HIV-1, Sexually Transmitted Infections, and Sexual Behavior Trends Among Men Who Have Sex With Men in Lima, Peru

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Objective: To assess and estimate trends in HIV, sexually transmitted infections (STIs), and sexual behavior among men who have sex with men (MSM) in Lima, Peru.

Design: Second-generation HIV sentinel surveillance surveys conducted in 1996, 1998, 2000, and 2002.

Methods: Adult men reporting sex with at least 1 man during the previous year were eligible to participate. Sexual behavior and serum HIV-1 and syphilis antibodies were assessed. HIV seroincidence was estimated by a sensitive/less-sensitive enzyme immunoassay strategy. Rectal and pharyngeal swabs for *Neisseria gonorrhoeae* culture and a first-void urine sample for urethral leukocytes for presumptive diagnosis of urethritis were obtained. Herpes simplex virus 2 (HSV-2) antibodies were measured in 2002.

Results: Although HIV prevalence increased from 18.5% to 22.3% from 1996 through 2002, bacterial prevalence declined significantly for syphilis (16.0% to 12.4%), early syphilis (8.6% to 3.4%), and rectal gonorrhea (5.1% to 0.2%). High HIV seroincidence was estimated, with the lowest (4.8%) incidence in 1998. In 2002, HSV-2 seroprevalence was 51.0%. After adjustment for age, education, and self-reported sexual identity, our data suggest that a yearly increase by 6% in the prevalence of HIV occurred among MSM in Lima, with a corresponding decline in syphilis (by 9%), early syphilis (by 18%), and rectal gonorrhea (by 64%). Condom use during last sexual intercourse increased by 26% each year with the most recent male steady partner and, among non–sex workers, by 11% with the most recent casual partner.

Conclusions: HIV continued to spread among MSM in Lima even when a decline in bacterial STIs and increase in condom use were estimated to occur. Intensification of medical and behavior prevention interventions is warranted for MSM in Peru.

Key Words: developing countries, HIV-1, homosexual men, sentinel surveillance, sexual behavior, sexually transmitted diseases

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Study protocols were approved by the US Navy Medical Research Center, University of Washington, Asociacion Via Libre (1998 and 2000), and Asociacion Civil Impacta Salud y Educacion (2002) Institutional Review Boards in compliance with all applicable federal regulations governing the protection of human subjects.

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After sub-Saharan Africa and Asia, Latin America is the region most heavily affected by HIV infection. The Latin American HIV epidemic reflects diverse transmission patterns and epidemiology.[1] In all countries of the Andean region, men who have sex with men (MSM) account for a substantial proportion of HIV infection[2] and comprise a "bridge" group

for spreading into the heterosexual population because of the high frequency of reported bisexuality.[3,4]

Different methods have been proposed to monitor the progress of the HIV epidemic.[5] Second-generation HIV sentinel surveillance has the benefit that through monitoring risk behaviors and serving as an "early warning system" for incident HIV infection and sexually transmitted infections (STIs), it may detect changes in HIV epidemiology and risk behavior patterns.[6]

A nationwide general population-based survey of urban young adults conducted in 20 Peruvian cities during 2002 showed an overall HIV prevalence of 0.2% (0.4% for men and 0.1% for women).[7] In comparison, a baseline second-generation HIV sentinel surveillance conducted among MSM in Lima in 1996 found prevalences of HIV and syphilis seroreactivity of 18.5% and 16.0%, respectively, and estimated HIV seroincidence as 11.2% per year.[3] Subsequently, the Ministry of Health (MoH) of Peru implemented HIV prevention activities for MSM and other vulnerable populations, including "gay-friendly" clinics in Lima and Peru's larger cities that provided free condoms, voluntary counseling, and STI diagnosis and therapy. Since 1996, second-generation HIV sentinel surveillance has been conducted biannually in Lima among MSM to assist in resource allocation for HIV programs and assess the impact of public health interventions.[6] More comprehensive understanding of longitudinal changes in HIV and STI epidemiology can identify appropriate populations and intervention strategies to reduce HIV transmission.[8–10] To gain further insight into the HIV and STI epidemic dynamics among MSM in Lima, we assessed and estimated trends in HIV, STIs and sexual behavior among MSM between 1996 and 2002.

METHODS

Study Population and Procedures

We conducted 4 different sentinel surveillance surveys in Lima, Peru over 3-month periods in 1996, 1998, 2000, and 2002. Men who were at least 18 years of age and had had sexual intercourse with at least 1 man during the previous year were eligible to participate, regardless of their history of HIV-1 testing, serostatus, or treatment. There was no effort to oversample HIV-infected persons during these survey periods. Survey protocols, informed consent, and recruitment materials were approved by the National AIDS and STD Control Program, MoH of Peru; US Navy Medical Research Center; University of Washington; Asociacion Via Libre; and Asociacion Civil Impacta Salud y Educacion Institutional Review Boards. Participants provided written informed consent for participation, HIV and STI testing, and specimen storage for future testing.

