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Perception of vulnerability to HIV infection in a cohort of homosexual/bisexual men in Rio de Janeiro, Brazil

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Abstract *The present study addresses sociodemographic characteristics, knowledge and attitudes regarding HIV/AIDS, as well as risk behaviour and perception of vulnerability to HIV infection, in the first 295 homosexual and bisexual volunteers (excluding male commercial sex workers and transvestites) taking part in a cohort study in Rio de Janeiro. The sample has a higher socio-economic level than the remainder of the cohort, and than comparable strata of the general population, and a sound knowledge about how to protect themselves against HIV infection. In addition, an association between perception of vulnerability to infection and the practice of unprotected anal sex was observed. An association was also observed between higher levels of formal education and perception of vulnerability; however no association was found with markers for past and recent exposure to sexually transmitted infections (hepatitis B, HbsAG and syphilis). The results of the present study suggest that knowledge and awareness of risk do not easily translate into behaviour change, since significant proportions of the cohort continue to practise unprotected sex with both principal and casual partners, despite their awareness of HIV infection risks as well as preventive measures.*

Introduction

The rapid spread of HIV-1 infection throughout the world, particularly in developing countries, motivated the World Health Organization (WHO), and subsequently UNAIDS, to propose a comprehensive action plan for the evaluation of anti-HIV vaccine candidates in different geographic areas. An evaluation previously carried out by WHO's Vaccine Develop-

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ment Committee (1991) concluded that Brazil, Thailand, Uganda and Rwanda fulfilled the minimum requirements to become trial sites. The HIV Vaccines Program in Brazil was launched in June 1992, with the appointment of a National Committee on HIV Vaccines. Three cities, Rio de Janeiro, São Paulo and Belo Horizonte, were selected to become potential vaccine test sites. These cities are located in the industrialized south-east of Brazil, the region with the highest cumulative AIDS incidence (Bastos *et al.*, 1995). As of November 1997, more than 120,000 AIDS cases had been registered in Brazil, with 39,667 (33%) of these occurring in homo- and bisexual men (Brazilian Ministry of Health, 1997). As of December 1997, Rio de Janeiro state registered 18,610 and 8,091 (43.5%) cases, respectively (Rio de Janeiro State Health Secretariat, 1997).

In 1994, a multi-centre cohort study of HIV-negative men who have sex with other men (MSM) was initiated in order to determine HIV incidence and follow-up attrition rates, as well as to assess sociodemographic and behavioural characteristics. The decision by the three regional centres that the cohorts would be composed of MSM was based on: the relevance of this population segment to the HIV/AIDS epidemic in Brazil; the fact that it is a population traditionally engaged in attempts to introduce safer sex practices; and its involvement in self-organizing initiatives and actions concerned with human rights advocacy. Sexual transmission has been the main route of HIV spread in Brazil. Until 1995, the yearly number of AIDS cases registered among MSM increased continuously, although since the beginning of the present decade the proportion of cases in this exposure category has decreased as a result of the increase in numbers of cases due to heterosexual transmission and to sharing of injecting equipment (Bastos *et al.*, 1995).

Epidemiological studies in a number of different countries indicate that several factors are consistently associated with new HIV infections in MSM, such as unprotected anal intercourse, having a known HIV-positive partner, having a sexually transmitted disease (STD), and injection drug use (Buchbinder *et al.*, 1996; DiFranceisco *et al.*, 1996; Williams *et al.*, 1996). Some recent reports suggest that HIV transmission may also occur as a result of unprotected oral sex (Bratt *et al.*, 1997; Page-Schafer *et al.*, 1997). With respect to psychosocial factors, poor knowledge about AIDS (Kelly *et al.*, 1990; Kippax *et al.*, 1995), lack of perceived severity of AIDS as an illness, negative attitudes and low self-efficacy with respect to condom use (Aspinwall *et al.*, 1991; Godin *et al.*, 1993), as well as normative factors in the social environment (McKusick *et al.*, 1990), have all been found to be associated with risky sexual behaviour.

