

Viagra, Methamphetamine, and HIV Risk: Results From a Probability Sample of MSM, San Francisco

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Objectives: To determine the prevalence and factors of Viagra use in combination with crystal methamphetamine and its association with HIV risk behavior in a probability sample of men who have sex with men (MSM).

Study Design: A cross-sectional, random-digit dial telephone survey of MSM in San Francisco conducted between June 2002 and January 2003.

Results: Of the 1976 MSM, 13.5% used Viagra alone, 7.1% used methamphetamine without Viagra, 9.6% used Viagra with a mood-altering substance (excluding methamphetamine), and 5.1% used Viagra with methamphetamine. Of the MSM using Viagra with methamphetamine, 57% were HIV-infected and 24% of these men reported serodiscordant unprotected insertive intercourse. Viagra used with methamphetamine was independently associated with a higher risk of serodiscordant unprotected insertive intercourse, serodiscordant unprotected receptive intercourse, and a recent diagnosis of a sexually transmitted disease.

Conclusion: MSM who use Viagra with crystal methamphetamine have high prevalence rates of HIV and engage in HIV risk behaviors.

SILDENAFIL CITRATE (VIAGRA), an orally administered prescription medication to treat erectile dysfunction, was approved by the Food and Drug Administration in March 1998. Viagra, a phosphodiesterase type 5 (PDE-5) inhibitor, was the first medication in this class of drugs that treat erectile dysfunction by selectively inhibiting the breakdown of cyclic guanosine monophosphate. Cyclic guanosine monophosphate causes relaxation of the corporal smooth muscle and vasodilatation of the arteries which in turn causes engorgement of the corpus cavernosum and penile erection. PDE-5 inhibitors are only effective in the presence of sexual stimulation.^{1,2}

Viagra use has been found to be associated with high-risk sexual and drug-using behavior, HIV infection, and sexually transmitted diseases (STD) among men who have sex with men (MSM) in several studies.^{3–8} Since the approval of Viagra, studies have

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shown crystal methamphetamine use increasing among MSM.⁹ There is great public health concern about the 2 being used together: specifically, that Viagra will be used to counteract erectile dysfunction that may result from use of crystal methamphetamine thus enabling individuals to have prolonged sexual activity in a mentally altered state.

In a previous study we used a population-based sample of MSM to determine the prevalence and factors associated with high risk of transmitting HIV infection.¹⁰ In that study, we found that use of Viagra or crystal methamphetamine was associated with behaviors likely to transmit HIV. However, in that study, we did not examine the effect of combining Viagra and crystal methamphetamine or the effects of combining Viagra with mood-altering substances other than crystal methamphetamine. To further increase our understanding of how these drugs used alone and in combination affect HIV sexual risk behaviors, we compared the prevalence of risk behaviors among men who used Viagra or crystal methamphetamine alone, men who used Viagra with mood-altering substances other than crystal methamphetamine, and men who combined Viagra and crystal methamphetamine.

Methods

Survey Methods

The survey methods have been previously described in detail¹⁰ (and the study methods report available from the last author). Briefly, MSM were sampled using a random-digit dial telephone survey of households in San Francisco between June 2002 and January 2003. The sampling frame consisted of 50 telephone exchanges from a set of 198 exchanges that covered the 13 ZIP codes where the estimated majority of MSM resided during 1996.¹¹ The decision to use a sampling frame of 50 exchanges was based upon population-level estimates of the percent of men in San Francisco who are MSM (12–14%)^{11–13} from which it was estimated that 21% of households in the targeted areas would have MSM residents. Once a telephone exchange was found to correspond to a household, the household was further screened to identify households where at least 1 adult male lived who self-identified as homosexual or bisexual or who had consensual sex

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with another man since he was 14 years old. If there was only one eligible human in the household, he was selected. If more than one eligible human resided in the household then the eligible humans with the most recent birthday was selected. A household was eligible for sampling only once.

Once an eligible subject was selected, the purpose and procedures of the study were explained and verbal consent was obtained. Interviews were conducted in English or Spanish using computer-assisted telephone interview technology by the Westat Corporation (Rockville, MD). Subjects were provided with \$25 as compensation for the approximately 45-minute interview. The Institutional Review Boards at the University of California at San Francisco, Centers for Disease Control and Prevention, and Westat Corporation reviewed and approved this study.

