	81	48.2	1.13	(0.5-2.4)
A/B	994	48.6	920	49.0	74	44.0	0.91	(0.4-1.9)
Age of first sexual experience*								
≤15 years	1074	52.7	978	52.3	96	57.1	1	
>15 years	963	47.3	891	47.7	72	42.9	0.82	(0.6-1.2)
Condom use during first sexual intercourse*								
Yes	842	41,2	808	43.1	34	20.2	1	
No/didn'treply	1202	58,8	1068	56.9	134	79.8	2.98	(1.9-4.6)
Engaged in sexual activity with someone from the same sex								
Yes	176	8,6	151	8.1	25	14.9	1	
No/ didn'treply	1868	91,4	1725	91.9	143	85.1	0.50	(0.3-0.8)
Casual sex partner over last 12 months**								
Yes	744	39.0	673	38.5	71	44.6	1	
No	1164	61.0	1076	61.5	88	55.4	0.77	(0.5-1.1)

* 7 people did not respond the question regarding age of first sexual experience. ** 136 people had not engaged in sexual activity over the last 12 months. Notes: the variables with a p-value of < 0.20 in the bivariate analysis were included in the multiple model.

partner during the last 12 months and 8.6% had engaged in sexual activity with other men. The bivariate analysis showed that not using a condom during first sexual intercourse was positively associated with STI, while not having engaged in sexual activity with someone from the same sex was negatively associated with STI (Table 2).

The sociodemographic characteristics of women were similar to those of men: the majority were white (53.5%), 43.7% had completed between 9 and 11 years of schooling, and over half lived with a partner (53.5%), as shown in Table 3. Bivariate analysis showed a positive association between STI and being aged over 25 years (Table 3) among women.

Over three quarters (77.8%) of women started to engage in sexual activity after the age of 15 years, 62.4% did not use a condom during their

Table 3. Sociodemographic characteristics and behaviors among women and factors associated with STI. City of São Paulo, 2014. (N = 2,013).

Variables	Total		STI				OR_{br} (95%CI) %	
			No		Yes			
	n	%	n	%	n	%		
Age group								
15-24 years	417	20.7	410	21.3	7	8.1	1	
25-34 years	533	26.5	510	26.5	23	26.4	3.39	(1.6-7.2)
> 34 years	1063	52.8	1006	52.2	57	65.5	4.28	(1.9-9.6)
Schooling (years of study)								
< 8 years	729	36.2	694	36.0	35	40.2	1	
9-11 years	879	43.7	841	43.7	38	43.7	0.84	(0.5-1.3)
12 +	405	20.1	391	20.3	14	16.1	0.73	(0.3-1.6)
Race/color								
White	1077	53.5	1032	53.6	45	51.7	1	
Black	347	17.2	328	17.0	19	21.8	1.33	(0.7-2.3)
Brown	510	25.3	489	25.4	21	24.2	1.02	(0.6-1.7)
Other	79	4.0	77	4.0	2	2.3	0.60	(0.1-2.5)
Marital status								
Living with a partner	1078	53.5	1042	54.1	36	41.4	1	
Not living with a partner	935	46.5	884	45.9	51	58.6	1.45	(0.9-2.3)
Economic status								
D/E	145	7.2	135	7.1	10	11.5	1	
C	918	45.6	881	45.7	37	42.5	0.56	(0.3-1.1)
A/B	950	47.2	910	47.2	40	46.0	0.56	(0.3-1.2)
Age of first sexual experience*								
≤15 years	443	22.2	417	21.8	26	30.6	1	
> 15 years	1555	77.8	1496	78.2	59	69.4	0.63	(0.4-0.9)
Condom use during first sexual intercourse*								
Yes	757	37.6	725	37.6	32	36.8	1	
No/didn't reply	1256	62.4	1201	62.4	55	63.2	1.04	(0.6-1.8)
Engaged in sexual activity with someone from the same sex								
Yes	84	4.2	78	4.1	6	6.9	1	
No/ didn'treply	1929	95.8	1848	95.9	81	93.1	0.57	(0.2-1.3)
Casual sex partner over last 12 months**								
Yes	277	17.4	255	16.8	22	31.0	1	
No	1315	82.6	1266	83.2	49	69.0	0.45	(0.3-0.7)

