

Unintentional HIV exposures from young men who have sex with men who disclose being HIV-negative

[EPIDEMIOLOGY AND SOCIAL]

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The findings and conclusions in this report are those of the author(s) and do not necessarily represent the views of the Centers for Disease Control and Prevention.

Abstract

Objective: To evaluate the proportion of new sexual partners potentially exposed to HIV from young MSM who disclosed being HIV-negative.

Design: Cross-sectional, observational study of men aged 23–29 years recruited from randomly sampled MSM-identified venues in six US cities.

Methods: Participants were interviewed and tested for HIV. Analyses were restricted to MSM who reported last testing HIV-negative and having one or more new partners in the prior 6 months.

Results: Of 1701 MSM who reported a total of 11 793 new partners, 1075 (63%) disclosed being HIV-negative to 4253 (36%) new partners before having sex with them for the first time. Of disclosers, 352 (33%) reported last testing HIV-negative > 1 year before their interview and 80 (7%) tested HIV-positive (HIV-infected unaware). By race, 24% of black, 5% of Hispanic, and 3% of white disclosers tested HIV-positive. Of the 4253 new partners, 296 (7%) were partners of the 80 HIV-infected unaware MSM. By race, 22% of new partners of black, 3% of new partners of Hispanic, and 4% of new partners of white MSM, were partners of HIV-infected unaware MSM who disclosed being HIV-negative.

Conclusions: Many new sex partners may be unintentionally exposed to HIV from young MSM, particularly those who are black and who disclose being HIV-negative based on an earlier test. Young MSM

should test for HIV more frequently and consistently use condoms with all partners unless they are in a mutually monogamous relationship in which both partners have tested HIV-negative at least 3 months since their last potential HIV exposure.

Introduction

HIV-negative serosorting, defined as either choosing partners or engaging in unprotected sex with partners based on concordant HIV-negative status, has been commonly practiced by men who have sex with men (MSM) since the early 1990s [1–7]. Although choosing sexual partners who have tested HIV-negative since their last potential exposure has been estimated to be one of the most effective strategies to reduce HIV acquisition risk [8], the previous testing behavior of MSM who practice HIV-negative serosorting is unknown. Many MSM, particularly those who are young, do not test on a regular basis and many are unaware that they are HIV-infected [9–14]. Among 15–29-year-old MSM recruited in six US cities, for example, 77% of 573 HIV-infected MSM were unaware of their infection [14]. Of the HIV-infected unaware young MSM, 59% perceived themselves at low risk for being HIV-infected and 24% reported engaging in unprotected anal intercourse because they perceived themselves or their partners to be HIV-negative [14]. Thus, unintentional HIV transmission may occur from HIV-infected MSM who believe and disclose they are HIV-negative to their sexual partners.

Information on the magnitude of unintentional HIV transmission from MSM who disclose they are HIV-negative is needed for informing local, state, and national HIV testing and prevention guidelines for MSM. For example, current national guidelines recommend that at risk MSM test for HIV at least yearly [15]. However, given the high HIV incidence among MSM, particularly those who are black [16], a negative HIV test result from a year ago may no longer be accurate. Although some recent studies suggest that HIV transmission may be considerable among MSM who practice HIV-negative serosorting [6,17,18], the magnitude of new partners who might be exposed to HIV from MSM who disclose being HIV negative, or how this magnitude might vary depending on the discloser's race/ethnicity and time since last negative test, is currently unknown. Due in part to the lack of this information and on actual HIV transmission risk from MSM who disclose being HIV-negative, guidance on HIV-negative serosorting as a prevention strategy for MSM do not currently exist.

To help meet these information needs, we used data from the second phase of the Centers for Disease Control (CDC) Young Men's Survey (YMS) to evaluate the proportion of new sex partners potentially exposed to HIV from young MSM participants who disclosed being HIV-negative, and whether this proportion varied according to the discloser's race/ethnicity and time interval since last negative HIV test.