Interview Measures

In addition to sociodemographic variables, information regarding sexual behaviors with men and women that occurred in the 12 months preceding the interview was collected. Questions regarding sexual risk behaviors focused on male sex partners only. Information on sexual behaviors was collected separately for primary sex partners (a sex partner that the respondent feels committed to above all others) and nonprimary sex partners. Respondents were asked about the number of sex partners, unprotected insertive anal intercourse, and unprotected receptive anal intercourse. For analytic purposes, sexual behaviors with primary and nonprimary sex partners were combined. Additional risk questions included giving or receiving money and/or drugs for sex, meeting a sex partner on the Internet, attending a circuit party, and receiving an STD diagnosis in the past 12 months. Circuit parties were defined as "any large party of more than 1000 gay men held at a major convention center, arena or outdoor facility around the U.S. or elsewhere." Subjects were also asked whether they had been diagnosed with HIV infection.

Subjects were asked about their use of Viagra, crystal methamphetamine, amyl nitrates (poppers), cocaine, and club drugs (ketamine hydrochloride, methylenedioxymethamphetamine [ecstasy], γ -butyrolactone, or γ -hydroxybutyrate [GHB]) in the past 12 months. Additionally, subjects who indicated that they had used Viagra in the past 12 months were asked whether they used Viagra in combination with mood-altering substances and if so, the type and frequency of use. The categories of use included "never," "once a month or less," "two to three days a month," "one to three days a week," "four to six days a week," or "daily." The frequency of drug use was dichotomized as having ever used the drugs or not using the drugs at all in the past 12 months because the number of respondents' who used the drugs more often than "once a month or less" was so small that meaningful analyses were not possible (less than 6%).

Statistical Methods

Descriptive analyses were performed to characterize demographic, sexual, and drug use behavior for the total study population, subjects who had never used Viagra and never used crystal methamphetamine, subjects who used Viagra without mood-altering substances, subjects who used crystal methamphetamine without Viagra, subjects who used Viagra without crystal methamphetamine but with other mood-altering substance, and subjects who used Viagra in combination with crystal methamphetamine (with or without other mood-altering substances).

To assess the relative importance of Viagra and crystal methamphetamine used alone and in combination with each other in predicting HIV sexual risk behavior we conducted 3 logistic re-

gression models in which the outcomes were (1) serodiscordant unprotected insertive anal intercourse, (2) serodiscordant unprotected receptive anal intercourse, and (3) a recent STD diagnosis. The factors of interest were Viagra use alone, crystal methamphetamine use alone, Viagra use with mood-altering substances but not crystal methamphetamine, and Viagra use with crystal methamphetamine (with or without other substances). These predictor variables were compared with not having used Viagra and not having used crystal methamphetamine. In each of these models we controlled for age group, exchanging money and/or drugs for sex, having met a sex partner through the Internet, circuit party attendance, HIV infection, and use of amyl nitrate, cocaine, or club drugs.

The point estimates and 95% confidence limits were calculated using weights that were constructed from the sampling probabilities and the nonresponse proportions and standardized to the size of the completed sample. Sampling weights were developed by the Westat Corporation. Crude analyses were conducted using SAS version 8.2 (Cary, NC) and weighted analyses were conducted using Stata SE 8.0 (College Station, TX).

Results

A total of 733,787 telephone numbers were called to identify 15,272 households of which 2676 (23%) held eligible MSM. Of these, 1976 (74%) participated in the interview.

Overall 13.5% of the total sample used Viagra without other mood-altering drugs in the past 12 months, 7% used crystal methamphetamine without Viagra, 9.6% used Viagra with mood-altering substances other than crystal methamphetamine, and 5.1% used Viagra in combination with crystal methamphetamine (with or without other mood-altering substances). Men who used Viagra without mood-altering substances were older (57.6% were 45 years and older) than the other sample groups investigated (Table 1), and men who used methamphetamine without Viagra were younger (20.3% were under 30 years old) than the other sample groups. Men who used Viagra with a mood-altering substance but not crystal methamphetamine and men who combined Viagra and methamphetamine were predominately between 30 and 45 years. Compared with the total study population Viagra use was more common among white men while crystal methamphetamine use without Viagra was more frequent among Asian and Latino men.

