

Correlates of Unprotected Anal Sex at Last Sexual Episode: Analysis from a Surveillance Study of Men who have Sex with Men in Montreal

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Abstract Recent increases in rates of unprotected anal sex (UAS) among men who have sex with men (MSM) signal the need to continually refine our understanding of factors associated with risky sexual behavior. Data were collected using a questionnaire eliciting information about the last sexual episode (LSE) with another man in the past 6 months. Logistic regression was used to identify both event-level and background correlates of UAS at LSE. 965 participants who reported having sex with a partner with whom they were not in a couple relationship at LSE were studied. Several event-level variables were significantly associated with UAS after adjusting for background factors, including finding the partner at LSE sexually attractive and using alcohol or cocaine at LSE. Our findings parallel the results of other HIV prevention studies which have highlighted the importance of interpersonal factors

that influence risk-taking at the moment of a sexual act among MSM.

Keywords HIV · Men who have sex with men · Event-level analysis

Introduction

Men who have sex with men (MSM) continue to be disproportionately affected by the human immunodeficiency virus (HIV) in Canada, accounting for 51% of estimated prevalent infections and 45% of estimated incident infections in 2005 [1]. Moreover, estimates from the Public Health Agency of Canada, the Vancouver Vanguard Project, and analyses of the Ontario provincial HIV testing

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data indicate an increase in the incidence of HIV among Canadian MSM from 1996 to 2007 [1–3]. Unprotected anal sex (UAS) has been established as the main source of HIV transmission among MSM [4]. From 1997 to 2002, the proportion of participants in a study of San Francisco MSM who reported UAS with a serodiscordant partner in the previous 12 months increased from 18.9 to 26.8% [5]. A similar, statistically significant increase in UAS with any partner other than a regular, seroconcordant partner in the previous 6 months was found in the Montréal OMEGA study: from 15.7% in 1997 to 18.8% in 2003 [6]. As observed by several other studies conducted internationally among MSM in the late 1990s, these increases may be part of a larger trend toward higher rates of risky sexual behaviour [7, 8].

Numerous and conceptually diverse correlates of UAS among MSM have been studied. Some of these factors are well established (e.g., partner serostatus [9–11] and number of sex partners [10, 12]), while others have been inconsistent in their association with UAS (e.g., anxiety and depression [13, 14]). Recent shifts in the socio-cultural norms of MSM, such as the emergence of a barebacking identity [15], have suggested the need to explore novel factors. One such example is partner attractiveness, which has been hypothesized in at least two studies as a correlate of UAS or intention to engage in UAS [16, 17]. These risk factors have been studied predominantly using questionnaires that elicit information about behaviors during the previous 6 months. This approach, however, may have limited precision and specificity when examining risky behaviors [18]. For example, questions about condom use during the previous 6 months represent an approximate and summative measure of this behavior; these measures also often lack a consideration of situational circumstances.

Event-level analyses offer several advantages in the collection of information on risk factors for HIV infection. These methods have been used extensively by researchers examining the link between risky sexual behaviors and alcohol use [19]. More recently, the methodology has been used in HIV prevention research among MSM [16, 20–26]. Studies that have focused on the circumstances surrounding risky sexual acts highlight the importance of contextual correlates. For example, partner characteristics, such as the duration of relationship with a sex partner [22] have been implicated as risk factors for UAS. However, the reported effects for some of these contextual factors have been inconsistent (e.g., disclosure of HIV serostatus [20, 27] and most notably, substance use, which has been studied extensively producing results that vary by population, study methodology, and variable definition [16, 20, 23, 25, 26]).

In this study, we sought to describe characteristics of the last sexual episode (LSE) reported by MSM who

participated in a survey in Montréal, Canada. We evaluated the relationship between UAS at the LSE and various event-level and background (non-event-level) factors, restricting our analyses to self-reported HIV-negative or HIV status-unknown men who had sex with a non-couple partner at the LSE.

Methods

Design

The data used in this study were collected within ARGUS [28], a second generation surveillance project [29]—conducted as part of the Canadian M-Track Survey [30]—which monitors trends in HIV, sexually transmitted infections (STIs), and associated risk behaviors among MSM living in Montréal. The first cycle was completed from January to August 2005. Study participants were recruited using modified time-location sampling; while recruitment sessions varied in timing and type of social space, the sessions were not randomly selected [31]. Participants were invited to complete a self-administered, anonymous questionnaire and provide a blood sample by finger prick for various serologic tests, including HIV.