Methods

Sampling

The CDC YMS methods have been described previously [14,19]. In summary, the second phase of YMS was conducted from 1998 to 2000 and involved men who attended MSM-identified venues (e.g., clubs) in Baltimore, Maryland; Dallas, Texas; Los Angeles, California; Miami, Florida; New York, New York; and Seattle, Washington. Formative research was conducted to construct monthly sampling frames of the days, times, and venues attended by young MSM. Each month, 12 or more venues and their associated day/time periods were selected randomly and scheduled for sampling. During sampling events, men were approached consecutively to assess their survey eligibility. Men aged 23 to 29 years who resided in a locally defined area and who had never previously participated were eligible and encouraged to participate.

Participants were interviewed using a standard questionnaire, had blood drawn for HIV testing, were provided with counseling and referral for care, and were reimbursed US\$ 50 for their time. Specimens were tested at local laboratories with Food and Drug Administration (FDA)-approved assays. The YMS protocol was approved by institutional review boards at CDC and at the state and local institutions that conducted the survey.

Measures

One standard questionnaire was used in all cities to measure sociodemographic characteristics, HIV testing and disclosure practices, and sexual behaviors. We asked all participants whether they had ever previously tested for HIV. For previous testers, we asked the month, year, and result of their most recent test. Participants who reported that their last HIV test result was negative and who tested HIV-positive as part of YMS were defined as HIV-infected unaware. Sexual behaviors with men and women were measured in the 6 months preceding the survey interview. During this period, we assessed insertive and receptive oral and anal intercourse with male partners, and vaginal and anal intercourse with female partners. We also assessed use of condoms, reasons for not using condoms during anal or vaginal intercourse (if applicable), and if a condom tore or slipped off during insertive or receptive anal sex with men. For the 6-month period, we also assessed separately the number of new male and female sex partners with whom participants had oral, vaginal, or anal sex for the first time. We asked with how many of the new partners (if applicable) participants' disclosed their HIV status before having sex for the first time.

Analyses

We restricted analyses to men who reported: (1) ever having sex with another man; (2) testing negative at their last HIV test; and (3) having one or more new partners. We evaluated the number and proportion of new partners to whom participants disclosed being HIV-negative before having sex for the first time, by participants' current HIV status (based on his YMS test result), race/ethnicity, and time interval since last negative HIV test (< 6 months, 6–12 months, > 12 months). We used the *t*-test to evaluate racial/ethnic differences in the mean number of new partners and new partners to whom participants disclosed being HIV-negative. We also used logistic regression to evaluate demographic and behavioral differences between HIV-infected unaware and non-infected MSM who disclosed being HIV-negative to one or more new partners. We included in the model: city, age group, race, and all variables that were moderately associated ($P < 0.25$) with being HIV-infected unaware in our univariate chi-squared analyses. The full model was then reduced by the stepwise elimination of variables with P -values ≥ 0.05 with the exception of important confounders.

Results

Participant characteristics

In the six cities, recruiters enrolled 1701 MSM (range by city: 269–296) who reported that their last HIV test result was negative and who had one or more new partners. Of the 1701 MSM, 47% were aged 23 to 25 years, 47% were non-white, 80% received at least some post-secondary education, and 84% were employed. The 1701 MSM reported a total of 11 793 new partners (median: 3; interquartile range: 2–7). Of the 1701 MSM, 1075 (63%) reported disclosing they were HIV-negative to 4253 (36%) new partners before having sex with these partners for the first time. Of the 1075 MSM who disclosed being HIV-negative to new partners, 462 (43%) reported last testing HIV-negative < 6 months, 261 (24%) 6–12 months, and 352 (33%) > 12 months before their survey interview.