The relationship between perception of personal vulnerability to HIV infection and the enactment of risky/safe sexual behaviour is however less clear. Some investigations, such as that carried out by Moore and Rosenthal (1991) in adolescents, indicate a contradiction between high levels of reported risk behaviours and perception of invulnerability to HIV infection. Other studies suggest, however, that MSM who practise risky sexual behaviour are also more aware of their risk of becoming infected (Bosga *et al.*, 1995; Kelly *et al.*, 1995). Differing results with respect to this issue may be due to a number of different issues such as cultural context, underlying conceptual and theoretical models, study design and the nature of the measures employed (Gerrard *et al.*, 1996; Poppen & Reisen, 1997). A better understanding of this issue is important, since perception of personal vulnerability may be seen as a necessary first step towards behaviour change.

In addition, characterization of patterns of risk behaviours, as well as the perception of volunteers of their vulnerability to HIV infection, are core issues in vaccine preparedness studies. Koblin *et al.* (1998) and Bartholow *et al.* (1997) have shown that participants reporting recent high-risk behaviours were more likely to be willing to participate in vaccine preparatory studies than those not reporting these behaviours. These findings are essential to

the feasibility of future vaccine trials, since they demonstrate the capacity to recruit volunteers at risk. There is also a need to gather data relevant to these questions in different cultural settings, in order to cross-compare perceived and actual risks.

In this paper, we present baseline sociodemographic and behavioural data on MSM enrolled in the cohort in Rio de Janeiro from January 1994 through March 1997. We also analyze the relationship between perception of vulnerability to HIV infection and socio-behavioural characteristics, specifically the enactment of risky sexual behaviour, as well as with laboratory data indicating exposure to STDs. Cohort members engaged in regular commercial sex activities (known locally as 'michês'), as well as transvestites and transsexuals (who are usually also engaged in commercial sex), were excluded from the present analysis, since exploratory analyses of our data, as well as previously published studies of comparable groups (Parker *et al.*, 1992), indicate that these groups have distinct sociodemographic characteristics and behaviours, composing a true sub-sample of the whole cohort.

Methodology

The study was reviewed and approved by the FIOCRUZ Ethics Committee. Study procedures, recruitment sources and sexually transmitted disease (STD) seroprevalence rates among potential volunteers have been reported previously (Sutmoller *et al.*, 1997). We briefly describe here the procedures used in the cohort study, focusing on issues relevant to this paper.

Study population

Entry criteria for this study were being male, HIV-seronegative, having sexual activity with other men (male homosexual intercourse), being aged between 18 and 50 years, not being engaged in regular commercial sex or being a transvestite/transsexual, and having agreed with the informed consent procedures. Volunteers were recruited through a combined strategy involving mainly outreach activities, e.g. recruitment by study volunteers themselves ('snow-ball') (45% of the volunteers here analyzed) and by non-governmental organizations (NGOs) (34.8%), as well as by media contacts (7.7%) with advertising, targeted interviews, etc., and referrals from health care facilities (12.5%). The most important factors determining the enrollment of these volunteers were: the desire to know their HIV status and their wish to engage in a project that provides volunteers with preventive resources, e.g. condoms, education and the support of a multidisciplinary team.

Study procedures

At the first (recruitment) interview basic sociodemographic data, opinions, HIV knowledge and attitudes on health issues were obtained, and an explanation of the *Programa Rio* study given. The volunteers were then given pre-test counselling, with subsequent blood specimen collection for HIV, syphilis (VDRL, with confirmation using TPHA) and hepatitis B (anti-HBc, anti-HBs, HBsAg) testing. On their return, one week later, the volunteers received the HIV and other test results during a session of post-test counselling. The HIV-positive individuals were referred to public health care facilities for follow-up care and those who were HIV-negative were asked to enroll in the study after signing the informed consent form. A more detailed questionnaire was administered after enrollment.

Standardized questionnaires were developed and applied by specifically trained study

staff at the three centres. The sociobehavioural questionnaire was composed of 100 (mainly closed) questions on: sociodemographic characteristics, knowledge about HIV transmission routes and prevention strategies, beliefs and attitudes towards AIDS and sexual life, sexual practices, and STD/AIDS preventive initiatives. The questions on knowledge of transmission routes, perception of vulnerability and protection from infection were formulated as multiple-option questions, permitting the interviewees to give at their discretion as many answers as they wished. Perception of vulnerability to HIV infection was addressed through a direct question: 'Do you think that you are at risk for HIV infection?', answers being yes/no with further detailing of the reasons for feeling 'vulnerable' or not.