Participants

HIV-negative and positive men aged at least 18 years, residing in Montréal, able to speak and read French or English, and who reported ever having had sex with another man were eligible to participate. For the purposes of the analysis reported here, the population was restricted to self-reported HIV-negative or HIV status-unknown men. This was done because HIV-positive MSM are known to have distinct sets of risk factors for UAS as compared with HIV-negative MSM [32, 33]. Initial analyses compared men who had sex with a non-couple partner at LSE (i.e., a partner with whom they were not in a couple relationship) to men who had sex with a couple partner at LSE. Subsequently, detailed analyses were restricted, however, to those who had sex with a non-couple partner at LSE. This restriction was used because the factors that influence condom use during sexual activity with primary or steady partners differ from those that influence sex with casual partners [34, 35].

Measures

A questionnaire was developed by a working group that included members with expertise in MSM research and HIV prevention. Where possible, questions were selected from instruments that had been tested elsewhere, including,

in particular, questionnaires from the Omega Cohort Study [12]. Behavioral measures were included based on key indicators suggested by UNAIDS and the USAID MEASURE (Monitoring and Evaluation to Assess and Use Results) project [29, 36]. The event-level sexual risk section of the questionnaire was inspired by other studies where this was a focus [16, 37, 38]. Recommendations from a US Centers for Disease Control and Prevention (CDC) working group on core items to be included in HIV/STI behavioral surveillance systems were also used to guide question selection [18]. Face validity of the instrument was confirmed by conducting a pilot study with 10 subjects from a convenience sample drawn from the target population. A feasibility study (50 participants recruited from 5 different venues: bar, café, sauna, discothèque, and community event) was then used to further fine-tune the lay-out and wording of the questionnaire to ensure comprehension.

Questions were organized into the following sections: personal and social background; alcohol and drug use; sexual behaviors with different types of partners; sex in exchange for money, drugs, or other goods and services; health care, HIV, hepatitis, and other STIs; opinions and knowledge on HIV and STIs; and questions specific to the LSE. An LSE was defined as the last time the respondent had oral or anal sex with a man in the previous 6 months, where there was no exchange of money, drugs, goods, or services, nor any group sex (sex with more than one person at a time).

The primary variable of interest in our study was having unprotected (i.e., without a condom) receptive or insertive anal sex at the LSE. “Event-level” variables were defined as contextual factors that were unique to the LSE (e.g., HIV serostatus of partner, location of LSE, substance use, emotional state at time of episode, etc.). Conversely, “background” variables (e.g., age, ethnocultural group, diverse beliefs toward HIV infection, etc.) were defined as the various characteristics and experiences the participant brought to the LSE, which were not specific to that particular event. Partners with positive or unknown HIV status were defined as “discordant,” and those with negative HIV status were defined as “concordant.”

Participants were asked to describe the sex partner at their last sexual episode as: “a man with whom you are in a couple” (hereafter referred to as “couple partner”), “a man with whom you already had sex a few times” (hereafter referred to as “fuckfriend”), “a man with whom you had sex for the first time who you already knew” (hereafter referred to as “acquaintance”), or “a man with whom you had sex for the first time who you didn’t already know” (hereafter referred to as “one-night stand”). The latter three were considered “non-couple” partners for the purposes of analysis. The emotional state was measured by four

questions concerning how the participant felt at the time of the LSE: (1) “Were you dealing with an emotional crisis (e.g., break-up or loss of job)?”; (2) “Were you feeling depressed, down, or having the blues?”; (3) “Were you feeling unhappy or unsatisfied with life?”; and (4) “Were you feeling stressed, preoccupied, or tense?” A total of four HIV perception variables were also considered: “HIV/AIDS has become a controllable disease (like diabetes).”; “An HIV-positive man who is taking anti-HIV medications is less likely to transmit HIV.”; “I am less concerned about getting HIV now that better anti-HIV medications are available.”; and, “I am tired of always monitoring my sexual behaviour.”

Both continuous and dichotomized forms of continuous variables were considered in the analysis. Where the effect was similar to that of the continuous-form variable, the dichotomized version was used for simplicity of analysis and interpretation. Variables with ordinal response options (e.g., proportion of friends who were gay men) were dichotomized at the mid-point of the scale (i.e., half or more versus less than half using the response scale options: “none; less than half; half; most; all”). Similarly, responses for the variables on HIV perceptions (e.g., “HIV/AIDS has become a controllable disease [like diabetes]”) were dichotomized as agree moderately to very much versus agree a little or not at all. This cut-off was chosen because these beliefs are evolving phenomena for which we wanted to measure a committed opinion; agreeing “a little” with these statements was regarded as noncommittal. The HIV perception variables were individual question items on various attitudes regarding HIV infection. They were not components of an a priori-defined scale, nor were they validated using exploratory factor analyses.