* 15 people did not respond the question regarding age of first sexual experience. ** 421 people had not engaged in sexual activity over the last 12 months. Notes: the variables with a p-value of < 0.20 in the bivariate analysis were included in the multiple model.

first sexual intercourse, and 17.4% reported that they had not engaged in sexual activity with a casual sex partner over the last 12 months. Bivariate analysis showed that there was a negative association between having initiated sexual activity after 15 years of age and not having a casual sex partner over the last 12 months and STI among women (Table 3).

The final model showed that there was a positive association between STI and the following variables among men: being aged over 34 years [OR_{aj} = 2.51 (CI95%: 1.5-4.0)] and not using a condom during first sexual intercourse [OR_{aj} = 2.45 (CI95%: 1.6-3.8)]. It was also shown that not engaging in sexual activity with someone from the same sex was a protective factor against STIs [OR_{aj} = 0.46 (CI 95%: 0.3-0.8)] (Table 4).

Among women, a positive association was shown between contracting STI and being aged over 34 years [OR_{aj} = 4.41 (CI95%: 2.1-9.1)] and

Table 4. Multivariate analysis of factors associated with STI among men and women. City of São Paulo, 2014.

Variables	Men		Women	
	OR_{aj}	(95%CI)	OR_{aj}	(95%CI)
Age group				
15-24 years	1		1	
25-34 years	1.40	(0.7-2.5)	2.86	(1.4-6.1)
> 34years	2.51	(1.5-4.0)	4.41	(2.1-9.1)
Condom use during first sexual intercourse				
Yes	1		***	
No/didn'trespond	2.45	(1.6-3.8)	***	***
Engaged in sexual activity with someone from the same sex				
Yes	1		***	
No/didn'trespond	0.46	(0.3-0.8)	***	***
Age of first sexual experience				
≤ 15 years	***		1	
> 15 years	***	***	0.46	(0.3-0.7)
Casual sex partner over last 12 months				
Yes	***		1	
No/didn'trespond	***	***	0.43	(0.3-0.7)

Note: *** Not included in the multiple model

between 25 and 34 years [OR_{aj} = 2.86 (CI 95%: 1.4-6.1)], while having started sexual activity after the age of 15 years [OR_{aj} = 0.46 (CI95%: 0,3-0,7)] and not having a casual sex partner in the last 12 months [OR_{aj} = 0,43 (CI 95%: 0,3-0,7)] were shown to be protective factors (Table 4).

After catching a STI, 72.1% and 64.7% of women received counseling about the importance of testing for HIV and syphilis, respectively; while among men these rates were only 40.2% and 38.6%, respectively (Table 5).

One hundred percent of women and 90% of men in the 15 to 24 year age group reported that they had been advised about the importance of using condoms and of informing sexual partners. These rates decreased with increased age: less than half (44.2%) of men aged between 50 and 64 years had been informed of the importance of using condoms, as shown in Table 5.

Half of the older women in the sample (aged between 50 and 64 years) who had had a STI had not received information about the importance of testing for HIV and syphilis. Furthermore, 70 and 80% of younger men, aged between 15 and 24 years, respectively, had not been advised to test for HIV and syphilis (Table 5).

The percentage of sample members receiving counseling about testing for HIV varied according to region: among women, the highest percentages (90% and 84.2%) were observed in the Center-West and North regions, respectively, while the lowest percentages were registered in the East region (41.2%). Among men, the highest percentage (52.9%) was shown to be in the North region (data not shown).

Discussion

It is difficult to obtain an accurate estimate and insight into the prevalence of STI, be it globally or at a regional level, due to fragile and inadequate regional and national health surveillance systems. However, STIs have marked social and economic consequences and a profound impact on sexual and reproductive health[2,4,5].

Given the global rise of STIs, the World Health Organization produces periodic estimates of the extent of the problem worldwide to inform STI prevention and control policy formulation and implementation[12].

The above findings reinforce the importance of household surveys such as this one, which determined that the prevalence of previous history of STIs in the City of São Paulo is 6.3%.