Recruitment and referral of participants were based on "snowball" techniques and outreach by peer educators representing diverse MSM subcultures in Lima at previously mapped venues. Approximately 800 different venues were identified for mapping activities every 2 years, including saunas, pornographic movie theaters, video arcades, areas frequented by sex workers and transvestites, discotheques, bars, beauty parlors, and sports areas. Recruitment strategies included the use of posters, distribution of flyers, and informational meetings.

Geographically, to cover Lima, which has more than 8 million inhabitants and encompasses 1750 square miles, different STI clinics from the MoH or private nongovernmental organizations (NGOs) served as sentinel sites during the study periods. At baseline in 1996, implementation of the surveys was piloted in an NGO-sponsored clinic located in a "high risk" area of downtown Lima. Since 1998, sentinel sites were increased to 4 in 1998 and 5 in 2000 and 2002, which are located in each of the most densely populated districts of Lima.

At each sentinel site, counselors explained the study objectives to potential participants and obtained informed consent (for their participation and for provision of blood samples for confidential HIV-1 and STI testing, storage for further testing, or contact for future studies). Men who agreed and provided informed consent underwent a structured interview to collect information about demographics, sexual risk behavior, previous HIV-1 testing and diagnosis, self-designated sexual identity, and number of male and female sexual partners. Questionnaires differentiated sex partners as a primary steady partner and nonprimary nonsteady partners or casual partners. During 1996, 1998, and 2000, interviews were conducted by trained counselors; in 2002, interviews were conducted by computer-assisted self-interview (CASI). Counselors assisted participants in case of illiteracy or computer unfamiliarity. Physicians obtained a medical history and a targeted physical examination, including the genitals, anus, lymph nodes, skin, and oropharynx.

All participants received confidential pre- and post-HIV test counseling, risk reduction counseling, and condoms. Participants with STIs were managed according to Peruvian STD treatment guidelines.[11] Participant with a diagnosis of HIV-1 infection received standard health care following Peruvian HIV and AIDS health care management guidelines,[12] which did not include antiretroviral therapy at the time these surveys were conducted.

Laboratory Procedures

A peripheral venous blood sample was obtained from all participants for detection of antibodies to HIV-1 by means of enzyme immunoassay (in 1996, Abbott Laboratories, Chicago, IL; since 1998, Vironostika, Organon Teknika, Durham, NC) and confirmed by Western blot (in 1996, Cambridge Biotech; Worcester, MA; since 1998, Biorad Laboratories, Hercules, CA). Presumptive recent acquired HIV-1 infection was categorized among HIV-1–infected participants who had an optical density signal-to-cutoff ratio <0.75 in sensitive/less-sensitive or "detuned" EIA testing (Vironostika, Organon Tecnica).[13] Those HIV-infected participants with a reactive less-sensitive and sensitive EIA were considered as having chronic HIV infection.

Antibodies to *Treponema pallidum* were determined by a quantitative venereal disease research laboratory (VDRL, Biotec Laboratories Limited, Suffolk, England) in 1996 or by a rapid plasma reagin (RPR; Organon Teknika) since 1998, with confirmation by microhemagglutination assay (MHA-TP; Organon Teknika). Syphilis seroreactivity was defined by

a VDRL or RPR titer ≥1:1 and a positive MHA-TP assay. A presumptive diagnosis of early syphilis was made for a VDRL or RPR titer ≥1:16 and a positive MHA-TP assay. In 2002, herpes simplex virus 2 (HSV-2) antibody testing was performed using a type-specific enzyme-linked immunoassay (ELISA; Focus Technology, Cypress, CA). HSV-2 seroreactivity was defined by a reactive ELISA with an index ratio ≥3.5 to improve specificity.[14]

Among participants who consented, rectal (from 1996–2000) and pharyngeal (only in 1998 and 2000) swabs were taken for *Neisseria gonorrhoeae* isolation following standard Thayer-Martin procedures.[15] A first-void urine sample was obtained for a leukocyte esterase test (Multistix 2; Bayer, Elkhart, IN) or microscopy of spun urine for white blood cells. A presumptive diagnosis of urethritis was made for those with a positive leukocyte esterase test result or ≥5 leukocytes per high-power field. No further attempts were made to identify the cause of urethritis.