Data Analyses

Comparisons between strata were examined using a two-sided *t*-test for independent samples for means and a chi-square test for proportions. Univariate logistic regression was used to identify event-level and background factors associated with UAS at LSE. Variables were included in a multivariate model if they were significant at alpha level 0.10 in univariate analyses. The most parsimonious model was chosen by sequentially removing variables and examining the change in the likelihood ratio of the resulting model using the purposeful selection of covariates modeling approach [39]. Age is known a priori to be an important factor and was therefore included in all models [40]. Partner type and HIV status of the partner (concordant versus discordant) were also included in all models because of the particular focus on partner attributes in this analysis. Event-level variables were given priority over non-event-level (background) variables in model selection where the

latter were known to measure the same construct (e.g., drug use at LSE versus drug use during sex during the previous 6 months) suggesting redundancy. Interactions of the selected variables with type and HIV status of partners, and age were also examined. All statistical analyses were performed using SPSS 12.0.2 for Windows.

Results

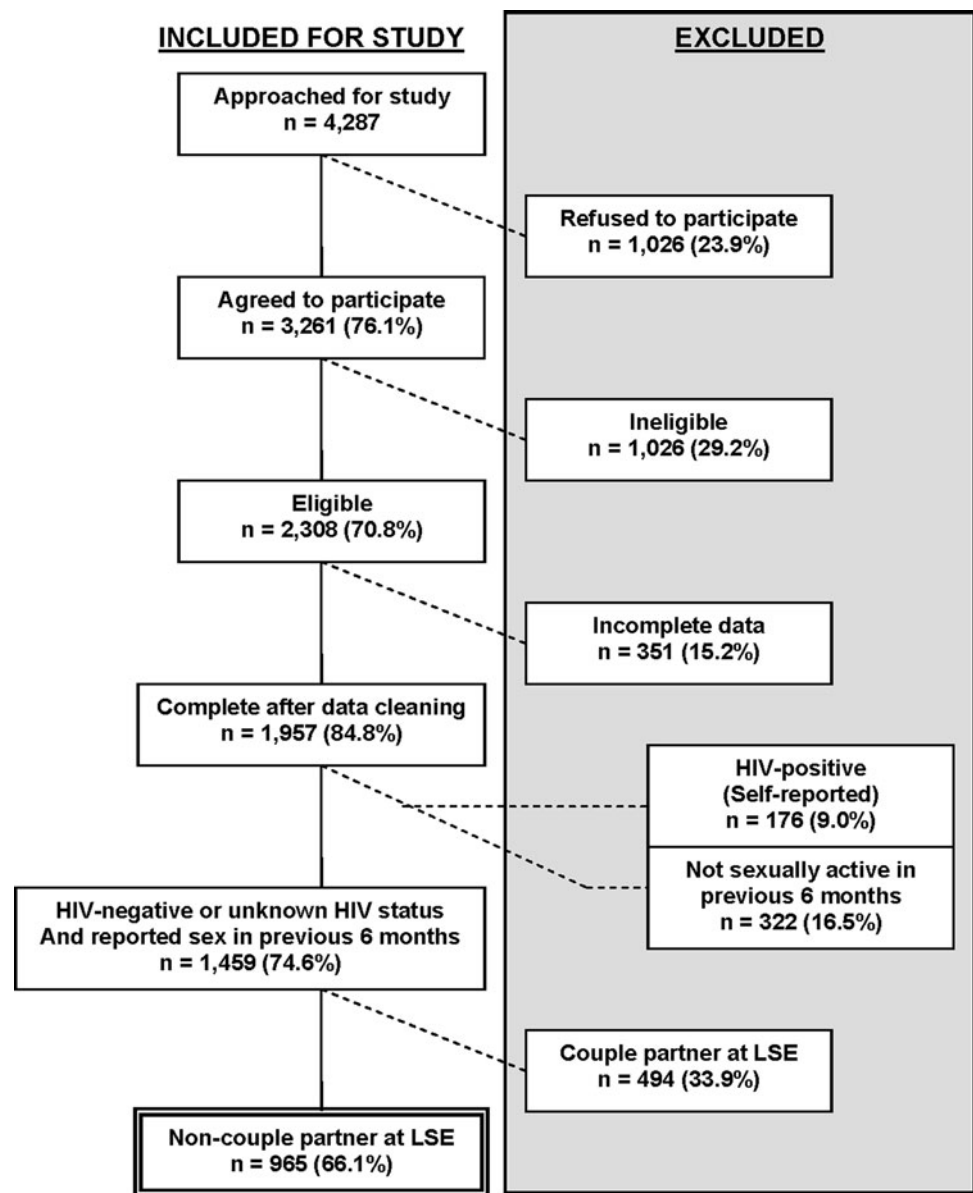
Of 4,287 men who were approached, 3,261 (76.1%) agreed to participate. Two thousand three hundred and eight (70.8%) were eligible, and 1,957 questionnaires were ultimately available for analysis. The reduction in the number of eligible participants was due primarily to the

large number of non-residents of Montreal. A flow chart illustrating the study population used for analysis is shown in Fig. 1. The majority (54%) of participants were recruited from a bar, discothèque, or gay strip club; the remainder were recruited from a café (12%), sauna (10%), community association (3%), event (3%), or fixed site (i.e., site available one night per week for participants who became aware of the study through the internet/e-mail invitations and for men walking through the city’s gay village; 18%).