The prevalence of high-risk sexual behavior was higher among men who used Viagra alone and in combination with other drugs than among men who did not use Viagra or crystal methamphetamine. However, all sexual risk behaviors, except having provided money or drugs in exchange for sex, were markedly higher among men who combined Viagra with crystal methamphetamine. For example, the median number of partners in the past 12 months for men who used Viagra alone was 6, for men who used crystal methamphetamine alone was 5, for men who used Viagra with mood-altering substances but not crystal methamphetamine was 9, and for men who combined Viagra with crystal methamphetamine was 20.

Serodiscordant unprotected insertive anal intercourse was reported by 19% of men who used Viagra alone, by 23% of men who used crystal methamphetamine alone, by 26% of men who used Viagra with mood-altering substances but not crystal methamphetamine, and by 47% of men who combined Viagra with crystal methamphetamine. Serodiscordant unprotected receptive anal intercourse was reported by 11% of men who used Viagra alone, by 18% of men who used crystal methamphetamine alone, by 20% of men who used Viagra with mood-altering substances but not crystal methamphetamine, and by 46% of men who combined Viagra with crystal methamphetamine.

TABLE 1. Demographic Characteristics, Sexual, and Drug Use Behavior Among Men Who Have Sex With Men by Viagra Use Without and in Combination With Other Mood-Altering Drugs, San Francisco, June 2002 to January 2003 (n = 1976)[†]

Characteristic	Total Study Population (n = 1976)	Did NOT Use Viagra and Did NOT Use Crystal Methamphetamine in Past 12 mo	Used Viagra Without Mood-Altering Drugs in Past 12 mo	Used Crystal Methamphetamine Without Viagra in Past 12 mo	Used Viagra With Other Drugs but NOT Crystal Methamphetamine in the Past 12 mo	Used Viagra in Combination With Crystal Methamphetamine in the Past 12 mo
		1,089 (55.1%)	266 (13.5%)	140 (7.1%)	189 (9.6%)	100 (5.1%)
Total						
Age group (y)						
<30	9.4	10.0	2.5	20.3	3.9	9.8
30–34	13.1	13.5	6.3	22.4	11.6	17.9
35–39	17.2	16.7	15.2	24.4	19.4	13.9
40–44	17.7	17.4	18.5	11.9	20.3	27.7
45–49	12.5	11.4	16.3	11.7	13.4	18.8
>50	30.2	31.0	41.3	9.3	31.4	12.0
Race/ethnicity						
White	74.7	77.7	80.3	66.9	76.3	77.8
African American	3.6	4.5	2.1	1.7	2.9	0
Asian	3.5	2.7	2.8	5.9	2.3	4.8
Latino	9.8	8.4	8.3	17.7	11.7	6.9
Mixed/other	8.3	6.7	6.4	7.7	6.8	10.5
Education						
Some high school	2.3	2.7	1.0	5.2	1.9	1.2
High school graduate	9.3	9.7	5.4	16.6	5.1	5.5
Some college	25.5	27.1	23.4	26.2	23.3	26.1
College graduate	36.5	36.0	37.5	36.2	39.5	45.4
Grad degree	26.4	24.6	32.8	15.8	30.2	21.7
Income in 2001						
<\$24,001	25.8	26.6	21.8	32.9	19.5	26.8
\$24,001–48,000	27.3	27.7	26.1	31.1	25.9	21.6
\$48,001–72,000	20.4	19.6	20.9	20.9	23.3	23.6
\$72,001–96,000	11.7	12.0	13.7	5.5	11.2	15.1
>\$96,001	14.8	14.1	17.4	10.0	20.1	12.9
Sexual behaviors in the past 12 mo						
Number of male partners (median)	3	2	6	5	9	20
Unprotected insertive anal sex with male partner of unknown or different HIV status	14.3	8.1	19.1	22.6	25.8	46.9
HIV-positive respondent	4.6	1.6	8.5	3.3	11.6	24.1
HIV-negative/unknown status respondent	9.7	6.6	19.1	19.3	14.2	22.7
Unprotected receptive anal sex with male partner of unknown or different HIV status	10.7	6.1	11.3	18.0	19.6	45.6
HIV-positive respondent	5.8	2.4	8.1	4.6	27.7	33.1
HIV-negative/unknown status respondent	4.9	3.7	3.1	13.4	12.1	12.5
Gave money/drugs in exchange for sex	5.1	3.7	3.8	7.7	13.2	5.9