Racial/ethnic differences in new partners

White MSM reported more new partners versus black MSM [median 3, mean 8.0, standard deviation (SD) 26.2; versus median 2, mean 5.3, SD 8.4; $P < 0.01$] and more new partners to whom they disclosed being HIV-negative (median 2, mean 4.4, SD 12.1; versus median 2, mean 3.0, SD 4.0; $P < 0.05$). White MSM also reported more new partners compared with Hispanic MSM (median 3, mean 8.0, SD 26.2; versus median 3, mean 5.6, SD 8.3; $P < 0.01$), but reported a similar number of new partners to whom they disclosed being HIV-negative (median 2, mean 4.4, SD 12.1; versus median 2, mean 3.4, SD 5.0; $P = 0.07$).

Prevalence of unrecognized HIV infection

Of the 1075 MSM who reported disclosing they were HIV-negative to new partners, 80 (7%) tested HIV-positive as part of YMS. By race, the proportion who tested HIV-positive was 24% (46/190) of black, 5% (13/238) of Hispanic, and 3% (19/575) of white disclosers. By time-interval since last test, the proportion who tested HIV-positive was 6% (30/462) among men who last tested < 6 months, 7% (17/261) among men tested 6–12 months, and 9% (33/352) among men tested > 12 months before their survey interview. Of the 80 HIV-infected unaware MSM who disclosed being HIV-negative to new partners, 30 (38%) reported last testing HIV-negative < 6 months, 17 (21%) 6–12 months, and 33 (41%) > 12 months before their survey interview.

New partners potentially exposed to HIV

Of the 4253 new partners to whom participants disclosed being HIV-negative, 296 (7%) were partners of the 80 HIV-infected unaware participants. By race/ethnicity, the proportion of new partners to whom HIV-infected unaware participants disclosed being HIV-negative was 22% of black, 4% of white, and 3% of Hispanic disclosers (Table 1). By time-interval since last test, the proportion of new partners to whom the 80 HIV-infected unaware MSM disclosed being HIV-negative was 5% among disclosers who last tested < 6 months, 4% among disclosers who last tested 6–12 months, and 12% among disclosers who last tested > 12 months before their YMS interview (Table 2). Of the 296 new partners of the HIV-infected unaware disclosers, 159 (54%) were partners of those who reported last testing HIV-negative ≤ 12 months before their YMS interview (Table 2). Restricting the analysis to black disclosers, the proportion of 566 new partners to whom HIV-infected unaware MSM disclosed being HIV-negative was 17% (42/246) among black disclosers who last tested < 6 months, 14% (17/123) among black disclosers who had last tested 6–12 months, and 31% (63/197) among black disclosers who last tested > 12 months before their YMS interview.

Partner sex and participant HIV status	NSPs of black participants n (%)	NSPs of Hispanic participants n (%)	NSPs of white participants n (%)	NSPs of all participants n (%)
New male partners of:				
HIV-negative participants ^a	388 (77%)	735 (97%)	2373 (96%)	3796 (93%)
HIV-positive participants ^b	113 (23%)	24 (3%)	103 (4%)	285 (7%)
All participants ^c	501 (100%)	759 (100%)	2476 (100%)	4081 (100%)
New female partners of:				
HIV-negative participants ^a	56 (86%)	39 (97%)	62 (98%)	161 (94%)
HIV-positive participants ^b	9 (14%)	1 (3%)	1 (2%)	11 (6%)
All participants ^c	65 (100%)	40 (100%)	63 (100%)	172 (100%)
Both new male and female partners of:				
HIV-negative participants ^a	444 (78%)	774 (97%)	2435 (96%)	3957 (93%)
HIV-positive participants ^b	122 (22%)	25 (3%)	104 (4%)	296 (7%)
All participants ^c	566 (100%)	799 (100%)	2539 (100%)	4253 (100%)

^aNumber of HIV-negative participants: 144 black, 225 Hispanic, 556 white, and 995 total.
^bNumber of HIV-positive participants: 46 black, 13 Hispanic, 19 white, and 80 total.
^cNumber of all participants: 190 black, 238 Hispanic, 575 white, and 1075 total.