Comparisons of Event-Level Characteristics by Partner Type

Among the 1,459 participants who reported being HIV-negative or having unknown HIV status, 34% had a partner

Fig. 1 Flow chart showing recruitment and participation in present analysis of ARGUS study



at LSE who was described as “a man with whom you are in a couple” (or, “couple partner”), while 23% described their partner as a “fuckfriend”, 12% as an “acquaintance”, and 31% as a “one-night stand”. Comparisons of event-level characteristics between the couple and all non-couple partner types revealed statistically significant differences with respect to most of the examined variables (Table 1). Notably, participants who had sex with a couple partner at LSE were, less likely to use alcohol (39 vs. 50%) or drugs (15 vs. 27%), more likely to know their partners’ HIV status (85 vs. 42%), and more likely to report anal sex (58 vs. 43%) and UAS (34 vs. 12%).

Comparisons between participants who had sex with different non-couple partner types are also presented in Table 1. Those who had one-night stands were even less likely to know their partners’ HIV status (21%) as compared to those who had sex with an acquaintance (56%) or fuckfriend (64%). The location of the LSE also varied widely between non-couple partner types; 49% of those who had one-night stands had sex in a public or

commercial space, while only 17% of those with an acquaintance partner and 14% of those with a fuckfriend partner had sex in these environments. Alcohol and drug use during LSE, however, did not differ substantially by non-couple partner type.

Demographic Characteristics of Participants Who Had Sex With a Non-Couple Partner

Nine hundred and sixty-five participants reported having sex with a non-couple partner at LSE. Seventy-one percent of these participants reported some level of education beyond high school, of which 81% completed college (“cégep” in Québec) or university and 19% completed postgraduate studies. Forty-seven percent earned a personal income of less than \$30,000 per year, and 11% earned \$60,000 per year or more. Participants predominantly described their sexual orientation as gay (81%) or bisexual (18%), with 1% identifying as heterosexual. The vast majority (86%) were single, while 4% were married to or

Table 1 Comparison of characteristics and sexual activities of self-reported HIV-negative or HIV status-unknown participants by male partner type at last sexual episode (LSE)

Characteristic or activity	Couple ¹ (<i>n</i> = 494) mean or %	All non-couple ² (<i>n</i> = 965) mean or %	Non-couple partner types ^a		
			Fuckfriend (<i>n</i> = 337) mean or %	Acquaintance (<i>n</i> = 172) mean or %	One-night stand (<i>n</i> = 456) mean or %
Age difference (participant minus partner)**	+0.6 years	+4.4 years	+5.2 years	+3.6 years	+4.0 years
Duration of sexual relationship with partner at LSE: 1 month or more**	80.3	26.4	73.1	0.0 ^a	0.0 ^a
Partner described as very or extremely sexually attractive**	79.7	52.5	58.0	54.7	47.5
Strong or very strong interest in emotional relationship with partner**	83.2	20.9	32.7	27.1	9.5
Partner’s HIV status unknown**	15.1	57.8	35.6	44.3	79.1
Location of LSE: public or commercial space**	2.7	30.7	14.4	16.9	48.6
Alcohol use 2 h before or during LSE**	39.4	49.8	48.4	55.8	48.6
Drug use 2 h before or during LSE**	14.6	27.3	29.6	27.3	25.5
Receptive oral sex	87.7	86.9	86.6	86.0	87.3
Insertive oral sex*	86.6	81.8	83.6	83.1	79.7
Rimming	41.6	39.4	46.4	33.7	36.2
Fisting*	6.8	10.2	12.3	11.0	8.3
Receptive anal sex only**	17.1	15.6	17.8	15.2	14.0
Insertive anal sex only**	22.4	17.3	17.8	11.0	19.3
Both receptive and insertive anal sex**	18.2	10.2	14.1	11.0	7.1
Receptive or insertive anal sex	57.7	43.1	49.7	37.3	40.4
Unprotected anal sex**	33.5	12.2	14.0	14.3	10.0

Note: Chi-square tests performed for all variables compared those with couple-partners¹ (column 1) to those with non-couple partners² (column 2)

Significance illustrated as follows: * $p < 0.05$; ** $p < 0.01$

^a As defined by these partner definitions presented in the study questionnaire

in a common-law relationship with a man, 2% were married to or in a common-law relationship with a woman, 3% were divorced from or widowed by a woman, and 2% were divorced from or widowed by a man. The ethnic, family, or cultural groups with which the participants most identified were: French Canadian (71%), English Canadian (8%), various European identifications (7%), Latino American (4%), Asian (2%), Caribbean (1.4%), and Sub-Sahara African (0.3%). Of those born outside Canada, 5.9% were born in the Caribbean or in Sub-Saharan Africa.

