Vulnerability and factors associated with HIV and syphilis among men who have sex with men, Belo Horizonte, MG

Vulnerabilidade e fatores associados a HIV e sífilis em homens que fazem sexo com homens, Belo Horizonte, MG

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ABSTRACT

Introduction: The HIV epidemic in Brazil is characterized as concentrated on key populations, including men Who have sex with men (MSM). However, monitoring and evaluation indicators are not well known at Municipal or State levels. **Objective:** To describe risk behaviors and HIV and syphilis prevalences among MSM in Belo Horizonte, MG. **Methods:** Cross-sectional study part of a national multicenter study among adult MSM in Brazil. The sample was recruited using Respondent Driven Sampling (RDS) technique. Semistructure interviews and serological exams for HIV and syphilis were conducted. **Resultads:** A total of 274 MSM were recruited in Belo Horizonte. Participants were mostly young, with high education, social classes A/B, self-reported as gay or homosexual and with high proportion of irregular use of condoms. Weighted prevalence of HIV infection and syphilis were, respectively, 10.3% and 13.9%. Age, color, sharing with their mother or father their sexual orientation, prior HIV and syphilis testing, and previous diagnosis of syphilis or other STDs were statistically associated with both infections (p<0.05). Marital status, family disapproval or indifference of their sexual orientation, better HIV/Aids knowledge, not knowing their chances of acquiring HIV were statistically associated only with HIV and social class only with syphilis. **Conclusion:** These results indicate the severity of the HIV epidemic amongthe MSM population in Belo Horizonte. Public policies at the municipal and state levels must be implemented and/or revised urgently.

Key words: HIV; Acquired Immunodeficiency Syndrome; Syphilis; HIV and Syphilis Seroprevalence; Sexual Behavior; Health Vulnerability; Brazil.

RESUMO

Introdução: a epidemia do HIV no Brasil caracteriza-se como concentrada em populações-chave, incluindo homens que fazem sexo com homens (HSH). No entanto, são pouco conhecidos os indicadores de monitoramento e avaliação da epidemia em nível estadual ou municipal destas populações. Objetivo: descrever comportamentos de risco e prevalências de HIV e sífilis em população de HSH em Belo Horizonte, MG. Métodos: estudo de corte transversal parte de estudo multicêntrico nacional entre HSH adultos. A amostra foi recrutada pela técnica Respondent Driven Sampling (RDS). Foram realizadas entrevistas semiestruturadas e exames para HIV e sífilis. Resultados: foram recrutados 274 HSH em Belo Horizonte. Os participantes eram principalmente indivíduos jovens, com alta escolaridade, de classes sociais A/B, que se autorreferiram gay ou homossexual e tinham alta proporção do uso irregular de preservativos. As prevalências ponderadas da infecção pelo HIV e de sífilis foram, respectivamente, 10,3 e 13,9%. Idade, cor, contar para a mãe ou pai sobre a orientação sexual, testagem prévia para o HIV ou sífilis, diagnóstico prévio de sífilis ou de outras DSTs foram estatisticamente associados a ambas as infecções (p<0,05). Estado civil, família ser indiferente ou desaprovar a opção sexual,

ter melhor conhecimento sobre HIV/Aids, mas não saber avaliar sua percepção de risco estiveram estatisticamente associados somente ao HIV e classe social somente com sífilis. Conclusão: os resultados revelam a gravidade da epidemia do HIV na população de HSH residentes em Belo Horizonte. Políticas públicas no nível municipal e estadual devem ser implementadas e/ou revistas com urgência.

Palavras-chave: HIV; Síndrome de Imunodeficiência Adquirida; Sífilis; Soroprevalência de HIV e Sífilis; Comportamento Sexual; Vulnerabilidade em Saúde; Brasil.

INTRODUÇÃO

The human immunodeficiency virus (HIV) epidemic remains an important public health problem, despite recent advances reached by some countries. The HIV/AIDS United Nations Program (UNAIDS)[1] classifiesthe epidemic in generalized (HIV prevalence in the generalpopulation greater than 1%), low transmission level (HIV prevalencein the general populationand among subgroups smaller than 1%), and concentrated (HIV prevalencein the general population smaller than 1% and amongsubgroups higher than 5%). In Brazil, the HIV prevalenceis estimated in 0.4% to 0.5% among the adult population, the epidemic is predominantlyof sexual transmissionand it is concentrated in populations at higher risk of exposure to HIV (key populations) including, injecting drug users (IDU), sex workers and, mainly, men who have sex with men (MSM).[2]

The UNAIDS goals for 2015 are well established and include: to reduce HIV sexual transmission by50%, to reduce by half IDU transmission, to eliminate vertical transmission,toexpand treatment to people living with HIV/AIDS (PLHA), to eliminate gender inequities, discrimination, stigma, and violence.[1] In order to reach such goals, it is necessary to establish an effective monitoring and evaluation system of the HIV epidemic through standardized indicators, both nationally and internationally. Estimates of HIV and other sexually transmitted infections (STI) prevalence, including syphilis, the proportion of unprotected sexual behavior, the proportion of HIV and syphilis testing, the proportion of adequate HIV and other STI knowledge are among the recommended indicators.In concentrated epidemics these indicators must be focused on monitoring of the epidemic among key populations.

Recent data from Brazil indicate high HIV prevalence among female sex workers (4.8%; IC 95%: 3.4 to 6.1)[3]and MSM(11.1%; IC 95%: 10.0 to 14.5),[4]and are of public health concern. The proportions of unpro-

tected sex – 36.5% of unprotected receptive anal sex among MSM [5]and lack of HIV testing – 51.0% amongMSM[4] are also high. In addition, evidence indicate late HIV diagnosis and initiation of antiretroviral treatment (ARVT)among PLHA– 59.0% between 2003 and 2006.[6] To this scenario we should add worrying rates of non-adherence to ARVT, which can affect mortality, the incidence of opportunistic infections and the circulation of HIV resistant viral strains. Stigma, discrimination, violence, unprotected sexual practices, and higher prevalence of licit or illicit drugs are among the contextual factors that potentially explain the higher vulnerability of these populations to HIV.

It is well known the difficulties of obtaining representative and reliable data capable of generating standardized indicators for monitoring and evaluation of the HIV epidemic. In particular,studies among key populations, usually characterized as hard to reach, demand specific sampling methodologies.Respondent Driven Sampling (RDS)technique stands out as one of the mostly usedmethodsamong key populations in many countries.Through this method it is possible to carry out population based behavior and serological surveys, thus minimizing biases commonly found in convenience samples (e.g. health services) or in studies based only on secondary data sources.[7-9]

This way, a national multicenter study was conducted in 2010 in ten Brazilian cities using the RDS technique (Belo Horizonte, Brasília, Campo Grande, Curitiba, Itajaí, Manaus, Recife, Rio de Janeiro, Salvador e Santos) among MSM[4]whose main objective was to establish baseline information for monitoring HIV infection and syphilis, sexual behavior and context vulnerability of this population. The aimg of this study was to present results from recruitment, descriptive characteristics and HIV and syphilis prevalences from the sample obtained in Belo Horizonte city, Minas Gerais.