Table 1. Number and proportion of 4253 new sex partners (NSPs) to whom 1075 participants disclosed being HIV-negative, by partner sex and participant's current HIV status and race/ethnicity, men who have sex with men, 23–29 years of age, six US cities, 1998–2000.

Partner sex and participant HIV status	NSPs of partners tested < 6 mo. ^a n (%)	NSPs of partners tested 6–12 mo. ^a n (%)	NSPs of partners tested > 12 mo. ^a n (%)	NSPs of all participants n (%)
New male partners of:				
HIV-negative participants ^b	2033 (95%)	833 (96%)	930 (88%)	3796 (93%)
HIV-positive participants ^c	115 (5%)	38 (4%)	132 (12%)	285 (7%)
All participants ^d	2148 (100%)	871 (100%)	1062 (100%)	4081 (100%)
New female partners of:				
HIV-negative participants ^b	68 (94%)	36 (95%)	57 (92%)	161 (94%)
HIV-positive participants ^c	4 (6%)	2 (5%)	5 (8%)	11 (6%)
All participants ^d	72 (100%)	38 (100%)	62 (100%)	172 (100%)
Both new male and female partners of:				
HIV-negative participants ^b	2101 (95%)	869 (96%)	987 (88%)	3957 (93%)
HIV-positive participants ^c	119 (5%)	40 (4%)	137 (12%)	296 (7%)
All participants ^d	2220 (100%)	909 (100%)	1124 (100%)	4253 (100%)

^amo., months from most recent HIV-negative test to survey interview.
^bNumber of HIV-negative participants: 432, < 6 months; 244, 6–12 months; 319, > 12 months; 995 total.
^cNumber of HIV-positive participants: 30, < 6 months; 17, 6–12 months; 33, > 12 months; 80 total.
^dNumber of all participants: 462, < 6 months; 261, 6–12 months; 352, > 12 months; 1075 total.

Table 2. Number and proportion of 4253 new sex partners (NSPs) to whom 1075 participants disclosed being HIV-negative, by partner sex, and participant's current HIV status and time interval since last negative HIV test, men who have sex with men, 23–29 years of age, six US cities, 1998–2000.

Sexual behaviors and correlates of HIV infection

Of the 1075 MSM who reported disclosing they were HIV-negative to new partners, 966 (90%) reported engaging in anal sex with men in the last 6 months and 505 (47%) reported anal intercourse with men without a condom. Of these 505 men, 362 (72%) reported not using condoms because either they 'knew' they were HIV-negative, 'knew' their partners were HIV-negative, or thought their partners were at low risk for HIV. Of the 80 HIV-infected unaware disclosers, 73 (91%) reported in the last 6 months one or more occurrences of the following: insertive oral sex with males without a condom ($n = 62$, 78%), vaginal or anal sex with females without a condom ($n = 5$, 6%), or anal sex with males without a condom ($n = 39$, 49%) or anal sex with males where the condom tore or slipped off ($n = 24$, 30%). HIV-infected unaware disclosers were more likely to be black, to have obtained no higher than a high-school education, and to have engaged in receptive anal sex with other men in the last 6 months (Table 3). No other variables, including unprotected anal sex, were associated with HIV infection after adjusting for the effects of covariates.