Correlates of Unprotected Anal Sex at LSE With a Non-Couple Partner

A total of 12.2% participants had UAS at LSE with a non-couple male partner. Univariate associations of the examined variables with UAS at LSE are shown in Table 2. Several background factors were significantly associated with UAS at LSE. The following event-level factors were additionally associated with UAS at LSE: length of sexual relationship with the LSE partner, interest in developing a relationship with the LSE partner, sexual attraction to the LSE partner, alcohol use at LSE, and cocaine use at LSE. Other drug use at LSE was examined—individually by substance (including cannabis, poppers, ecstasy, crystal methamphetamines, etc.); however, none was associated with UAS. The multivariate model is presented in Table 3. The following background factors remained significantly associated with UAS in the multivariate model: being part of a couple with a man, agreement with the statement, “An HIV-positive man taking medications is less likely to transmit HIV,” and history of an STI diagnosis. Several event-level variables were additionally important in the multivariate model, including finding the partner at LSE sexually attractive and using alcohol or cocaine at LSE. Having an interest in developing a relationship with the sexual partner was also associated in the multivariate models; however, this variable was highly correlated with finding the partner sexually attractive, thus, only one variable was included in the model at a time.

Discussion

In this study, we examined the associations of background and event-level factors with sexual behavior. A variety of factors from both of these sets remained associated with UAS.

Background Factors

In our analysis of HIV seronegative men who had sex with a non-couple male partner at LSE, being in a couple with a

man was one of the strongest correlates of having UAS at the LSE. Therefore, there is a particular need to identify high risk scenarios in which men otherwise considered low risk because of their relationship status may still be at risk because of unprotected sex outside the couple.

Participants who agreed that an HIV-positive man taking medications is less likely to transmit HIV were also more likely to engage in UAS at LSE. However, agreement with two related belief statements—“I am less concerned about getting HIV now that better anti-HIV medications are available” and “HIV/AIDS has become a controllable disease (like diabetes)” —were not independently associated with UAS. This finding that beliefs related to viral transmission may be more strongly associated with risky sexual behavior than beliefs related to severity of disease is not surprising considering other research among MSM that has highlighted the importance of beliefs around HIV transmissibility [9, 41].

History of an STI diagnosis also remained significantly associated with UAS at LSE in the final multivariate model of our analysis. Forty-three percent of participants reported having been diagnosed with an STI at some point in their lifetimes. The most commonly reported STIs were gonorrhea (23% of participants), genital warts/human papilloma virus (18%), and chlamydia (10%). We believe that this variable represented a surrogate marker for a history of risky sexual behaviour and is thus not unexpectedly associated with UAS at LSE.

Interestingly, the number of male sex partners (oral or anal sex) in the previous 6 months was not associated with UAS at LSE. Since our study sample included men who did not have anal sex in the last 6 months, we did not evaluate a relationship between the number of anal sex partners in the previous 6 months and UAS at LSE within the whole sample. When we restricted the data set to only those who had anal sex during the last 6 months, we observed no relationship between number of anal sex partners during the last 6 months and UAS at LSE (data not shown). This observation suggests that the number of partners, despite possibly being linked to an increased probability of having sex with an infected partner or to an increase in the number of sexual acts, is not necessarily associated with a decrease in condom use per sexual activity.

Event-Level Factors

Finding the partner to be very or extremely sexually attractive was associated with a greater likelihood of engaging in unprotected anal sex. This underscores the important role that interpersonal factors play in sexual risk-taking among MSM and reinforces the utility of event-level analyses. The impact of partner attractiveness on sexual

Table 2 Frequency distribution of characteristics and univariate correlates of unprotected anal sex at last sexual episode (LSE) among self-reported HIV-negative or HIV status-unknown participants with a non-couple male partner at LSE ($n = 947$)