METHODS

Design and Population

This is a cross-sectional study part of the national multicenter study among MSM in the ten Brazilian cities.[4] The project was approved by Ethical Review Board from the Federal University of Ceará, (number 202/07), by the National Ethical Review Board (CONEP number 14494) and by the partici-

pating centers, including Belo Horizonte City Health Department(CHD) (number 062/2007).

Eligibility criteria included MSM who had at least one sexual contact with other men during 12 months prior to the interview, age 18 years old or more, who presented a valid coupon and were not under the effect of drugs during the interview. Inaddition,they should live in each city and should not identify themselves as transvestites or transexuals. Participation was voluntaryand written consent form was obtained. For this analysis, only participating residents in Belo Horizonte, MG, were included, where the project was named "Projeto Atitude".

Sample size and recruitment

The sample size was *a priori* definedby The Department of STD, AIDS andViral Hepatitis, Ministryof Health (DSAVH/MH) in 250 to 350 participants per city. RDS technique was used for recruitment. This technique is a type of chain based sampling method commonly used to approach hard to reach populations.[7-9] Recruitment is carried out by participants themselves using a two-way incentive system and the first recruiters are named seeds. This method is based on assumptions from Markov´s stochastic model and generates chains of recruitment that, after saturation, become independent from the original seeds. Those recruited are asked to report the size of their personal social network of potential individuals to be invited to participate in the estimated sample size. Because individuals with larger social networks have greater probability of being selected, a smaller weight is given to this group in the analyses. Each initial seed receivesthree non-falsifiable coupons to distribute to acquaintances of their social network. These coupons are previously identified with numeric codes, allowing complete analysis of the final recruitment. Depending on the characteristics of the first seeds andon the social network of those recruited, saturation occurs in the first waves of the study.

In this study, seeds were chosen during preliminary formative research (e.g. focal groups and interviews), consideringage ($\leq$ 25 or > 25 years old) and schooling ($\leq$8 or> 8 years of formal education). MSM who received a valid coupon were advised by their recruiters to contact the researchers in order to schedule time and place for the interviews. The first individuals who arrived at the research center with a valid coupon and fulfilled the inclusion criteria constituted the first

wave of the study. Following standard research procedures, these participants received three new previously identified coupons to distribute within their social network.This process was repeated thereafter until the desired sample size was reached, creating this way successive waves of recruitment. Non-eligible individuals or those who refused to participate were invited to answer to a short interview on sociodemographic characteristics and reasons for not participating.

Data Collection

The study was conducted in two sites in Belo Horizonte:Sagrada Família Counseling and Testing Center (CTC)and at an independentoffice located within the hospital area. Participants were invited to answer to a semi-structured questionnaire and perform HIV and syphilis testing. Interviews were carried out face-to-face by previously trained professionals, and answers were coded in a hand-held pocket computer. The questionnaire was previously tested and standardized and explanatory variables were grouped as follows:

- sociodemographic data (e.g. age, schooling, socioeconomic class, skin color, marital status, individual monthly income, currently working, place of residence);
- history of HIV and syphilis testingand HIV/AIDS knowledge;
- sexual identity (e.g. sexual orientation, identityand attraction, visibility, family support);
- sexual behavior (e.g. ageand gender of first sexual intercourse, type of partnership, condom use, type of sexual practices, number of partnersand places used for sexual encounters, sex under the effect of alcohol or drugs);
- licit drug use (e.g. current and abusive use of alcohol –*binge drinking*, cigarette smoking) and illicit drug use (e.g. cannabis, cocaineinjecting drug use);
- mental health (e.g. preocupations, sadness depression, sleeping problems, fear or panic, suicidal ideation), and history of violence (e.g. physical, sexual, verbal) and discrimination(e.g. due to race, sexual orientation, age, social class);
- social participation (e.g. non-governmental organization – NGO, religious) and social support (e.g. family, acquaintances, work, friends);
- health care, access to condoms and STI/HIV information;

- history of STI, self-perceptionof the risk of acquiring HIV.

In addition, data on the size of the social network of each participant was obtained using the following questions, in sequence:

- how many men you know and who know you well, that you think have sex with other men and who live in Belo Horizonte?;
- of these men you mentioned, how many are 18 years old or older?;
- how many of these men 18 years old or over have you spoken with or met in person, by phone or internet in the last two months?;
- of these men who have sex with men, who are 18 years old or over, and with whom you have spoken in the last two months, how many might you invite to participate in this study? The final question was used to weight data in analysis to account for different probability of inclusion due to network size differences.

Sexual behavior was characterized according to type of partnership (fixed, ocasional or comercial) and time (last six months, last year and lifetime). Condom use during sexual intercourse was classified as always, sometimes, rarely or never, both with other men (oral and anal) and with women (oral, anal and vaginal). Sometimes, rarely or never were considered inconsistent condom use. Participants were classified into five socioeconomic classes, from A (the highest) thru E (the lowest) according to Brasil Criterion.[10] HIV/AIDS knowledge was assessed through ten questions on transmission and were analyzed using item response theory (IRT).[11] Scores below the 25th percentile were considered low knowledge. Abusive use of alcohol (*binge drinking*) was defined as the consumption of five or more doses in one day, at least once a week.Sexual identity was self-reported and classified as gay, homosexual, HSH, and others (e.g. bisexual, heterossexual). Self-perception of the risk of acquiring HIV was classified into two catgories: none or little and moderate or high.

All participants were invited to perform HIV and syphilis rapid testing. Blood sample was obtained from finger pricking and whole blood was used for all diagnostic tests. The study followed norms and algorithm recommended by the Ministry of Health for HIV rapid tests: Rapid Check HIV-1&2 and Bio-Manguinhos HIV-1&2 were performed simultaneously, follo-

wed by confirmatory tests in case of discrepancy of results from the first two tests.[12,13]Syphilis *Determine™ Sífilis TP* rapid test was used for syphilis diagnosis. This is a treponemal qualitativeimunoessayfor the detection of antibodies, a screening test. All tests were provided by DSAVH/MH. All participants received pre and post-test counseling. Those HIV positivewere invited to perform genotyping and were referred for medical care at AIDS referral centersand those positive for syphilis were referredfor confirmation of diagnosis and treatment if necesssary.

Statistical analysis

Descriptive analysis of categorical data and central tendency measures of continuous variables were carried out.The network of participants was described including the degree of dependency of recrutees in relation to recrutiers,i.e., degree of homophily, for the following variables:age, socioeconomic class, HIV and syphilis infection, self-report of previous HIV test result,and participation in NGO. McNemar Chi-square for paired samples was used to assess statistical significance among recruiter-recruitee paris. The level of significance considered was p<0.05. As previously indicated, the probability of an individual participating in the recruitment using RDS technique depends on the social network size of this individual.[7-9] This way, the estimates were weighted by the harmonic mean of the inverse of the network size reported by each participant. Diferences in proportions were assessed by Pearson´s Chi-square, and the significance level was 0.05. RDSAT, NetDraw e SAS® (SAS Inst., Cary, USA) softwares were used for the analyses.