(Continues)

TABLE 1. (Continued)

Characteristic	Total Study Population (n = 1976)	Did NOT Use Viagra and Did NOT Use Crystal Methamphetamine in Past 12 mo	Used Viagra Without Mood-Altering Drugs in Past 12 mo	Used Crystal Methamphetamine Without Viagra in Past 12 mo	Used Viagra With Other Drugs but NOT Crystal Methamphetamine in Past 12 mo	Used Viagra in Combination With Crystal Methamphetamine in Past 12 mo
Received money/drugs in exchange for sex	2.3	1.3	2.1	6.9	3.1	8.6
Met sex partner on Internet	26.9	18.9	38.9	31.7	39.8	72.1
Attended circuit party	14.0	9.7	11.6	21.1	26.8	40.3
Diagnosed with an STD	10.9	7.6	13.6	13.2	19.7	33.1
HIV infected	25.2	18.9	33.7	26.4	39.7	57.1
Ever injected drugs	15.6	13.4	12.6	28.0	20.5	44.6
Drug use in past 12 mo						
Amyl nitrate	22.9	14.1	25.3	48.1	47.7	73.2
Used crystal methamphetamine	16.8	NA	9.7	100.0	23.0	NA
Used cocaine	13.3	10.0	8.8	35.2	22.3	38.2
Used club drugs [†]	18.5	11.5	13.4	39.2	42.7	67.1

*Results are weighted by survey design.

[†]Excludes 192 subjects missing information on Viagra or methamphetamine use.

[‡]Ketamine hydrochloride, methylenedioxymethamphetamine (ecstasy), γ -butyrolactone, or γ -hydroxybutyrate.

HIV prevalence was higher among men who used Viagra alone (34%), among men who used Viagra with mood-altering substances but not crystal methamphetamine (40%), and among men who combined Viagra with crystal methamphetamine (57%) than among the total study population (25%). Among the men who used Viagra combined with crystal methamphetamine, serodiscordant unprotected insertive anal intercourse was reported by 24% of the HIV-infected MSM and serodiscordant unprotected receptive anal intercourse was reported by 13% of men who were HIV-negative or whose HIV serostatus was unknown.

All of the drug combinations were independently associated with higher sexual risk, although the magnitude of the association varied (Table 2). Viagra and crystal methamphetamine each used alone were found to double the risk of serodiscordant unprotected insertive anal intercourse. Neither was independently predictive of serodiscordant unprotected receptive anal intercourse. Viagra used alone, but not crystal methamphetamine used alone, predicted a diagnosis of an STD. Viagra combined with mood-altering substance that did not include crystal methamphetamine was independently predictive of all 3 sexual risk outcomes and the magnitude of the association was slightly higher than for Viagra used alone or crystal methamphetamine used alone. Viagra used in combination with crystal methamphetamine was also independently predictive of all 3 sexual risk outcomes and at a strikingly higher magnitude of association than for Viagra used with mood-altering substances other than crystal methamphetamine.

Discussion

Our study confirms previous reports that found Viagra³⁻⁸ and methamphetamine each^{7,8,14-16} used alone to be associated with high-risk sexual behavior among MSM. However, our study goes further by demonstrating that the prevalence of high-risk sexual behavior is similar among users of either of these drugs alone, is higher among users of Viagra in combination with mood-altering drugs other than crystal methamphetamine and is highest among those who used Viagra with crystal methamphetamine.

The increased likelihood of engaging in sexual high-risk behavior among men who combined Viagra with crystal methamphetamine has serious implications for HIV transmission particularly given our finding that such a high proportion of the HIV-infected men who used Viagra combined with crystal methamphetamine reported unprotected insertive anal intercourse with a partner of unknown or different serostatus. This finding suggests that this particular group is likely to be transmitting HIV-infection. An additional concern is that Viagra use may contribute to HIV-transmission by enabling men whose sexual activity, before Viagra use, was only receptive anal intercourse to also engage in insertive anal intercourse providing another avenue for HIV transmission. Moreover, men who use both methamphetamines and PDE-5 inhibitors have been shown to be less likely to be afraid of acquiring HIV infection.¹¹