Variable	Frequency distribution of characteristics % or Mean	Univariate correlates of unprotected anal sex at LSE	
		OR	95% CI
<i>Background</i>			
Age, years	38.7	0.99	(0.98–1.01)
Born outside of Quebec	23.3%	1.15	(0.73–1.81)
Ethno-cultural identification			
French Canadian	70.8%	REFERENT	
English Canadian	8.0%	1.43	(0.74–2.77)
Various European identifications	7.0%	0.60	(0.23–1.53)
Latino American	4.0%	1.58	(0.74–3.38)
Caribbean and sub-saharan Africa	1.7%	1.36	(0.55–3.36)
Other	8.5%	0.66	(0.29–1.47)
Education beyond high school	71.1%	0.98	(0.64–1.52)
Gross annual income of \$30,000 CAD or more	53.0%	1.00	(0.65–1.54)
Reported sexual orientation as bisexual or heterosexual	18.6%	0.86	(0.51–1.45)
More than half of friends are gay men	75.7%	1.84	(1.09–3.13)*
Part of a couple with a man at time of completing questionnaire	8.0%	3.35	(1.93–5.83)**
Number of male partners for oral or anal sex in the last 6 months			
1	14.0%	REFERENT	
2–5	37.9%	0.83	(0.45–1.52)
6–9	16.7%	0.71	(0.34–1.48)
10–19	14.6%	1.08	(0.54–2.18)
20+	16.7%	1.27	(0.65–2.47)
Received money, drugs, goods, or services in exchange for sex in the last 6 months	11.3%	1.44	(0.84–2.46)
Gave money, drugs, goods, or services in exchange for sex in the last 6 months	14.0%	2.14	(1.31–3.51)*
Feels satisfied with sex life ^a	69.3%	1.50	(0.95–2.37)*
Feels satisfied with social life ^a	80.0%	1.00	(0.61–1.63)
Agrees with the statement: “I am tired of having to always monitor my sexual behavior” ^a	30.9%	1.70	(1.14–2.54)*
Agrees with the statement: “An HIV-positive man taking medications is less likely to transmit HIV.” ^a	8.2%	2.08	(1.15–3.76)*
Agrees with the statement: “HIV/AIDS has become a controllable disease [like diabetes]” ^a	17.4%	0.76	(0.44–1.33)
Agrees with the statement: “I am less concerned about getting HIV now that better anti-HIV medications are available” ^a	9.9%	1.36	(0.74–2.50)
Ever diagnosed with a sexually transmitted infection (gonorrhea, chlamydia, syphilis, genital warts, genital herpes, hepatitis A or B)	43.3%	1.61	(1.08–2.40)*
<i>Event-level</i>			
Type of non-couple partner at LSE			
Fuckfriend	35.9%	REFERENT	
Acquaintance	18.4%	1.02	(0.60–1.74)
One-night stand	45.7%	0.69	(0.44–1.06)
In sexual relationship with partner at LSE for at least one month	12.2%	1.54	(1.04–2.28)*

Table 2 continued

Variable	Frequency distribution of characteristics % or Mean	Univariate correlates of unprotected anal sex at LSE	
		OR	95% CI
HIV status of partner at LSE			
HIV-negative (concordant)	36.8%	REFERENT	
HIV-positive and unknown (discordant)	63.2%	0.90	(0.60–1.35)
Strong interest in developing or maintaining an emotional relationship with partner	20.9%	2.04	(1.32–3.13)*
Found partner to be very or extremely sexually attractive	52.2%	1.78	(1.18–2.68)*
Feeling unsatisfied, unhappy with life at time of LSE ^a	28.0%	1.18	(0.76–1.82)
Dealing with an emotional crisis (break up, lost of job) at time of LSE ^a	8.5%	0.87	(0.39–1.79)
Feeling depressed, down, having the blues at time of LSE ^a	7.1%	1.39	(0.69–2.83)
Feeling stressed, preoccupied, tense at time of LSE ^a	13.5%	0.89	(0.48–1.64)
Five or more alcoholic drinks at LSE ^b	19.4%	1.78	(1.13–2.80)*
Drug use at LSE			
No drug use	72.7%	REFERENT	
Other drug use than cocaine	21.3%	1.76	(1.10–2.80)
Cocaine use with or without other drug	6.0%	3.01	(1.65–5.49)*
Location of LSE			
Home or partner's home (reference: any other location)	64.5%	1.51	(0.97–2.33)
Hotel or motel (reference: any other location)	5.0%	1.09	(0.45–2.62)
Bathhouse (reference: any other location)	24.4%	0.69	(0.42–1.13)
Public place (reference: any other location)	6.1%	0.54	(0.19–1.52)

Note: OR odds ratio, CI confidence interval

* $p < 0.05$; ** $p < 0.01$

^a Variable dichotomized to include those who moderately or very much agree

^b The number of alcoholic drinks reported at the LSE was dichotomized as less than five and five or more, based on recommendations of the World Health Organization for the measurement of alcohol consumption and related harm (Department of Mental Health and Substance Dependence, 2000)

decision-making has been demonstrated by qualitative research conducted with MSM [42].