RESULTS

Recruitment

Among the 3859 MSM which comprised the total sample of the study in the ten Brazilian municipalities, 274 (7.1%) were recruitedin Belo Horizonte (Projeto Atitude). This recruitment was slow with difficulties in establishing the network – 21 seeds were necessary to generate the final network in the city. From a total of 828 valid coupons distributed, only 33.9% (n=282) scheduled an interview and 253 (30.9%) actually sho-

wed up, thus comprising 274 participants, including the seeds. Also, the seeds had difficulties in recruiting participants, and we should note the high concentration of participants in few seeds. From the 21 seeds, 43% did not generate any recruitment, seven (33%) generated onetofive recrutees, and six (24%) generated six or more recrutees. Only three seeds generated the main networks with strong concentration on 14(S14) (50% S14; 18% S15; 15% S20) (Figure 1).

Homophily analyses (dependency) included 220 recruiter-recruiteepairs among the 274 MSM. The probability of recruiting an HIV positive participant when the recruiter was also HIV positive was 28.6% and 6.6% when this was HIV negative, indicating a borderline homophily (p=0.084). For syphilis serology, participation in NGO, and socioeconomic classthere was no evidence of dependency during recruitment (p=0.391; p=0.211; p=0.146), respectively. However, there was evidence of statistical dependency for age groups (18-24; 25-34; 35+) (p=0.045), i.e., recruiters tended to invite participants of the same age, with a predominance of younger MSM (18 to 24 years old) (Figure 2).
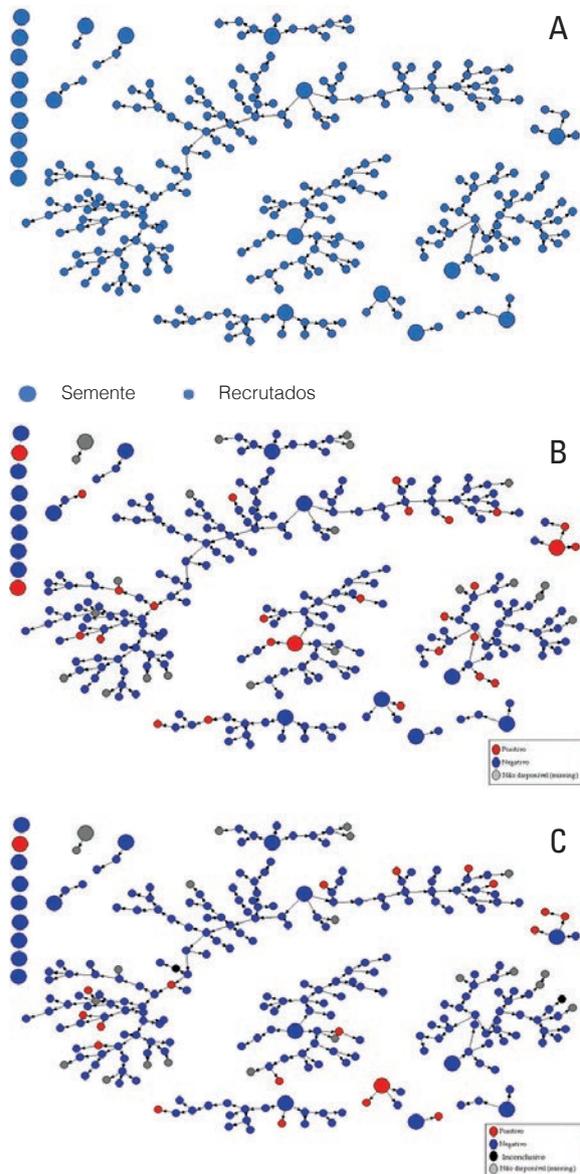

Figure 1 - Recruit network, Projeto Atitude, Belo Horizonte, 2010: A: Without attributes; B: According to positive syphilis serology; C: According to HIV positive serology.
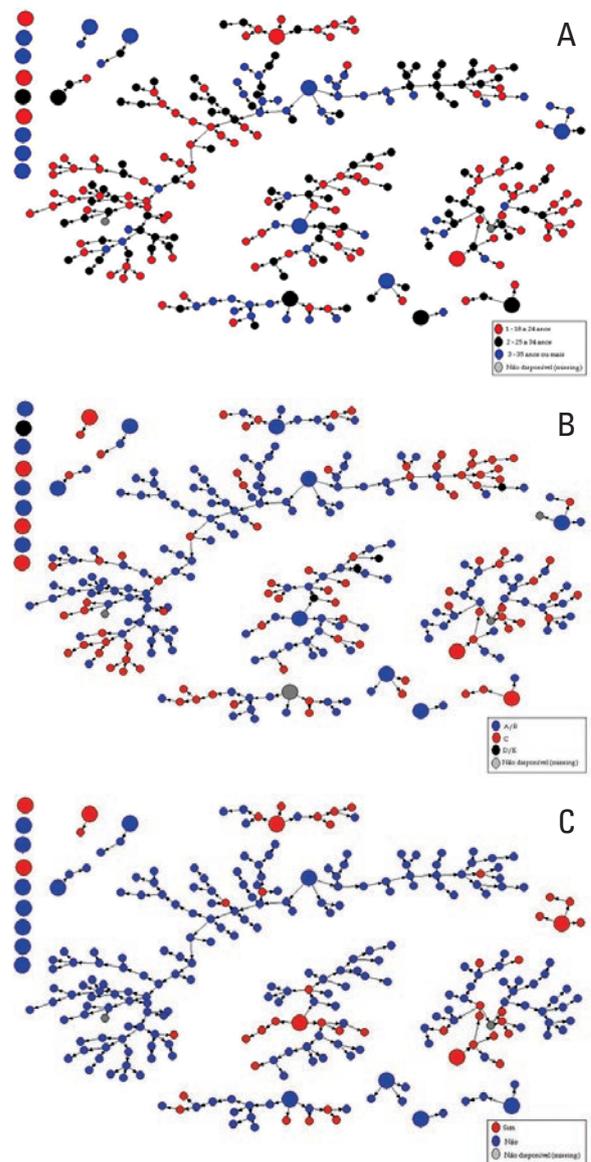

Figure 2 - Recruit network, Projeto Atitude, Belo Horizonte, 2010 according to A: age; B: social class C: Participation in NGOs.

Descriptive

Descriptive analysis is shown on Table 1. Most participants wereyoung (41.3% were 18-24 years ol-dand 36.8% were 25-34 years old), with high schooling (72.8%), from social classes A or B (63.0%), white (43.5%) orbrown (41.3%),and single (87.0%). They also reported to live with their parents (44.4%) or partners (38.9%), to currently work (82.6%) and to have higher income in the last month (≥US$420.00) (67.9%).