Although Viagra used in combination with crystal methamphetamine was most strongly associated with sexual high-risk behavior. Viagra and crystal methamphetamine each used alone as well as Viagra used in combination with other mood-altering drugs were found to be independently associated with some sexual risk behavior. This highlights the need for broad-spectrum substance abuse prevention and treatment in this population. Recent evidence has documented that substance use treatment can reduce high-risk sexual behavior in such groups¹⁷ and public health HIV/STD prevention programs can implement effective substance use interventions.¹⁸

Several limitations to this study may have affected the results and its interpretation. This was a cross-sectional study; therefore

TABLE 2. Sexual Risk Behaviors Associated With Use of Viagra, Methamphetamine, and Other Drugs Using 3 Multivariate Logistic Regression Models,* San Francisco, June 2002 to January 2003, (n = 1772)[†]

Drug and drug combinations used in past 12 mo	Serodiscordant Unprotected Insertive Anal Intercourse in Past 12 mo	Serodiscordant Unprotected Receptive Anal Intercourse in Past 12 mo	STD Diagnosis in Past 12 mo
No Viagra and no crystal methamphetamine use	Referent	Referent	Referent
Viagra use without mood-altering drugs	2.1 (1.3–3.2)	1.3 (0.7–2.2)	1.8 (1.1–2.9)
Crystal methamphetamine use without Viagra	1.9 (1.1–3.3)	1.6 (0.9–3.1)	1.2 (0.6–2.2)
Viagra use with other drugs but NOT crystal methamphetamine	2.4 (1.5–4.0)	1.7 (1.0–3.0)	2.3 (1.3–3.9)
Viagra use in combination with crystal methamphetamine	4.0 (2.2–7.5)	3.3 (1.7–6.3)	3.0 (1.6–5.5)

Values given are adjusted odds ratio (95% confidence limit) values.

*Results are weighted for survey design.

[†]All three models control for age group, having exchanged money or drugs for sex, meeting partners on the Internet, circuit party attendance, HIV infection, amyl nitrate use, cocaine use, and club drug use in past year.

[‡]Excludes 192 subjects missing information on Viagra or methamphetamine use.

our data cannot demonstrate a causal relationship between Viagra and methamphetamine use and sexual risk behavior. Additional longitudinal studies to determine whether Viagra and methamphetamine use combined predicts high-risk sexual behavior and HIV incidence are necessary to answer this critical question.

In addition, this study was subject to the limitations associated with random-digit dial telephone surveys of residences including homes that may not have phones and missing people who were not at home when calls were made. Although there has been an increase in cell phone use in recent years, this is unlikely to be a source of extensive nonparticipation bias since in the first half of 2003 only 3% of households in the United States relied solely on cell phones.¹⁹ Additionally, to minimize the risk of failing to contact persons who were infrequently at home, calls were made at various times during the day and evening.

It is important to consider how representative the men in our study are to the population of gay men and other MSM in San Francisco and elsewhere. We included any men who reported sex with a man since age 14. It is possible that we sampled men who are not actively homosexual. However, 96% of the men who reported sexual activity in the past 12 months had sex with a human. Thus, we believe that our sampling method was effective at identifying sexually active MSM.

Public health efforts to address the use of methamphetamine alone and in combination with Viagra are urgently needed to combat high HIV sexual risk. Gay men and other MSM who attend STD clinics are very interested in substance use treatment programs²⁰ and new treatment models using contingency management have been piloted and successfully implemented in some areas.¹⁸ Studies to determine the efficacy of pharmacological treatment to reduce substance abuse have shown some promise²¹ and should be expanded. In addition to treatment of methamphetamine use, a multifaceted response to reduce inappropriate use of Viagra is warranted. This includes direct-to-consumer marketing restrictions as implemented in every country outside of the United States and New Zealand, the promotion of the appropriate use of PDE-5 inhibitors to physicians, further education on the assessment and diagnosis of erectile dysfunction responsive to PDE-5 inhibition by physicians before prescribing these medications, and enhanced awareness among clinicians, educators, drug manufacturers, and regulatory bodies regarding the widespread illegal avenues for the acquisition and abuse of PDE-5 inhibitors. Taken together, these efforts may be effective in reducing the inappropriate use of Viagra as well as the use of crystal methamphetamine alone and in combination with Viagra. Unfortunately, until policy makers begin to address the use of illicit drugs and the abuse of prescription

drugs like Viagra and its association with high-risk sexual behavior, continued HIV transmission in the United States is inevitable.

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