Statistical analysis

Data were entered on a Foxpro (2.0) spreadsheet and analyzed (frequency, correlation and statistics) with SPSS for Windows 95 package for PCs (Norusis, 1997). Significance was defined by *p*-values less than 0.05. In the univariate analyses, associations with vulnerability were assessed through chi-square tests, Yates corrected, and 95% confidence intervals for the odds ratios (ORs). Fisher's exact test was used when necessary.

To further assess the role of the different variables in a multivariate form, a stepwise forward logistic regression was carried out, maximizing at each step the likelihood ratio, with perception of vulnerability to HIV infection as the dependent variable. The significance level for variable inclusion was 5% and that for exclusion, 10%.

Results

During the period of the study, 818 men were interviewed as potential study participants; however, 24% of these tested positive for HIV. By March 1997, 470 persons had actually enrolled in the study. The sample analyzed here was composed of 295 volunteers, of whom 177 (60%) were men reporting strictly homosexual practices, and 118 (40%) reporting sexual intercourse with both men and women.

Mean age was 27.6 years, with a standard deviation of 7.26 and a mode of 23 years (Table 1). With respect to marital status, 251 volunteers (85.1%) were single, 33 (11.2%) married or divorced and 11 (3.7%) classified in a miscellaneous category which includes stable relationships with boyfriends (not currently defined by Brazilian law as 'legal unions'). Most of the interviewees—227 (77%)—lived with relatives and friends, while 68 (23%) lived alone. The majority of interviewees (70.5%) were in paid employment; 187 (65%) interviewees received a monthly wage of between 1 and 6 minimum Brazilian salaries (approximately US\$ 122.00–732.00). Half (54.7%) of the sample had completed full high school education.

The vast majority of interviewees (75.6%) reported having changed their sexual practices since the onset of the AIDS epidemic (Table 2); around 58% of those reporting behavioural change mentioned the systematic use of condoms. Other reported behavioural changes included: a redefinition of partnerships (less partners, exclusive relationship with a principal partner, 'sex only with chosen partners', sex only with former—supposedly better known—partners), and changes in sexual practices themselves (such as lower frequencies of penetrative intercourse).

In an open question with multiple answers permitted, 202 subjects (68.5%) stated that HIV infection could be transmitted through unprotected sexual intercourse (non-specified); 208 (71%) volunteers mentioned blood transfusion as a risk factor and 164 (55.6%)

Table 1. Sociodemographic characteristics of the 295 participants in the HIV-negative cohort of MSM

Variables	n (%)
Age (years)	
18–19	29 (9.8)
20–24	96 (32.5)
25–29	70 (23.7)
30–34	50 (17.0)
35–39	26 (8.8)
40–44	17 (5.8)
45–49	7 (2.4)
Marital status	
Single	251 (85.1)
Currently or previously married	33 (11.2)
Other	11 (3.7)
Living with:	
Parents	150 (51.0)
Alone	68 (23.0)
Friend/companion	60 (20.3)
Wife/children	9 (3.0)
Others	8 (2.7)
Employment	
Active	208 (70.5)
Unemployed	81 (27.5)
Unknown	6 (2.0)
Volunteers' income	
No income	27 (9.1)
< 1 MS ^a	12 (4.1)
1–3	131 (44.4)
3–6	56 (19.0)
6–10	32 (10.8)
10–14	7 (2.4)
+ 14	12 (4.1)
Unknown	18 (6.1)
Educational level	
Illiterate	— (—)
Primary	
Incomplete	46 (15.6)
Complete	86 (29.1)
Secondary	104 (35.2)
University	56 (19.0)
Unknown	3 (1.1)

^aMinimum salary currently about R\$120.00/US\$125.00.