Table 1 - Descriptive characteristics of the sample of men who have sex with men. Belo Horizonte, 2010

	n (%)	% Weighted
Sociodemographic		
Age (years old):		
18-24	113 (41.3)	42.2
25-34	100 (36.8)	29.8
35+	59 (21.7)	28.0
Schooling (≥12 years):		
Social Class:		
A-B	170 (63.0)	61.7
C	95 (35.2)	32.2
D-E	5 (1.9)	6.1
Skin color:		
White	117 (43.5)	43.7
Brown	111 (41.3)	38.3
Other	41 (15.2)	18.0
Marital status (Single):	235 (87.0)	86.5
Individual Monthly Income (≥ US$420):	184 (67.9)	65.6
Currently working:	223 (82.6)	85.7
Live with:	31.8	31.9
Partner/ other	105 (38.9)	41.2
Alone	45 (16.7)	16.8
Parents	120 (44.4)	42.0
Identity assumption		
Sexual Identity:		
Bisexual/other	28 (10.4)	15.1
Gay	110 (40.7)	30.5
MSM/homosexual	132 (48.9)	54.4
Sexual attraction (only men):	201 (74.4)	70.3
Shared their attraction to men with:		
Colleagues	219 (81.4)	77.5
Mother	167 (62.1)	58.8
Father	99 (36.8)	34.8
Other relatives	210 (78.1)	73.5
At least one person	250 (92.9)	91.5

Continues…

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Table 1 - Descriptive characteristics of the sample of men who have sex with men. Belo Horizonte, 2010

	n (%)	% Weighted
Identity assumption		
Family support in relation to attraction to men:		
Partially or totally approve	131 (48.0)	46.8
Indifferent	76 (27.7)	27.5
Partially or totally disprove	19 (6.9)	6.1
Unknown	48 (17.5)	19.6
Discrimination and Violence		
Any feeling of discrimination:	*128 (47.4)*	*38.4*
Due to color/race:	*14 (5.2)*	*3.5*
Due to social condition:	*15 (5.6)*	*5.0*
Due to age:	*23 (8.5)*	*6.3*
Due to sexual orientation:	*110 (40.7)*	*33.8*
Where sexual discrimination occurred:		
Work	29 (26.4)	39.2
School	25 (22.7)	29.7
Church	14 (12.7)	13.3
Business	20 (18.2)	19.7
Leisure	25 (22.7)	20.1
Street	44 (40.0)	29.8
Other	22 (20.0)	14.6
Verbal aggression due to sexual orientation:	*167 (61.8)*	*59.9*
Physical aggression due to sexual orientation:	*27 (10.0)*	*6.8*
Sexual intercourse against their will:	*35 (12.9)*	*12.4*
Age of sexual intercourse against their will (≤ 14 years old):	*24 (68.6)*	*70.8*
Mental Health[2]		
Some/a lot of tension and/or concerns[2]:	*227 (84.1)*	*78.0*
Some/a lot of problems to sleep[2]:	*128 (47.4)*	*43.6*
Some/a lot of feeling of fear and/or panic[2]:	*35 (13.0)*	*11.2*
Some/a lot of feeling of sadness or depression[2]:	*144 (53.3)*	*54.8*
Some/a lot of suicidal ideation[2]:	*35 (13.0)*	*16.4*
Alcohol or Drugs use		
Alcohol use:		
Never-occasional	101 (37.4)	41.9
2+ times a week	169 (62.6)	58.1
Binge drinking[1]:	*55 (20.4)*	*15.9*
Illicit drugs use[2]:	*89 (33.1)*	*23.5*
Sexual intercourse under the influence of alcohol[2]:	*187 (69.3)*	*61.4*
Sexual intercourse under the influence of illicit drugs[2]:	*55 (20.5)*	*15.3*
Sexual intercourse under the influence of alcohol or drugs[2]:	*193 (71.5)*	*62.1*

Continues…

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Table 1 - Descriptive characteristics of the sample of men who have sex with men. Belo Horizonte, 2010

	n (%)	% Weighted
Sexual behavior		
Age at first sexual intercourse (years):		
< 15	62 (23.0)	26.2
15-18	129 (47.8)	47.2
18+	79 (29.2)	26.6
Gender of the first sexual partner (men):	185 (68.5)	67.4
Number of sexual partners³ (> 5):	119 (44.2)	39.0
Number of sexual partners² (> 5):	79 (29.5)	33.6
Sexual intercourse exclusively with men³:	249 (92.2)	91.7
Irregular use of condoms with men³:	176 (65.2)	56.9
Irregular use of condoms during receptive anal intercourse²:	109 (40.5)	35.7
Only male sex partners in the last 6 months:	252 (95.5)	95.1
Locations of sexual encounters in the past month:		
No specific place	161 (59.6)	61.4
Gays pubs	45 (16.7)	18.6
Nightclubs	19 (7.0)	8.1
Dark rooms	13 (4.8)	2.8
Sauna	16 (5.9)	7.9
Cinema	11 (4.1)	0.9
Public bathrooms	2 (0.7)	0.3
Parties	1 (0.4)	0.1
Friends' house	1 (0.4)	0.1
Use the internet	1 (0.4)	0.1
History STD / HIV		
Knowledge about HIV / AIDS (high):	204 (75.3)	77.9
Chance to get infected with HIV (No / low):	144 (52.9)	53.7
Prior HIV testing:	201 (74.4)	76.3
HIV testing in the last 12 months:	103 (38.3)	37.3
Prior syphilis testing:	91 (35.3)	36.2
Previous diagnosis of syphilis:	19 (7.0)	8.7
STD diagnosis in the past 12 months:	66 (24.4)	23.0
Network / Social Participation		
All/ most of my friends talk about STD / Aids prevention:	173 (63.8)	66.9
All/most friends encourage condom use	156 (57.6)	54.9
All/most of my friends say they use condoms	191 (70.5)	67.4
Participation in religious activity	73 (26.9)	30.9
Activity participation in services	37 (13.6)	12.9
Knowledge about NGO that working on AIDS	139 (51.3)	52.6
Participation in NGO	47 (17.3)	14.7

¹ Five or more drinks in one occasion or more times a week.
² In the last six months.
³ In the last twelve months.

With regard to sexual identity, most were self--identified as gay (40.7%) or homosexual (48.9%) and reported to be sexually attracted to men only (74.4%). More than 90% shared with someone else their sexual preference, most of them with friends (82.4%), followed by mothers (62.1%) and only 36.8% with their fathers. A large proportion (48.0%) indicatedto have total or partial support from family members, while 27.7% of these were indifferent to the participants´ sexual preference for other men. We should note the relevance of discrimination and violence context in this population. While 47.4% reported to have suffered some type of discrimination, most of these were due to their sexual orientation (40.7%). The places where most frequently this occurred were at streets (40.0%), at work (26.4%), during leisure (22.7%), andatschools (22.7%). Most participants reported to have suffered verbal aggression (61.8%) due to their sexual orientation, while almost 10.0% reported physical aggression also due to sexual orientation.Approximately 13.0% reported to have had sexual intercourse against their will, and for most of them this occurred when they were less than 14 years old (68.6%).

We should note the mental health state and substance use situation of this population. A large proportion reported a lot of tension and concerns (84.1%), while 53.3% and 47.4% reported a lot of sadness/depressionfeelingsor sleeping problems, respectively. Suicidal ideation was present for 16.4% some or most of the time. The proportions of illicit drug use (33.1%) and alcohol use (62.9%) in the previou six months were high, while 20.4% reported binge drinking. Most participants reported to have had sexual intercourse under theeffect of alcohol or drugs in the past six months (71.5%).