In Brazil, the National Department of STDs, AIDS and Viral Hepatitis (*Departamento Nacional de DST, AIDS e Hepatites Virais* - DDAHV) and state and municipal STD/AIDS programs are stepping up efforts to improve universal free ac-

Table 5. Number (n) and percentage (%) of types of counseling received by men and women that had previous history of STI and sought treatment by age group. São Paulo, 2014.

Counseling received	MEN								p
	15 a 24		25 a 34		35 a 49		50 a 64		
	n	%	n	%	n	%	n	%	
Condom use									
Yes	9	90.0	19	82.6	29	69.1	23	44.2	
No	1	10.0	4	17.4	13	30.9	29	55.8	0.001
Informed partners									
Yes	9	90.0	18	78.3	27	64.3	27	51.9	
No	1	10.0	5	21.7	15	35.7	25	48.1	0.041
Tested for HIV									
Yes	3	30.0	17	73.9	22	52.4	9	17.3	
No	7	70.0	6	26.1	20	47.6	43	82.7	<0.001
Tested for Syphilis									
Yes	2	20.0	12	52.2	21	50.0	14	26.9	
No	8	80.0	11	47.8	21	50.0	38	73.1	0.036
Tested for HB and HC									
Yes	1	10.0	12	52.2	20	47.6	7	13.5	
No	9	90.0	11	47.8	22	52.4	45	86.5	<0.001
Counseling received	**WOMAN**								**p**
	15 a 24		**25 a 34**		**35 a 49**		**50 a 64**		
	n	**%**	**n**	**%**	**n**	**%**	**n**	**%**	
Condom use									
Yes	2	100.0	17	100.0	19	65.5	11	55.0	
No	0	0	0	0	10	34.5	9	45.0	0.012
Informed partners									
Yes	2	100.0	17	100.0	18	62.1	11	55.0	
No	0	0	0	0	11	37.9	9	45.0	0.01
Tested for HIV									
Yes	1	50.0	15	88.2	23	79.3	10	50.0	
No	1	50.0	2	11.8	6	20.7	10	50.0	0.04
Tested for Syphilis									
Yes	1	50.0	13	76.5	23	79.3	7	35.0	
No	1	50.0	4	23.5	6	20.7	13	65.0	0.009
Tested for HB and HC									
Yes	1	50.0	10	58.8	20	69.0	9	45.0	
No	1	50.0	7	41.2	9	31.0	11	55.0	0.412

cess to condoms in order to increase the adoption of safe sexual practices, which is one of the strategies targeted at reducing sexually transmitted infections, including HIV.

Other important STI prevention strategies include education and awareness campaigns to provide information on how STIs are spread and signs and symptoms[13], in order to raise public awareness and guide patients to seek early treatment. A national study showed that in the case of young people schools would be the ideal setting for receiving information about STIs[14], while another study concluded that the content dealing with STIs/AIDS on television and in magazines is insignificant[15]. Finally, despite receiving information, many young people fail to adopt protective measures against STIs[16,17].

Our study reveals that a significant proportion of the population has shown signs and symptoms of STIs, and also showed that later sexual initiation was a protective factor against catching STIs, which is in line with findings in

the literature that show that early initiation of sexual activity is associated with STIs[18].

The early initiation of sexual activity makes people more susceptible to catching STIs, both through the search for new sexual experiences, which may lead to high-risk sexual behavior, and due to greater difficulty negotiating condom use, fuelled by a feeling of perceived invulnerability among young people[16].

Living with a partner and schooling were not shown to be protective factors against STI. People living with a partner generally do not perceive themselves to be vulnerable to STIs and thus may fail to adequately protect themselves against STIs; this misconceived judgment of the absence of risk may also be shared by health care professionals. Although our findings show that there is no association between level of schooling and STIs, a study showed that lower levels of schooling are associated with early initiation of sexual activity[14], and therefore both factors are particularly relevant when it comes to the formulation of prevention policies.

Since STIs are not part of the everyday lives of young people, this group is often unaware of the risk of infection and therefore do not adopt protective measures. Married women tend to have a particularly limited perception of vulnerability[13,19]. The resulting lack of early diagnosis when they contract a STI delays treatment, thus contributing to the development of complications and perpetuating transmission[20].