spontaneously mentioned the risk of needle sharing among injection drug users. Nevertheless, the practice of unprotected anal intercourse, both insertive and receptive, continued to be reported with relatively high frequencies among those with both principal and casual partners in the six months prior to the interview. Among those with a principal partner (168/295 or 57% of the cohort), 40% (67/168) engaged in unprotected insertive, and 33% (60/168) in unprotected receptive, anal intercourse. Among those with casual partners (180/295 or 61% of the cohort), 36% (65/180) had engaged in unprotected insertive, and 27% (49/180) in

Table 2. Behavioural change as a result of the AIDS epidemic as reported by the 295 participants of the HIV-negative cohort of MSM

Behavioural change	n (%)
No behavioural change	52 (17.6)
Behavioural change [#] :	223 (75.6)
Condom use in most relationships	129 (57.8)*
Reduction in the number of sexual partners	72 (32.3)*
Sex only with carefully chosen sexual partners	76 (34.0)*
No new partners, due to fear of AIDS	27 (12.0)*
Only mutually faithful partnerships	30 (13.5)*
Safer sexual practices (e.g. lower frequency of penetrative anal sex)	150 (67.2)*
Other answers	22 (9.8)*
No answer/incoherent answer	20 (6.8)

[#]Behavioural change items allow for multiple answers.

*Of those reporting behavioural change.

unprotected receptive, anal sex. For the whole sample under analysis, the frequency of unprotected insertive and receptive anal sex was therefore 23% (67/295) and 20% (60/295), respectively, for sex with permanent partners; and 22% (65/295) and 17% (49/295), respectively, for casual partners.

Despite the fact that 40% of the men interviewed described themselves as bisexuals, actual rates of sexual intercourse of these men with their female partners were very low, precluding any kind of valid analysis.

The prevalence of STDs in the cohort was discussed in a previous paper (Sutmoller *et al.*, 1997), and STD risk data presented here refer to sexual partnerships: 11.8% reported having had sexual intercourse with partners supposedly infected with a STD other than HIV in the six months prior to interview. Twenty-four (8%) interviewees reported having had sexual intercourse with *known* HIV-positive partners during the same period; 19 (79%) reported systematic condom use with the latter.

Illicit drug use was rarely reported, with 83.3% of the subjects reporting never having used any kind of illicit drug. The consumption of alcoholic beverages was much more frequently reported, and almost all interviewees had used it on at least a few occasions during the six months prior to interview; 51.5% reported having drunk alcohol before and during dating and ensuing sexual intercourse, but only 9.8% subjects affirmed having engaged in unsafe sexual practices 'due to the fact they were under the influence of alcohol'.

With respect to perception of vulnerability to HIV infection, 185 (72% of the valid answers) of the volunteers interviewed perceived themselves as being 'vulnerable' (at risk). The main reasons (in an open question with multiple answers permitted) given for perceiving themselves as 'vulnerable' are presented in Table 3. Variables related both to individual/dyadic behaviours (e.g. prediction of the difficulty of being engaged only in safe sexual relationships in the foreseeable future), as well as variables related to the broader social context (e.g. fear of receiving a transfusion of infected blood or the rather fatalistic statement that 'everyone is at risk of being infected with HIV'), were mentioned by the interviewees. No interviewees perceived themselves as vulnerable based only on such 'broader social context' variables: all mentioned at least one variable associated with risky sexual behaviour.

Seventy-two (28% of the valid answers) interviewees did not perceive themselves as being at risk (i.e. perceived themselves as 'non-vulnerable') for HIV infection. Among these respondents (free to list multiple answers), the vast majority 'trust in condoms as a preventive

Table 3. Grounds (multiple answers allowed) for self-perception of (in)vulnerability, given by volunteers in the HIV-negative cohort of MSM

Responses	n (%)
Vulnerable (n = 185)	
Afraid to receive a transfusion in the near future	68 (37.0)
Everyone is at risk of being infected with HIV	82 (45.0)
Afraid condoms could break	73 (40.0)
At risk due to very fact one is a male homo/bisexual	30 (16.0)
Has seropositive sexual partners	9 (4.9)
Scared by own lack of control over his sexual desires and behaviour	32 (17.0)
Speculate about having unprotected sexual intercourse in the foreseeable future	80 (44.0)
Non-Vulnerable (n = 72)	
Trust in condoms as a preventive measure, using them in all sexual relations	57 (79.0)
Has sex only with principal partners	21 (29.0)
Now, has a smaller number of sexual partners	21 (29.0)
Chooses partnerships carefully	19 (26.0)

measure', referring to use of them in all sexual relationships in which they engaged. The 38 men with no answer to this question, or with inconclusive answers, were excluded from the final analysis.