With regard to sexual behavior, almost a quarter (23.0%) had early sexual debut (< 15 years old) and 47.8% between 15 and 18 years old, most of them with men (68.5%). Five or more sexual partners in the past six or twelve months were reported by, respectively, 39.0% and 33.6% – 95% of which were with male partners only. Inconsistent condom during sex use was very high, both, during any type of practices (65.2%) or during receptive anal sex (40.5%). For most participants, no specific place for sexual encounters was reported. (59.6%).For those who described such places, most of them were gay bars and night clubs.

HIV/AID Sknowlegde was high (75.3%) and more than half considered their chances of acquiring HIV

none or low (52.9%). However, we should note that 16.8% did not know their chances of acquiring HIV. A large proportion had a previous HIV test (74.4%), but this was low, considering only the last 12 months (37.3%), while for syphilis, there was a low proportion of previous testing (35.3%), and, among these, approximately 7.0% reported positive results.

Social participation results indicated that a high proportion talked with friends about HIV/STD prevention and reinforced using condoms (63.8%).However, although 70.5% of their friends said they used condoms, this constrasts with a high proportion of inconsistent condom use among the participants (65.2%). Finally, while approximately one quarter reported participating in religious activities, only 17.3% indicated some activity in NGO, despite the fact that 51.3% knew of NGO that carried out AIDS related actions.

Factors associated with HIV and syphilis

Weighted HIV and syphilis prevalences were 10.3% (IC 95%: 6.6 to 13.9) and 13.9% (IC 95%: 9.7 to 18.1), respectively. We should note that 5.4% of the participants who had a previous negative HIV test were tested positive in the survey, indicating a potential high HIV incidence in this population. In addition, 1.4% of the participants who were never tested for HIV, were found to be HIV positive during the survey, while 23.1% of those who were never tested for syphilis were found to be positivefor spyhilis during the survey. HIV and syphilis prevalences were higher among those who were older, with less schooling, from social classes C, D or E, non-white and single. However, only age and skin color were statistically associated with both infections (p <0.05), while lower social class was associated with syphilis only, being single with HIV only, and schooling was borderline significant with both infections (Table 2).

Sharing their sexual orientation with their mother or father was associated with HIV and syphilis positivity, while indifference or non-approval by family members was associated with HIV only. Although not statistically significant, HIV and syphilis prevalences were higher among those reporting discrimination due to race or age and among those who suffered sexual violence.Similarly, participants with feelings of tension, panic, sadness, sleeping problems, and suicidal ideation had higher prevalence of HIV and syphilis, though not statistically significant. We should note that having better HIV/AIDS knowledge but not knowing ones chances of acquiring HIV infection were statistically associated with HIV. Previous HIV and syphilis testing as well as previous diagnosis of syphilis or other STD were strongly associated with HIV and syphilis in this population. Finally, not talking about prevention and having few friends that said they used condoms or stimulate their use had higher prevalence of syphilis while those who reported participating in NGO had greater prevalence of both, HIV and syphilis.

DISCUSSION

This investigation, part of a national multicenter study in ten Brazilian cities, is so far the only study carried out in Belo Horizonte using RDS methodology among MSM living in the city.It is of public health concern the high HIV prevalence found (10.3%), 20 times higher than the estimate for the adult Brazilian population and twice those found among female sex workers and injecting drug users.HIV prevalence was heterogeous in the multicenter study, varying from 5.2%, in Recife, to 23.7%, in Brasília, among the ten participating cities, with an overall mean weighed prevalence of 14.2% (IC95% 12.1 a 16.6). In this scenario, Belo Horizonte presents the fourth highest prevalence and reinforces findings that indicate that the HIV epidemics in Brazil is disproportionally concentrated among MSM, similar to many other countries.[4]We should also note that this result is higher than the prevalence found among MSM in Belo Horizonte in the late nineties (9.8%)[14] and higher than the HIV prevalence in most Latin-american countries which used similar RDS methodology between 1984 and 2010.[15]Recent data from the AIDS epidemic in Belo Horizonte corroborate these results. In 2012, Belo Horizonte had an AIDS incidence rate of 24.8/ 100,000 inhabitants, higher than the national mean incidence (20.2/100,000 inhabitants in 2011). In addition, the AIDS incidence was 51.4/100,000 among menand 10.7/100,000 among women, indicating na increasing male:female ratio, from 2.2 in 2001 to 4.1 in 2012. It can also be observed an increase in the sexual transmission among MSM. While in 2001, 31.0% of the new AIDS cases were due to sexual contact with other men, in 2012 this proportion was greater than 53.0%.[2]

Table 2 - Univariate analysis of HIV and Syphilis seroprevalence among men who have sex with men, Belo Horizonte, 2010 (n=274)

Characteristics	N[1]	HIV			Syphilis		
		n (%)[2]	(Wt %)[3]	χ^2 (p-value)	n (%)[2]	(Wt %)[3]	χ^2 (p-value)
Sociodemographic							
Age (years old):							
≤ 24	113	3 (2.8)	(2.1)	12.42 (<0.001)	8 (7.21)	(7.4)	6.35 (0.012)
>24	159	17 (10.9)	(15.7)		21 (13.4)	(18.3)	
Schooling (years):							
> 12	198	13 (6.7)	(7.9)	3.01 (0.083)	20 (10.2)	(11.1)	3.51 (0.061)
<12	74	7 (9.7)	(14.8)		9 (12.5)	(19.5)	
Social Class:							
A-B	170	9 (5.4)	(8.2)	1.78 (0.181)	13 (7.7)	(8.2)	11.20 (<0.001)
C-D-E	100	11 (11.2)	(13.4)		16 (16.2)	(22.9)	
Skin color:							
White	117	3 (2.6)	(1.9)	14.27 (<0.001)	8 (6.96)	(7.4)	6.93 (0.008)
Non-white	152	17 (11.5)	(16.4)		21 (14.0)	(18.8)	
Marital Status:							
Married	35	2 (6.1)	(1.08)	3.72 (0.054)	3 (9.1)	(8.0)	1.22 (0.270)
Single	235	18 (7.8)	(11.8)		26 (11.2)	(15.0)	
Individual Monthly Income:							
≥ US$420	184	14 (7.8)	(10.6)	0.040 (0.840)	20 (11.1)	(12.7)	0.62 (0.431)
< US$420	87	6 (7.1)	(9.76)		9 (10.5)	(16.2)	
Live with:							
Partner/ other	105	8 (7.8)	(8.0)	0.977 (0.323)	10 (9.8)	(7.8)	1.20 (0.273)
Alone	45	5 (11.4)	(10.9)		6 (13.3)	(30.0)	
Parents	120	7 (5.9)	(12.1)		13 (10.8)	(13.2)	
Identity assumption							
Sexual Identity:							
Bisexual/other	28	1 (3.9)	(4.3)	2.47 (0.116)	2 (7.1)	(10.3)	1.33 (0.249)
Gay	110	7 (6.4)	(8.9)		9 (8.2)	(11.7)	
MSM/homosexual	132	12 (9.4)	(12.7)		18 (14.0)	(16.3)	
Shared their attraction to men with:							
Mother							
No	102	6 (6.1)	(4.3)	7.00 (0.008)	9 (8.8)	(7.1)	7.56 (0.006)
Yes	167	14 (8.5)	(14.5)		20 (12.2)	(19.0)	
Father							
No	170	11 (6.6)	(6.2)	9.39 (0.002)	16 (9.4)	(8.7)	12.02 (<0.001)
Yes	99	9 (9.4)	(18.5)		13 (13.5)	(24.6)	
Family support about their attraction to men:							
Support totally or partially	179	12 (6.9)	(6.24)	8.43 (0.004)	19 (10.9)	(13.2)	0.22 (0.636)
Indifferent/not support	95	9 (9.6)	(17.7)		11 (11.6)	(15.3)	
Discrimination and Violence							
Discrimination due to color/race:							
No	256	18 (7.2)	(9.8)	1.54 (0.214)	27 (10.6)	(13.5)	1.07 (0.301)
Yes	15	2 (15.4)	(22.3)		2 (15.4)	(25.4)	