	HIV-positive (n = 80) %	HIV-negative (n = 995) %	OR (95% CI)	AOR (95% CI) ^a
Age group ^b				
23–25	44	48	Reference	Reference
26–29	56	52	1.2 (0.7–1.9)	1.5 (0.9–2.5)
Race/ethnicity ^b				
Black	58	14	9.3 (5.3–16.4)	7.0 (3.8–12.9)
Hispanic	16	23	1.7 (0.8–3.5)	1.4 (0.6–3.0)
Other ^c	2	7	0.9 (0.2–3.8)	1.1 (0.2–4.8)
White	24	56	Reference	Reference
Education ^b				
At least some college or technical school	58	83	Reference	Reference
High school only	42	17	3.6 (2.2–5.7)	2.8 (1.7–4.8)
Annual income ^b				
< US\$15 000	41	21	3.7 (2.0–6.7)	–
US\$ 15 000–29 999	36	36	1.9 (1.0–3.4)	–
≥ US\$ 30 000	23	42	Reference	–
Sexual identity ^b				
Gay	68	81	Reference	–
Bisexual/heterosexual/other	32	19	2.0 (1.2–3.3)	–
Interval since last HIV-negative test ^b				
< 6 months	38	43	Reference	–
6–12 months	21	25	1.0 (0.5–1.9)	–
> 12 months	41	32	1.5 (0.9–2.5)	–
New sex partners ^d				
1	25	24	Reference	–
2–3	38	32	(0.6–2.0)	–
> 3	37	44	0.8 (0.5–1.5)	–
Sexual behaviors with men ^e				
Insertive oral sex without a condom ^{b,f}	78	93	0.3 (0.2–0.5)	–
Receptive oral sex without a condom ^{b,f}	79	90	0.4 (0.2–0.8)	–
Insertive anal sex	75	80	0.8 (0.4–1.3)	–
Insertive anal sex without a condom	36	39	0.9 (0.6–1.4)	–
Receptive anal sex ^b	75	68	1.4 (0.8–2.3)	2.2 (1.2–3.9)
Receptive anal sex without a condom ^b	38	31	1.3 (0.8–2.1)	–
Insertive or receptive anal sex ^b	94	90	1.8 (0.7–4.4)	–
Insertive or receptive anal sex without a condom	49	47	1.1 (0.7–1.7)	–
Condom tore or slipped off during anal sex ^{b,f}	30	18	1.9 (1.1–3.1)	–
Unprotected anal sex ^{b,g}	63	55	1.4 (0.9–2.2)	–
Sexual behaviors with women ^e				
Oral, vaginal, or anal sex	14	12	1.2 (0.6–2.3)	–
Vaginal or anal sex without a condom	6	8	0.8 (0.3–2.1)	–

OR, odds ratio; CI, confidence interval.

^aAdjusted odds ratios (AORs) reported for variables that remained in the reduced logistic regression model predicting HIV infection (see Methods). Variables within the table that had a univariate chi-squared *P*-value < 0.25 were included in the initial full model. AOR also adjusted for city (data not reported).

^bIncluded in initial full logistic regression model.

^cIncludes 52 Asian MSM, none of whom tested positive for HIV.

^dDefined as male or female partners with whom participants had sex for the first time in the 6 months preceding the Young Men's Survey (YMS) interview.

^eMeasured in the 6 months preceding the YMS interview; includes both current and new partners.

^fThe univariate associations between HIV infection and oral sex and condom failure were confounded by race. In comparison with MSM of other race/ethnicity, proportionally fewer black MSM reported insertive or receptive oral sex without a condom, and proportionally more black MSM reported that a condom tore or slipped off during anal sex.

^gOccurrence of anal sex either without a condom or where the condom tore or slipped off.

Table 3. Multiple logistic regression analysis comparing HIV-infected unaware and non-infected men who have sex with men (MSM), 23–29 years of age, who disclosed being HIV-negative to one or more new sex partners in the last 6 months, six US cities, 1998–2000.

Discussion

In six US cities, we found that overall, approximately one in 14 new male and female sex partners may have been unintentionally exposed to HIV from young MSM who disclosed being HIV-negative. The number of new partners who may have been exposed increased from approximately one in 20 from young MSM who disclosed they had last tested HIV-negative within the past year, to approximately one in eight from young MSM disclosers who tested over a year ago. Of new partners of young black MSM who disclosed being HIV-negative, approximately one in five may have been exposed overall, and nearly one in three may have been exposed from those who tested over a year ago. Although proportionally more new partners may have been exposed to HIV from young MSM disclosers who last tested negative over a year ago, over half of all new potentially exposed partners were partners of HIV-infected young MSM who had last tested negative within the past year.