We present in Table 4 all statistically significant associations between perception of vulnerability and sociodemographic/behavioural variables. As shown in Table 4, perception of vulnerability was associated with higher school attainment (OR = 2.4, $p = 0.002$). Other sociodemographic variables assessed but showing no significant association were age, housing, employment, income, religion, and attending or not health care facilities (data not shown).

With regard to sexual behaviour during the six months prior to interview, we found that those reporting any unprotected anal intercourse (OR = 2.3, $p = 0.004$) were significantly more likely to perceive themselves as vulnerable to HIV infection. Other associations were observed with respect to those reporting unprotected sexual intercourse with casual partners

Table 4. Associations between main sociodemographic and risky behavioural variables and perception of (in)vulnerability to HIV infection among the 257 HIV-negative cohort participants with valid answers

Variables	Vulnerability*		Non-vulnerability**		OR	95% CI	p^{***}
	n	%	n	%			
Sociodemographic							
Higher educational level****	76	41	45	64	2.4	1.4-4.2	0.002
Behaviours/practices							
Anal intercourse without condoms, with (male) partners, in the last 6 months	109	59	28	39	2.3	1.3-3.9	0.004
Any unprotected intercourse with occasional partners, in the last 6 months	107	58	25	35	2.6	1.5-4.5	0.001

*185 valid answers, excluding 38 subjects who did not answer/gave incoherent answers; **72 valid answers; ***chi-square—Yates corrected; ****cut-off being (over/under) high school level.

Table 5. Variables associated with perception of vulnerability to HIV infection in the final multiple logistic regression model

Selected variables	Coefficient(β)	<i>p</i>	Exp (B)	95% CI
Educational level (ordinal)	0.1392	0.0032	1.1494	1.0478–1.2608
Anal intercourse without condoms, with (male) partners, in the last 6 months (any partner) (1 = yes/0 = no)	0.8477	0.01	2.3343	1.2244–4.4501
Any unprotected intercourse with occasional partners, in the last 6 months (1 = yes/0 = no)	0.6130	0.0581	1.8460	0.9790–3.4808

Table 6. Seroprevalence of syphilis and (ever/acute) hepatitis B in the 295 HIV-negative cohort participants vis-à-vis perception of vulnerability to HIV-infection

Self-perception of vulnerability	Positive for syphilis		Positive for hepatitis B (ever)		Positive for HBsAg (acute Hepatitis B)	
	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%
Vulnerability	37	18.8	54	27.4	4	2.0
Non-vulnerability	23	27.0	23	27.0	1	1.2
<i>p</i> *	0.06		0.8		0.9	

*Chi-square, Yates corrected/Fisher's exact test.

(OR = 2.6, $p = 0.001$). No other significant associations were found among other variables tested, including age of first sexual intercourse with other men and/or women, different 'scenes' from where partners were recruited, behavioural changes after the AIDS epidemic and sex with HIV-positive partners (the lack of association with this latter variable may be due to the relatively low numbers of MSM reporting sex with known HIV-positive partners).

The final multiple logistic regression model (model chi-square = 24.688, $p = 0.0000$) identified as factors predictive of perception of vulnerability, following the inclusion order as defined by the stepwise procedure: 'educational level' (defined as an ordinal variable); 'anal intercourse without condoms, with any male partners in the last six months'; and 'any unprotected intercourse with casual partners in the last six months' (Table 5).