Fifty-eight percent of the participants who had sex with a non-couple partner were unaware of their partner's HIV status (79.1% for those who reported a "one-night stand"). Furthermore, compared to sexual partners representing a low risk (HIV-negative; i.e., concordant HIV status), subjects in the study who reported LSE with an at-risk partner (HIV status unknown or HIV-positive; i.e., discordant HIV status) were not more likely to protect themselves, i.e. less likely to have UAS. This finding—within a population of HIV-negative MSM—is in contrast to research conducted among the larger MSM community which suggests that MSM may increasingly be using serosorting as a risk reduction strategy. That is, by choosing similar HIV-status sexual partners, men are able to reduce the risk of HIV infection [43–45].

As demonstrated in Table 1, different gradients of sexual risk-taking were observed according to partner type.

Participants who had sex with a couple partner were more than twice as likely to have UAS than those who had sex with a fuckfriend or an acquaintance, who were in turn more likely to have UAS than those who had a one-night stand. Likewise, those who knew their partner for less than a month were less likely to engage in risky behavior. Thus, it seems that intimacy, commitment, and duration of relationships all have a strong influence on sexual behaviors during a particular event. The type of non-couple partner, however, did not play a role in UAS with non-couple partners at LSE after controlling for other factors.

In evaluating the circumstances of sexual episodes, we considered variables related to substance use, location of sexual activities, and emotional state. Alcohol and cocaine use at the time of LSE were associated with UAS in the multivariate model. Several authors have noted an event-level relationship between substance use and UAS [16, 20, 24, 46]. Indeed, Vanable et al. [26] observed this relationship only for those who had sex with non-primary

Table 3 Multivariate correlates of unprotected anal sex at last sexual episode (LSE) among self-reported HIV-negative or HIV status-unknown participants with a non-couple male partner ($n = 908$)

Variable	OR	95% CI
<i>Background</i>		
Part of a couple with a man at time of completing questionnaire	3.99	(2.18–7.31)**
Agrees with the statement: “An HIV-positive man taking medications is less likely to transmit HIV” ^a	3.06	(1.54–6.07)*
Ever diagnosed with a sexually transmitted infection (gonorrhea, chlamydia, syphilis, genital warts, genital herpes, hepatitis A or B)	1.72	(1.09–2.72)*
<i>Event-level</i>		
Found partner to be very or extremely sexually attractive	1.88	(1.19–2.99)*
Five or more alcoholic drinks at LSE ^b	1.78	(1.06–3.00)*
Drug use at LSE		
No drug use	REFERENT	
Other drug use than cocaine	1.38	(0.82–2.35)
Cocaine use with or without other drug	2.49	(1.23–5.04)*

Note: The model was adjusted for (1) age, (2) type of non-couple male sexual partner at LSE (fuckfriend, acquaintance or one-night stand), and (3) HIV status of partner at LSE (concordant versus discordant)

OR odds ratio, CI confidence interval

* $p < 0.05$; ** $p < 0.01$

^a Variable dichotomized to include those who moderately or very much agree

^b The number of alcoholic drinks reported at the LSE was dichotomized as less than five and five or more, based on recommendations of the World Health Organization for the measurement of alcohol consumption and related harm (Department of Mental Health and Substance Dependence, 2000)

partners. In our study, multiple drugs (including marijuana, ecstasy, poppers, ketamine, crystal methamphetamine, GHB, and Viagra) were considered individually and in categories, but only cocaine use at LSE was associated with UAS. This contrasts with some previous studies that have found other drugs, notably crystal methamphetamine use, to have the strongest relationship with risky sexual behavior [20]. This discrepancy may be explained by differences in statistical power; the less prevalent use of crystal methamphetamine in our population (only 0.5% had used crystal methamphetamine during sex in the past six months) may have precluded us from detecting this association. The greater use of cocaine in Montreal may also explain these findings. Indeed, approximately 22% of MSM in the ARGUS study reported snorting cocaine at least once in the previous 6 months, and 6% of men reported using cocaine during their LSE. These indicators should be carefully noted in light of data from other studies which have shown a recent increase in cocaine use among Montreal MSM; Otis et al. [47] found that the proportion of Montreal MSM reporting any cocaine use in the previous 6 months increased from 9.7% in 1997 to 15.4% in 2003, a statistically significant trend. Otis et al. [47] also noted a significant association between risky anal sex and cocaine use. How this use compares to other urban environments

needs to be examined and may reflect regional drug patterns and related availability.

In exploratory analyses, we examined various reference category cut-offs for the variable, “number of alcoholic drinks at LSE.” A significant change in risk for UAS was observed between those who consumed four or fewer drinks and those who consumed five or more (data not shown). This finding supports the conventional threshold recommended by the World Health Organization as an indicator of high risk drinking [48].

In comparing several categories of location (shown in Table 2), we found no association between where the participants had sex and whether or not they had UAS. Our results parallel those of Colfax et al. [16] and Pre-stage et al. [27] who similarly found no effect of location.