Our finding of the magnitude of partners who may have been unintentionally exposed to HIV from young MSM who disclose being HIV-negative is corroborated by three recent reports, two of which suggest that HIV-negative serosorting among MSM reduces but does not eliminate HIV transmission risk. First, in a longitudinal study of 4295 MSM, the magnitude of new HIV infection among men who reported engaging in unprotected receptive anal intercourse (URAI) with partners believed to be HIV-negative was lower in comparison with men who engaged in URAI with partners of unknown or HIV-positive status (HIV seroconversion hazard ratio for URAI with HIV-negative, unknown, and positive partners respectively: 1.92, 2.85, 3.40) [17]. However, 21.6% of HIV incidence observed in this study was attributed to URAI with partners who were believed to be HIV-negative [17]. Second, of 881 MSM tested for HIV in a sexually transmitted disease clinic in Seattle, Washington, proportionally fewer (although still considerable) MSM who reported unprotected anal intercourse (UAI) with only HIV-negative partners in the past 12 months tested HIV-positive for the first time compared with MSM who reported having UAI with partners of unknown or HIV-positive status (% HIV-positive: 1.7 versus 9.6) [6]. Finally, as many as half of all new HIV diagnoses among MSM in King County, Washington, occur among MSM who deny engaging in UAI with HIV-positive or unknown status male partners [18]. Although the findings from these three reports cannot rule out sexual HIV transmission from partners of unknown or HIV-positive status through oral sex [8,20–22], or from condom failure or actual non-use of condoms (due to invalid self-reported behavior) during anal intercourse [23,24], they do suggest considerable transmission may occur from MSM who disclose or who are believed to be HIV-negative.

Considerable HIV transmission risk from young MSM who disclose being HIV-negative is not unexpected given (1) the high HIV incidence and prevalence of unrecognized infection among young MSM, particularly young black MSM [13,14,16]; and (2), as suggested in this study, that one-third of all disclosers (41% among the 80 HIV-infected unaware disclosers) may rely on a negative test result that is over 1-year old. We found similarly high prevalence of unrecognized HIV infection among young MSM who disclosed being HIV-negative to new sex partners: 7% of all young MSM disclosers and 24% among young black MSM disclosers. Not surprisingly, we found that the proportion of new partners potentially exposed to HIV, by race, was similar to the proportion of participants who were unaware that they were HIV-infected, by race. Although the total number of new partners who may have been exposed to HIV from young black MSM was greater than from young white MSM, this finding is attributed to the higher proportion of young black MSM who were HIV-infected unaware. Relative to young white MSM, young black MSM actually reported fewer total new partners and new partners to whom they disclosed being HIV-negative.

Our finding that over half of new partners who may have been exposed to HIV from MSM who disclosed being HIV-negative were from men who tested within the past year is alarming given the high viral loads known to occur during recent infection [25] and that most disclosers engaged in high-risk behaviors including unprotected anal intercourse. The fact that most disclosers who engaged in anal sex without condoms did so because they perceived themselves or their partners to be HIV-negative or at low risk for infection is consistent with prior reports suggesting that many MSM practice HIV-negative serosorting as a means to have unprotected sex and avoid infection [1–7]. However, placed in the context of high HIV incidence and prevalence of unrecognized infection, our findings suggest that current guidelines that recommend at least annual testing for MSM [15] are inadequate for those who practice HIV-negative serosorting as their only means for HIV prevention. Young MSM, particularly those who are black, should test for HIV more frequently and should consistently use condoms with all partners unless they are in a mutually monogamous relationship in which both partners have tested negative at least 3 months since their last potential HIV exposure [8,25–27]. Prevention programs, counselors, and health-care providers should caution MSM that a previous negative test result disclosed by a partner is no guarantee that that partner does not have HIV [13,14,26].