Another important finding of our study is that the prevalence of STI is greater among men who have sex with men (MSM), which is in line with studies conducted in Brazil[19] and Australia[21] that showed that there was an increase in the incidence of STIs among MSMs between 2007 and 2013. This could be due to certain types of sexual behavior, such as irregular condom use and engagement in anal sex, thus increasing the risk of STIs, along with homophobia, stigma and discrimination, which can also negatively affect the health of MSMs[22].

STIs generally require actions that involve a low degree of technological complexity. However, there is still a general lack of integration between health surveillance efforts and health care. Given that the Brazilian health system should provide universal and equitable access to health services, it is unacceptable that people with a STI do not receive early diagnosis, timely treatment, and comprehensive information and advice. In a cosmopolitan metropolis such as São Paulo[11], there should be broad access to health care services that ensure early diagnosis and treatment, thus preventing complications and HIV infection.

Another important issue concerns the lack of counseling for people seeking treatment, a gap highlighted by a study conducted in Campinas[23] with women receiving treatment under the primary health care network and by the Ministry of Health[24]. This situation reveals a discrepancy between the guidelines and norms laid down by the Ministry of Health and practices in the health care services. This fact may be explained by lack of knowledge on the part of health care professionals in the City of São Paulo and/or lack of compliance with protocols for the management of STIs[25].

In particular, the lack of information provided about the importance of informing sexual partners and condom use among older people may be due to health professionals' misconceptions, lack of preparedness, or uneasiness when dealing with older people.

The analysis of the data by region revealed differences in the quality of information and counseling provided to people seeking treatment, reflecting the social diversity and range of health needs within a municipality the size of São Paulo. These regional differences point to the need for continuing education for health care professionals that takes into account the particular characteristics and different situations of vulnerability of people who have STIs and HIV, with a view to improving the sexual and reproductive health of the population of São Paulo.

Limitations of this study include the fact that the survey enquired into the most intimate details of the participants' private lives. The responses may therefore be susceptible to memory bias and the possible tendency to give socially and politically accepted answers, which in turn may lead to the underestimation of the prevalence of previous history of STIs. However, the use of electronic self-completion questionnaires decreased the likelihood of such bias. On the other hand, the fact that this investigation consisted of a population-based study allows us to draw conclusions about the population of the City of São Paulo as a whole.

This type of study is therefore able to provide policy makers, health service managers, health care professionals, universities and the general public with up-to-date information about the magnitude of STIs in a given population and their health needs.

Reducing the extent of the STI problem depends heavily on public awareness of these infec-

tions, condom use, and access to health care services that provide effective treatment, including vaccination for groups at high risk[26].

Conclusion

The proportion of the population of the City of São Paulo aged between 15 and 64 years with previous history of STIs is high. Early initiation of sexual activity, not using a condom during first sexual intercourse, and having a casual sexual partner over the last 12 months are associated with STI. It is important that STIs are placed on the political agenda of health movements with the same vigor and commitment as other issues such as abortion, maternal death, and HIV, since there is a deep connection between these problems characterized by their magnitude and profound impact on sexual and reproductive health.

One of the measures adopted by the City of São Paulo after this study was to break down the barriers that hinder access to free condoms through the installation of large-scale condom dispensing machines outside of health facilities. In December 2015, these machines, known as "jumbos", and each with a capacity for 15,000 condoms, were installed in 28 of the capital's bus stations, facilitating the distribution of around eight million condoms over a 30-day period.

The Municipal STD/AIDS Prevention Program has also produced a software application called "Tá Na Mão", which focuses on STI and HIV prevention, counseling and risk management with the participation of health care professionals, men who have sex with men, and young people. The free app, which also tells users where they can obtain free condoms, testing and post exposure prophylaxis, is available on Android, iOS and Windows phones.

Collaborations

VM Pinto, CR Basso, CRS Barros and EB Gutierrez participated in all phases of analysis and interpretation of data and approval of the version to be submitted, as well as in project design and monitoring of field work.

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