None of the four variables related to emotional state was associated with UAS at LSE. Several studies have evaluated the effect of depression and negative affect on risky sexual behavior among sexually active MSM; however, these results have been inconsistent [13, 14, 49, 50]. Most of these studies have measured affect (or depression score) at the time of responding to the questionnaire and considered this in relation to sexual behavior over the previous three or 6 months. The results from our study add to this

literature by measuring emotional state at the time of the sexual event.

Event-level analysis offers the advantage of strengthening causal inference by limiting the time frame of the variables of analysis, thus increasing our confidence regarding the temporal sequence of factors as they relate to the outcome of interest. Nonetheless, it cannot guarantee that event-level factors precede the outcome of interest. This is an important limitation to inferences drawn from our analyses. Some variables—e.g., interest in an emotional relationship with the partner—may have changed after having sex, and we cannot be certain that we have measured the sentiment that preceded the sexual act.

We are similarly limited when interpreting the association between relationship status (being part of a couple) and UAS at LSE. The questionnaire elicited information about participants' relationship status at the time of completing the questionnaire, so we do not necessarily know that it is concordant with their relationship status at the time of LSE (62% of participants who had sex with a non-couple partner at LSE and who were part of a couple had been in that relationship for 6 months or longer). However, we also examined the effect of being in a relationship at least 6 months on UAS at LSE and found that the effects were similar. Furthermore, the LSE was defined as the last time the participant had sex with a man, so for those who reported being "part of a couple," it is reasonable to assume that they were in a relationship at the time of the LSE, unless they had never had sex with their primary ("couple") partner.

Numerous studies have addressed the question of whether alcohol use (and other substance use) has a true contextual effect on sexual behavior as opposed to merely being confounded by other factors such as personality characteristics [16, 19, 23]. In our study, alcohol use at LSE was correlated with alcohol use in the previous 6 months, which was also associated with UAS at LSE. Similar patterns were found for other drug use. This suggests that although event-level research improves our confidence in causal inference by ensuring that the substance use occurred within the same temporal window as the risky behavior, it does not remove the possibility that the association is explained by personality traits, such as a predisposition to risk-taking.

The data from this study were subject to the social desirability and recall biases that are common to studies which elicit information about sexual behavior; however, by asking respondents to focus on a particular occasion with a 'last episode' approach, the latter is thought to be generally limited.

In addition, it is important to note that the primary purpose of this study was surveillance; therefore, we did

not use a psychological model of behavior adoption to understand and explain reported behaviors. For similar reasons, we did not develop and test a priori—defined scales on attitudes and perceptions regarding HIV. Also, while we optimized the content validity (using focus groups and expert panels) of the questionnaire, we were unable to assess statistical psychometrics, such as criterion validity, test/retest reliability, and intraclass correlation.

Finally, we must be cautious when generalizing these results to MSM outside the scope of this study. Our results may not be representative of MSM who do not frequent gay venues or of sexual episodes involving an exchange of money, drugs, goods, or services. Also, MSM in Montreal may not be representative of MSM populations elsewhere, and HIV-positive MSM may have distinct risk factors for UAS from the HIV-negative MSM we have studied.

Our results illustrate the utility of event-level analyses in identifying contextual and interpersonal factors that influence risk-taking at the moment of a sexual act among MSM. By focusing on a specific event, they allow an examination of specific details about the sex event (e.g., location of sexual encounter), as well as the attributes of partners. Furthermore, this approach is useful from a public health perspective because results lend themselves to focused interventions [51]. In our study, the following variables were not associated with UAS at LSE: sexual orientation, ethno-cultural identification, perceived HIV severity, number of male sexual partners during the last 6 months, emotional state at LSE, type of non-couple partner, and partner's HIV status (concordant versus discordant). However, after controlling for background factors which were associated with UAS at LSE (i.e., being part of a couple with a man, the belief that HIV medications reduce HIV transmission, and history of STI diagnosis), men who used cocaine or alcohol and who regarded their partner as sexually attractive were more likely to report UAS at LSE with non-couple sexual partners, wherever they had sex. This last finding parallels the results of event-level research in other areas of HIV prevention, such as studies of injection drug users, which similarly highlight the importance of interpersonal relationships in risk-taking scenarios [52].

Future research can augment the results of this study by using event-level questionnaires that further explore the nature of interpersonal relationships with sex partners and their effect on sexual behaviors. Specific research questions arising from this study include further clarification around the disparate effects of HIV optimism-related belief statements and additional evaluation of sexual attraction to partners and its relationship with sexual risk-taking. Our research has also underscored the variation in context and behavior among sexual episodes with different non-couple partner types. Future research may expand on the results of

this study by using validated scales which measure some of the constructs discussed here, such as emotional state. Continuing to refine and update our understanding of the context of sexual risk among MSM is essential given the potential rises in the rates of UAS and HIV incidence reported by studies worldwide.

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