Data on syphilis and hepatitis B seroprevalence (HBsAg, anti-HBs and anti-HBc) were available for all interviewees. As shown in Table 6, no statistically significant associations were found between perception of vulnerability/non-vulnerability and seropositivity for syphilis ($p = 0.06$); hepatitis ($p = 0.8$); or the presence of HBsAg ($p = 0.5$). Syphilis seroprevalence was actually higher among volunteers perceiving themselves as 'non-vulnerable', although this difference was not statistically significant.

Discussion

In this study we present sociodemographic and behavioural profiles, as well as data relating to knowledge of/attitudes towards HIV/AIDS, from 295 HIV-negative volunteers taking part in the first cohort study on incidence of HIV infection in MSM in Brazil, at the Rio de Janeiro HIV Vaccine Centre. We also analyze the relationship between perception of vulnerability to HIV infection and other sociodemographic, behavioural and laboratory variables in the study population.

The sociodemographic characteristics of our sample are comparable to those from

another study on MSM in Rio de Janeiro (Parker *et al.*, 1998). Educational attainment and salary levels were somewhat higher in our sample than those of the general population. A significant proportion of the sample here analyzed were involved in NGOs and/or recruited through cohort participants, which in a country with profound social inequalities could be interpreted as belonging to more 'conscious' social strata, with an associated tendency towards higher educational levels/higher professional status (FIBGE 9, 1991; Suttmoller *et al.*, 1997). The proportion of MSM defining themselves as bisexual was higher in our sample than in studies carried out by Parker *et al.* (1998), where, in 1995, 73% of MSM perceived themselves as homosexual/gay. However, in our study, we found that most MSM defining themselves as bisexuals had actually engaged very infrequently in sexual intercourse with women. The latter issue, however, merits further consideration, given the recent dramatic increase in the number of women infected with HIV through heterosexual intercourse in Brazil, many of whom report having had bisexual male partners (Bastos *et al.*, 1995).

Our results indicate that knowledge regarding HIV transmission and prevention was generally adequate in our sample, as was also found in the study by Parker *et al.* (1998). Most (76%) of the volunteers reported having changed their behaviour as a consequence of the AIDS epidemic; these changes included: reduction in the number of sexual partners, more careful choice of sexual partners, more frequent use of condoms, and lower frequencies of penetrative anal intercourse. Despite this, unprotected anal sex with both principal and casual partners remained a common practice (almost one-quarter of the sample under analysis reported unprotected anal intercourse in the six months prior to interview), suggesting that preventive attitudes are probably not being consistently acted out as safer behaviours. MSM from other countries also report relatively high levels of risky behaviour: over 50% of a sample of 250 MSM in San Francisco reported having unprotected anal intercourse in the last six months (Peterson *et al.*, 1992); these men were more likely to be poor and to have a higher perceived risk vis-à-vis HIV infection. In New York, 48.7% of a sample of 698 MSM reported receptive anal sex in the last three months, with 34% of these acts unprotected or with condom breakage or slippage (Koblin *et al.*, 1997).

Of particular note in our study is the high frequency of reported unprotected anal sex with casual partners (22% of the sample), and the fact that the proportion of the cohort reporting this behaviour is very similar to that reporting unprotected anal sex with principal partners (23%). This differs from results from studies in other countries, which tend to show that the usual intimacy of stable relationships, with their atmosphere (accurate or not) of mutual trust, is one of the privileged contexts for unprotected anal intercourse. Data from two cohort studies of MSM in Canada (Vancouver and Montreal) show that approximately 26% of cohort members engage in unprotected sex with principal partners, in contrast to only 9–14% who engage in unprotected anal sex with casual partners (Dufour *et al.*, 1997; Strathdee *et al.*, 1997).

Such findings may be a reflection of differences in the definition of what constitutes a safe as opposed to a risky sexual relationship for MSM in different contexts. It would seem a very common practice for MSM to be aware of their serostatus in some countries: for instance, 87% of MSM enrolling in a cohort study in Montreal had already been tested for HIV at least once (Turmel *et al.*, 1997). Similar figures were found by Koblin *et al.* (1997), with 84% of volunteers of Project ACHIEVE, in New York City, reporting having been previously tested for HIV. The figure for the members of the Rio cohort previously tested was much lower, at 45.4%.