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Table 2 - Univariate analysis of HIV and Syphilis seroprevalence among men who have sex with men, Belo Horizonte, 2010 (n=274)

Characteristics	N[1]	HIV			Syphilis		
		n (%)[2]	(Wt %)[3]	χ^2 (p-value)	n (%)[2]	(Wt %)[3]	χ^2 (p-value)
Discrimination and Violence							
Discrimination due to social condition:							
No	255	19 (7.5)	(10.7)	0.96 (0.328)	28 (11.1)	(14.5)	0.999 (0.317)
Yes	15	1 (7.1)	(2.3)		1 (7.1)	(4.7)	
Discrimination due to age:							
No	247	18 (7.4)	(9.65)	1.64 (0.200)	25 (10.2)	(14.1)	0.070 (0.791)
Yes	23	2 (9.5)	(19.7)		4 (19.1)	(11.7)	
Discrimination due to sexual orientation							
No	160	10 (6.4)	(11.7)	1.22 (0.270)	16 (10.1)	(15.2)	0.786 (0.375)
Yes	110	10 (9.3)	(7.3)		13 (12.0)	(11.2)	
Verbal aggression due to sexual orientation:							
No	103	4 (4.0)	(10.1)	0.01 (0.934)	12 (11.8)	(18.6)	2.95 (0.086)
Yes	167	16 (9.8)	(10.4)		17 (10.3)	(11.0)	
Physical aggression due to sexual orientation:							
No	244	19 (7.9)	(10.8)	1.70 (0.192)	22 (9.1)	(13.3)	1.00 (0.317)
Yes	27	1 (4.0)	(0.5)		7 (26.9)	(21.7)	
Sexual intercourse against their will:							
No	236	17 (7.4)	(9.6)	0.68 (0.409)	22 (9.4)	(12.6)	2.39 (0.122)
Yes	35	3 (8.8)	(14.3)		7 (20.6)	(22.5)	
Mental Health in the last six months							
Tension and concerns:							
Never or little	43	4 (10.0)	(8.75)	0.14 (0.712)	5 (12.9)	(16.2)	0.23 (0.633)
Some or a lot	227	16 (7.1)	(10.6)		24 (10.7)	(13.5)	
Problems to sleep:							
Never or little	142	10 (7.2)	(7.1)	3.48 (0.062)	13 (9.3)	(11.9)	1.09 (0.296)
Some or a lot	128	10 (8.0)	(14.2)		16 (12.6)	(16.4)	
Feeling of fear and/or panic:							
Never or little	235	16 (7.0)	(9.5)	1.19 (0.274)	24 (10.3)	(13.2)	0.78 (0.379)
Some or a lot	35	4 (11.8)	(16.0)		5 (14.7)	(19.2)	
Feeling of sadness or depression:							
Never or little	126	7 (5.65)	(7.6)	1.74 (0.187)	9 (7.1)	(7.8)	7.18 (0.007)
Some or a lot	144	13 (9.29)	(12.60		20 (14.2)	(19.3)	
Suicidal ideation:							
Never or little	235	15 (6.5)	(9.0)	2.54 (0.110)	23 (9.9)	(12.6)	2.61 (0.107)
Some or a lot	35	5 (14.7)	(17.6)		6 (17.7)	(22.4)	
Alcohol or Drugs use							
Alcohol use:							
Never-eventual	101	7 (7.1)	(7.8)	1.21 (0.271)	9 (9.0)	(11.6)	0.89 (0.346)
2+ times a week	169	13 (7.8)	(12.1)		20 (12.0)	(15.7)	
Alcohol use:							
Never-eventual	101	7 (7.1)	(7.8)	1.21 (0.271)	9 (9.0)	(11.6)	0.89 (0.346)
2+ times a week	169	13 (7.8)	(12.1)		20 (12.0)	(15.7)	

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Table 2 - Univariate analysis of HIV and Syphilis seroprevalence among men who have sex with men, Belo Horizonte, 2010 (n=274)

Characteristics	N[1]	HIV			Syphilis		
		n (%)[2]	(Wt %)[3]	χ^2 (p-value)	n (%)[2]	(Wt %)[3]	χ^2 (p-value)
Alcohol or Drugs use							
Binge drinking in the last six months:							
No	215	16 (7.6)	(10.5)	0.13 (0.718)	20 (9.5)	(13.6)	0.15 (0.699)
Yes	55	4 (7.4)	(8.7)		9 (16.7)	(15.9)	
Illicit drugs use in the last six months:							
No	180	14 (7.9)	(11.3)	0.83 (0.361)	19 (10.6)	(15.4)	1.37 (0.242)
Yes	89	6 (6.9)	(7.2)		10 (11.5)	(9.5)	
Sex under the influence of alcohol or drugs in the last six months:							
No	77	8 (10.7)	(11.5)	1.15 (0.284)	10 (13.0)	(17.4)	1.64 (0.200)
Yes	193	12 (6.3)	(9.5)		19 (10.0)	(11.8)	
Sexual behavior							
Age at first sexual intercourse (years):							
>18	62	5 (8.2)	(15.1)		4 (6.5)	(15.32)	
15-18	129	9 (7.1)	(7.25)	0.67 (0.410)	12 (9.4)	(10.40)	0.41 (0.521)
≤14	79	6 (7.8)	(10.9)		13 (16.9)	(19.41)	
Number of sexual partners (last six months):							
1	58	8 (14.3)	(31.8)		10 (17.8)	(28.8)	
2-5	131	7 (5.4)	(4.4)	6.10 (0.013)	9 (6.9)	(10.3)	2.40 (0.121)
>5	79	4 (5.3)	(10.2)		10 (12.8)	(13.6)	
Sexual intercourse with men only in the last twelve months:							
No	21	1 (5.0)	(1.59)	1.74 (0.186)	1 (4.8)	(11.9)	0.09 (0.767)
Yes	249	19 (7.8)	(11.0)		28 (11.4)	(14.2)	
Use of condoms use in all receptive anal intercourse in the last six months:							
Always	160	13 (8.3)	(8.9)	1.04 (0.306)	18 (11.4)	(14.9)	0.29 (0.59)
Irregular	109	7 (6.6)	(12.9)		11 (10.2)	(12.5)	
History STD / HIV							
Knowledge about HIV / AIDS							
High	104	17 (8.5)	(12.2)	4.04 (0.044)	20 (10.0)	(13.7)	0.02 (0.885)
Low	67	3 (4.5)	(3.1)		9 (13,4)	(14.5)	
Chance to get infected with HIV							
None or low	144	5 (3.6)	(4.0)		8 (5.6)	(6.3)	
Moderate or high	82	5 (2.5)	(3.0)	31.12 (<0.001)	14 (17.5)	(20.1)	16.56 (<0.001)
Unknown	46	14 (30.4)	(33.8)		8 (17.4)	(27.0)	
Prior HIV testing:							
No	69	1 (1.49)	(0.0)	9.24 (0.002)	4 (5.9)	(4.8)	5.74 (0.017)
Yes	201	19 (9.6)	(13.5)		25 (12.6)	(16.8)	
Prior syphilis testing:							
No	167	9 (5.6)	(5.0)	13.90 (<0.001)	8 (4.9)	(5.0)	30.60 (<0.001)
Yes	91	11 (12.1)	(19.9)		21 (23.1)	(30.2)	
Previous diagnosis of syphilis:							
No	252	14 (5.7)	(4.9)	77.99 (<0.001)	15 (6.0)	(7.5)	92.50 (<0.001)
Yes	19	6 (32.6)	(62.8)		14 (73.7)	(79.4)	