As HIV acquisition risk is dependent, in part, on the prevalence of unrecognized and recognized HIV infection within sexual networks, HIV-status assessment and disclosure practices, accuracy of perceived infection status, and partner-specific sexual and drug-use behaviors, it was not surprising that only one of our relatively simple behavioral measures was associated with HIV infection. Self-reported sexual behavior often fails to predict the incidence of sexually transmitted diseases [28] and the considerable variation in prevalence of HIV infection among racial/ethnic groups of young MSM [29]. However, our finding that receptive anal sex was associated with unrecognized HIV infection is consistent with extensive literature suggesting that this practice is one of the most riskiest for acquiring HIV [8,20]. Finally, the high proportion (18%) of HIV-negative MSM in our study who reported one or more occurrences of condom failure is similar to the finding of a previous study that 16.6% of 2592 HIV-negative MSM reported condom slippage or breakage in the prior 6 months [30]. Although condom failure was not associated with HIV infection in our study, these similar findings underscore the ongoing need for research on condom use among young MSM and intensified efforts to improve their use.

Our findings are subject to several limitations. First, since our survey was limited to 23 to 29 year-old men who attended MSM-identified venues in six cities, our findings may not generalize to MSM who are older, who reside in other cities, and who do not attend MSM-identified venues. Second, because we did not measure sexual behaviors specifically with new partners, the type of sexual behavior that may have led to HIV exposure cannot be characterized. It may be true, for example, that condoms were always used without failure during anal or vaginal sex, or that only oral sex occurred between HIV-infected unaware participants and their new partners. If true, HIV transmission risks might have been very low. However, condoms are not 100% effective even when reported to be used correctly [23,24], and while fellatio is less risky than anal intercourse [8,20], transmission from HIV-infected persons who engaged in insertive fellatio has been documented [21,22]. Furthermore, nearly all MSM disclosers in our study probably engaged in behaviors with new partners that can lead to HIV transmission. For example, among the 548 MSM disclosers who *only* had sex with one or more new partners in the last 6 months, 518 (95%) reported one or more occurrences of either insertive oral sex with new male partners without a condom, vaginal or anal sex with new female partners without a condom, or anal sex with new male partners either without a condom or where the condom tore or slipped off. Finally, it may be true that some disclosers acquired HIV from their new partners or only after they had sex with one or more new partners. Thus, we can only characterize HIV exposures to new sex partners as potential. However, our findings on the proportion and number of partners who may have been exposed to HIV from infected-unaware MSM disclosers are probably underestimates for three reasons. First, we did not measure disclosure to all current partners and to all partners *after* having sex for the first time. Second, we measured the number of new partners in only a 6-month period, which is probably much shorter than the average duration in which HIV-infected young MSM remain unaware of their infection and can potentially expose partners [13,14]. Finally, we restricted our analysis to MSM who reported last testing HIV-negative. Some HIV-infected MSM who are aware of their infection may intentionally disclose being HIV-negative to some partners.

HIV-negative serosorting based on disclosed results from prior (but not necessarily recent) testing may fail to prevent HIV transmission, underscoring the need to increase HIV testing and the consistent and correct use of condoms among at-risk MSM [27]. Before engaging in sex with new partners, many MSM may rely on prior HIV test results because of the inconvenience, stigmatization, or other barriers imposed by having to test in clinical settings [31]. These barriers to more frequent testing suggest that rapid HIV testing, if available as an over-the-counter self test, may allow more HIV-infected persons the opportunity to learn their current HIV status [32]. Our findings support the Blood Products Advisory Committee recommendation to the FDA for research on whether high-risk persons and their partners will appropriately use over-the-counter rapid HIV tests, and ultimately, if these tests might be able to reduce HIV

transmission among MSM who practice HIV-negative serosorting [33]. In the meantime, MSM who have sex with new partners should take precautions to avoid infection, even if the new partner reports being HIV-negative.

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