HIV testing in Rio de Janeiro, although available at no cost in public facilities, is performed with significant delay. This probably explains the fact that the most frequent reason given by volunteers for participation in the *Projeto Rio* cohort was the desire to have

a reliable and rapid HIV test result. It is also noteworthy that the prevalence of HIV in initial volunteers (i.e. before exclusion of seropositive individuals from the cohort study) was 24% in Rio, despite the fact that the cohort recruitment material stated that only seronegative MSM or MSM with unknown serostatus should consider participation. This contrasts with baseline HIV prevalences of less than 2% in the two cohorts cited above (Dufour *et al.*, 1997; Strathdee *et al.*, 1997), suggesting that large numbers of MSM in Rio are unaware of their serostatus, although many of them perceive themselves as being at risk of infection.

Among the 72 subjects perceiving themselves as being 'not vulnerable to HIV infection', the main reason given was the regular use of condoms. Participants who perceived themselves as being at risk tended more frequently to have practised unprotected anal sex both with their principal and casual partners in the six months prior to interview, and to have had casual sex partners more frequently.

The observed association between the reporting of recent risky sexual practices and perception of vulnerability is encouraging, since it may represent a first step towards behaviour change. Indeed, some of the more influential models of behaviour change, such as the Health Belief Model (Becker, 1974) and the ARRM (AIDS Risk Reduction Model; Catania *et al.*, 1990), highlight 'perceived personal susceptibility' as one of their core components. Relatively high frequencies of risky behaviour were nevertheless reported by cohort members in this study, suggesting, as found in many other studies, that knowledge does not necessarily translate into safer practices (Perkins *et al.*, 1993; Valdisserri *et al.*, 1988). Barriers to behavioural change identified in such studies include difficulties in using condoms in challenging situations, for example where a high degree of affective bonding and/or sexual attraction exists, as well as factors such as lack of social support (Dilley *et al.*, 1998).

The lack of observed association between serological markers of recent and past STD infection and perception of vulnerability may also reflect that fact that cohort members who perceive themselves as non-vulnerable do not in fact consistently practise safe sex. Alternatively, this may be a function of the cross-sectional design of the present study (Gerrard *et al.*, 1996). While acute hepatitis B infection may be a relatively good surrogate marker of recent exposure to infectious agents through unprotected sexual intercourse (particularly since the use of illicit drugs is exceptional in our cohort), the small number of cohort members positive for HbsAg (only five), and the resultant lack of statistical power, may account for the lack of association observed between this marker and perception of vulnerability to HIV infection.

We found that interviewees with higher levels of formal education more frequently perceived themselves as being vulnerable to HIV infection. Although people with lower educational attainment seem to be, in fact, less empowered to face the HIV/AIDS challenge (Mann *et al.*, 1992), the general level of information in the sample is good, with no meaningful differences among volunteers with different socio-economic backgrounds. Other factors such as denial of risk, or the relationship between specific information on HIV/AIDS and broader attitudes and beliefs, could explain the differences observed.

In a community survey carried out in São Paulo, in 1993–95 (De Franco *et al.*, 1998), a sub-group of MSM, composed of younger and less educated men, belonging to the lower social strata, reported higher levels of risk behaviour. The same men perceived themselves as being at less risk of HIV infection, reported more difficulties in negotiating and enacting safer sex, and were less integrated in the gay community, as well as being out of reach of most prevention programmes.

Finally, we would like to register here that ten subjects from the sample under analysis seroconverted between February 1996 and October 1998, among these being six who considered themselves as vulnerable to HIV infection, three as non-vulnerable, and one with no response.

In conclusion, although the data presented in this paper demonstrate that the HIV-negative participants of the Rio de Janeiro MSM cohort had good levels of knowledge regarding HIV transmission, in addition to a high rate of reported behavioural change as a result of the AIDS epidemic, it would appear that a gap continues to exist between knowledge and action, in the sense that relatively high proportions of interviewees continued to engage in risky sexual behaviours. The association between perception of vulnerability/invulnerability to HIV infection and risky/safe sexual behaviours is encouraging, but whether this perception has already or could in the future translate into actual behavioural change and effective risk reduction is as yet unclear.

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