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Table 2 - Univariate analysis of HIV and Syphilis seroprevalence among men who have sex with men, Belo Horizonte, 2010 (n=274)

Characteristics	N[1]	HIV			Syphilis		
		n (%)[2]	(Wt %)[3]	χ² (p-value)	n (%)[2]	(Wt %)[3]	χ² (p-value)
History STD / HIV							
STD diagnosis in the past 12 months:							
No	205	12 (6.0)	(5.7)	17.91(<0.001)	13 (6.4)	(8.2)	23.21 (<0.001)
Yes	66	8 (12.3)	(24.5)		16 (24.6)	(32.5)	
Network / Social Participation							
How many friends talk about STD / Aids prevention?							
Everybody-majority	98	6 (6.4)	(11.8)	0.29 (0.587)	12 (12.5)	(10.2)	1.41 (0.236)
Some-few-none	173	14 (8.2)	(9.5)		17 (9.8)	(15.6)	
How many friends encourage condom use?							
Everybody-majority	156	7 (4.6)	(5.5)	7.11 (0.007)	15 (9.7)	(9.1)	5.86 (0.016)
Some-few-none	115	13 (11.5)	(15.6)		14 (12.4)	(19.5)	
How many friends say they use condoms?							
Everybody-majority	191	13 (7.0)	(10.9)	0.27 (0.600)	16 (8.5)	(12.8)	0.46 (0.50)
Some-few-none	80	7 (8.7)	(8.8)		13 (16.2)	(15.9)	
Participation in NGO							
No	224	15 (6.8)	(8.8)	4.03 (0.045)	19 (8.5)	(12.1)	4.79 (0.029)
Yes	47	5 (11.1)	(20.1)		10 (22.2)	(26.2)	

[1]N= Total number of participants in each category; [2] n(%)=number and unweighted proportion of positives in each category; [3] Wt%= Weighted proportion of positives in each category.

Though more scarce, data on syphilis are equally of concern. Syphilis prevalence varied from 2.8%, in Campo Grande, to 23.5% in Rio de Janeiro, while Belo Horizonte (13.9%) ranked second in the national multicenter study among MSM.[16]In the period 2009 thru June 2013, 1,140 new cases of acquired syphilis were reported in Belo Horizonte, 73.8% among men. Among these, a high concentration of cases was observed among sexually active men 20 to 39 years old.[2]

This scenario of concentrated epidemic and the results herein presented reveal a serious challenge for public health officials aiming at monitoring and evaluating of the HIV epidemic. This way, we should emphasize the high proportion of inconsistent condom use in recent sexual intercourses (less than six months), especially anal receptive intercourse, considering that in Belo Horizonte this was higher than the 36.5% observed for the national sample.[5] In contrast, more than half of the sample considered to be at low or no risk of acquiring HIV, also greater than the national average (47.0%), despite the higher proportion of participants with adequate HIV/AIDS knowledge (75.3%), with good education (72.8% with 12 or more years of schooling), high mean income, andranked in social classes

A and B(63.0%). Most likely, a considerable portion of new infections occurred thru unprotected receptive anal intercourse among these men, once this is considered to be the riskiest exposure to HIV during sex.[17]

The reduction in condom use among MSM has been observed worldwide and may indicatea decrease in the effectiveness of prevention strategies. The optimism related to antirretroviral treatment efficacy, the expansion of internet as an envionment for potential risky sexual encounters, and structural deficiencies in the organization of health services provided to MSM are among potential explanations for this reduction in condom use and the high rates of unprotected sex among MSM.[18]

Along with the results herein discussed, UNAIDS-[1]points out to important challenges for this population.Difficulties in access to high quality and efficient AIDS prevention services among young MSM remain. In addition, some youngsters are jeopardized in their capacity to obtain essential services due to a limited protection of their confidentiality and rights to medical privacy.Comprehensive sexual education has shown to be efficatious in delaying sexual debut and in increasing condom use among sexually active young

MSM.However, inadequate access to educational activities also jeopardize efforts to protect these young men from acquiring HIV infection.[19]

For MSM, sex workers and other marginalized populations who have elevated risk of acquiring HIV, programatic deficits are aggravated by legal and social disadvantages that increase their vulnerability and difficulties in obtaining necessary services. This way, MSM may have limited access to condoms, water-based lubricants, education and support to reduce sexual exposure to HIV. Fear of disapproval and discrimination by health service providers may also disencourage many MSM to search for conventional health services.This was evident in this study due to the need to find an alternative and comfortable site toCTC that would guarantee privacy to participants. Only after such a decision, the recruitment process effectively launched. It is also clear the elevated proportion of participants who reported discrimination due to their sexual orientation (40.7%), of suffered violence also due to their sexual orientation, of early sexual debut, and the worrying proportion of non-consensual sex, in a network predominantly composed of young MSM ages 18 to 24 years old. It is urgent, both global and locally, to increase access to culturally sensitive counseling on HIV/AIDS among MSM, in addition to increment HIV testing and early antirretroviral treatment to all those found to be positive.[19]

Insuficient availability of resources limits efforts to provide essential HIV prevention services to MSM. The effects of limited funding are aggravated by additional challenges, including those related to homophobic deterrement on the capacity of MSM to search and obtain these services. Decision makers must work on expanding access and utilization of condoms and lubricants. Specific and concentrated efforts must guarantee good quality condoms for young people in general, and specifically for key populations. It is also essencial the participation of civil organizations in this process. As previously observed, participation of this population in NGO was quite low.[20]

Federal, State and Municipal governmentsmust develop coordinated efforts to evaluate the extent of the HIV epidemic among MSM while expanding services that remove barriers to access to services. Stigma, discrimination and legal oppression in many environments deter MSM from searching for HIV testing. It is essential the availability of high quality prevention, treatment and care services. The national program and, in particular, the municipal programs,

must develop efforts to increase sensibility to MSM health needs, improve access to health services and develop programs to intensify preventive behaviors in this population. Resources must be directed towards critical facilitators and the development of sinergies that reduce vulnerability and increase efficacy, efficiency and efforts of HIV prevention. Such approaches should include judicial system reform, reduction of stigma, access to judicial services, awareness of rights, sensibilization of police and training of health professional.Among the many population groups that can benefit from critical facilitators and sinergy development, this type of funding is particularly relevant to MSM, sex workers and other marginalized groups at increased risk of HIV.[1]

The present study has some limitationsThis is a cross-sectional study whose sampling methodology (RDS) may not necessarily represent Belo Horizonte MSM population.Because recruitment is based on the invitation to acquaintances, the social network created may not reach saturation in successive waves. Similarly, a network can have high degree of homophily according to selected characteristics. In this study, we can note a network which was composed of MSM who had high socioeconomic level, good HIV/AIDS knowledge, who were young and with good schooling, which could have potentially generated underestimation of prevalence rates and risk behaviors. In addition, the sample size obtained was insuficient to generate precise estimates of the magnitude of the associations between explanatory variables and HIV and syphilis infections. Nonetheless, this method outstands in its capacity to study hard to reach populations, avoiding biased results which are solely based on convenience samples. Despite these limitations, these results are suficiently of serious magnitude to demand immediate actions from pubic authorities.

CONCLUSION

The results of this study indicate the seriousness of the HIV epidemic among MSM residents in Belo Horizonte. Despite the important role played by the DSA-VH/MH in monitoring and evaluating the HIV epidemic in Brazil, the current state of the art on HIV/AIDS indicates that the epidemic is not uniform throughout the countries´ Regions, States or Municipalities. Public policies at the State and Municipal levels must be urgently implemented and/or revised. From the public

health stand point, it is absolutely imperative to evaluate public investments and interventions, including the production and consolidation of municipal indicators for monitoring HIV and syphilis prevalence, HIV testing and risk behaviors among key populations. In addtion, it is necessary to evaluate access and utilization of health services among persons living with HIV/AIDS, emphasizing the need to start treatment early and maintain good levels of adherence.

ACKNOWLEDGMENTS

REFERENCES

1. World Health Organization -WHO. Joint United Nations Programme on HIV/aids. Global Report: UNAIDS Report on the global AIDS Epidemic. Genebra: WHO; 2013.

2. Brasil. Ministério da Saúde. Secretaria de Vigilância em Saúde. Boletim Epidemiológico HIV-Aids. 2012; 1(1). 2012. [Cited 2013 Nov 28]. Available from: http://www.aids.gov.br/sites/default/files/anexos/publicacao/2012/52654/boletim_2012_final_1_pdf_21822.pdf

3. Szwarcwald CL, Souza Jr PRB, Damacena GN, Barbosa Jr A, Kendall C. Analysis of Data Collected by RDS Among Sex Workers in 10 Brazilian Cities, 2009: Estimation of the Prevalence of HIV, Variance, and Design Effect. J Acquir Immune Defic Syndr. 2011; 57(supl.3): S129-35.

4. Kerr LR, Mota RS, Kendall C, Pinho Ade A, Mello MB, Guimarães MD, et al. HIV among MSM in a large middle-income country. AIDS. 2012; 27(3):427-35.

5. Rocha GM, Kerr LRFS, Brito AM, Dourado I, Guimarães MDC. Unprotected Receptive Anal Intercourse Among Men Who have Sex with Men in Brazil. AIDS Behav. 2013; 17:1288-95

6. Grangeiro A, Escuder MML, Castilho EA. Evaluation of strategies by the Brazilian Ministry of Health to stimulate the municipal response to AIDS. Cad Saúde Pública. 2011; 27(Sup 1):S114-28.

7. Heckathorn DD. Respondent-Driven Sampling: a new approach to the study of hidden populations. Soc Probl. 1997; 44(2):174-99.

8. Heckathorn DD. Respondent-Driven Sampling II: deriving valid population estimates from chain-referral samples of hidden populations. Soc Probl. 2002; 49(1):11-34

9. Salganick MJ, Heckathorn DD. Sampling and estimation in hidden populations using respondent-driven sampling. Social Methodol. 2004; 34:193-240.

10. Associação Brasileira de Empresas de Pesquisa - ABEP. Critério de classificação econômica Brasil. 2005. [Cited 2013 Nov 22]. Available from: http://www.abep.org.

11. Gomes RRFMG, Batista JR, Ceccato MGB, Kerr LRFS, Guimarães MDC. HIV/Aids Knowledge among men who have sex with men in Brazil: applying the item response theory. Rev Saúde Pública (In Press).

12. Brasil. Ministério da Saúde. Secretaria de Vigilância á Saúde. Portaria 34 de 28 de julho de 2005. Brasília: Ministério da Saúde, SVS, 2005. [Cited 2013 Nov 22]. Available from: http://bvsms.saude.gov.br/bvs/saudelegis../svs/2005/prt0034_28_07_2005.html

13. Brasil. Ministério da Saúde. Secretaria de Vigilância em Saúde. Portaria SVS/MS no. 151, 14/10/2009. [Cited 2013 Nov 22]. Available from: http://www.aids.gov.br/sites/default/files/portaria151_2009.pdf

14. Carneiro M, Cardoso FA, Greco M, Oliveira E, Andrade J, Greco DB, Antunes CMF Determinants of Human Immunodeficiency Virus (HIV) Prevalence in Homosexual and Bisexual Men Screened for Admission to a Cohort Study of HIV Negatives in Belo Horizonte, Brazil: Project Horizonte. Mem Inst Oswaldo Cruz. 2003; 98(3):325-9.

15. Miller WM, Buckingham L, Sánchez-Domínguez MS, Morales-Miranda S, Paz-Bailey G. Systematic review of HIV prevalence studies among key populations in Latin America and the Caribbean. Salud Pública México. 2013; 55(Sup1):S65-S78.

16. Kerr LRFS. Comportamento, atitudes, práticas e prevalência de HIV e sífilis entre homens que fazem sexo com homens (HSH) em 10 cidades brasileiras. Relatório Final. Departamento de DST, Aids e Hepatites Virais. Brasília: Secretaria de Vigilância em Saúde, Ministério da Saúde; 2009.

17. Baggaley RF, White RG, Boily MC. HIV transmission risk through anal intercourse: systematic review, meta-analysis and implications for HIV prevention. Int J Epidemiol. 2010; 39: 1048-63.

18. Beyrer C, Baral SD, van Griensven F, Goodreau SM, Chariyalertsak S, Wirtz AL, Brookmeyer R. Global epidemiology of HIV infection in men who have sex with men. Lancet. 2012; 380(9839):367-77.

19. Paz-Bailey G, Hall HI, Wolitski RJ, Prejean J, Handel MMV, Le B, et al. HIV Testing and Risk Behaviors Among Gay, Bisexual, and Other Men Who Have Sex with Men — United States. MMWR. 2013; 62(47):958-62

20. Murure AF, Machado CJ, Rocha GM, Guimarães MDC. Participação de homens que fazem sexo com homens em organizações não governamentais em Belo Horizonte, 2007 a 2009. Rev Med Minas Gerais. 2013; 23(1):22-31.