Statistical Analysis

Data were entered into electronic databases, and statistical analyses were computed using Intercooled STATA 7.0 for Windows 98/95/NT (Stata Corporation, College Station, TX). Point prevalences and 95% confidence intervals (CIs) were computed using binomial approximation. HIV seroincidences and 95% CIs were estimated using the testing strategies described by Janssen et al.[13] Bivariate comparisons of selected variables used the χ^2 test for categoric variables or nonparametric tests as appropriate. Observed trends were analyzed through the extended Mantel-Haenszel χ^2 procedure using Statcalc, Epi Info version 3.3.2 (Centers for Disease Control and Prevention, Atlanta, GA). Multivariate binary logistic regression analysis was used to compute annual odds ratios (ORs) for estimated trends of HIV, STI, and condom use among MSM in Lima. Variables for the multivariate model were selected using the single stepwise-forward method. All statistical tests were 2-tailed ($P < 0.05$).

RESULTS

Study Population

A total of 4370 MSM met entry criteria, provided informed consent, and were enrolled in the sentinel surveillance surveys: 444 participated in 1996, 1211 in 1998, 1357 in 2000, and 1358 in 2002. Overall, age distribution varies by study year, with a higher proportion of older men in the later years and differences in educational level (Table 1). From 1996 through 2002, knowledge of current HIV-1 serostatus among participants increased from 41.3% to 71.5%, and knowledge of being HIV-positive also increased from 1.4% to 9.7% ($P < 0.001$ for each comparison). The study population composition based on self-reported sexual orientation varied in each survey ($P < 0.001$). Across all survey periods, the largest proportion (42.3%–66.7%) of participants self-identified as homosexuals/gays. The proportion of participants reporting any STI symptom during the last year significantly decreased from 34.1% to 29.1% between 1996 and 2002 ($P < 0.001$).

HIV and Sexually Transmitted Infection Trends

There was an increasing observed trend in the prevalence of HIV-1 infection from 18.5% (95% CI: 15.0% to 22.4%) in 1996 to 22.3% (95% CI: 20.1% to 24.6%) in 2002 ($P = 0.006$; Table 2). In contrast, there was a decreasing trend in the prevalence of bacterial STIs: syphilis decreased from 16.0% to 12.4% ($P = 0.001$), early syphilis decreased from 8.6% to 3.4% ($P < 0.001$), and rectal gonorrhea decreased from 5.1% to 0.2% ($P < 0.001$). A presumptive diagnosis of urethritis increased modestly from 6.2% in 1998 to 9.4% in 2002. Pharyngeal gonorrhea was diagnosed in 1.5% of participants in 1998 and in 0.7% of participants in 2000. A presumptive diagnosis of recently acquired HIV-1 infection was made in 15 participants in 1996, 17 participants in 1998, 50 participants in 2000, and 32 participants in 2002, providing estimated HIV seroincidence rates of 11.3% per year (95% CI: 4.8% to 23.6%) in 1996, 4.8% (95% CI: 2.1% to 9.6%) in 1998, 12.4% (95% CI: 7.4% to 20.3%) in 2000, and 8.3% (95% CI: 4.5% to 14.7%) in 2002, with no significant trend observed.

No significant trend was found in the prevalence of HIV among young men (18–20 years old) who self-identify as homosexuals/gays (8.0% in 1996, 10.1% in 1998, 8.1% in 2000, and 13.0% in 2002). No significant trend was present when the analysis included men between 18 and 24 years of age (14.3% in 1996, 12.9% in 1998, 16.0% in 2000, and 14.5% in 2002).

HIV and STI prevalence varied by self-reported sexual orientation and year, as shown in Table 3. Importantly, a statistically increasing trend for HIV infection was only observed among those who self-identify as homosexuals/gays (from 18.0% to 26.2%; $P < 0.001$), which coincided with an increasing proportion presumptively diagnosed with urethritis (from 4.5% to 9.2%; $P < 0.001$).

Although, overall, transvestites had the highest STI prevalences during the study period, significant decreasing trends for syphilis (from 51.1% to 24.3%; $P < 0.001$), early syphilis (from 28.9% to 4.3%; $P < 0.001$), and rectal gonorrhea (from 7.5% to 0.0%; $P = 0.003$) were observed in this group. Likewise, syphilis also seemed to decrease among those self-identifying as bisexuals (from 11.9% to 3.0%; $P < 0.001$), whereas early syphilis and rectal gonorrhea significantly decreased among those identifying as bisexuals and homosexuals (see Table 3).

In 2002, overall HSV-2 seroprevalence was 51.0%, with significant differences between groups: 22.4% in those self-identifying as heterosexuals, 26.0% in bisexuals, 57.3% in homosexuals, and 79.6% in transvestites ($P < 0.001$).

Sexual Behavior and Trends of Reported Condom Use

Self-reported identification as a sex worker was 14.4% in 1998, 10% in 2000, and 17.2% in 2002 (Table 4); however, over all study years, more than 30.2% of subjects reported receiving money or gifts in exchange for sex with other men. The proportion of men reporting sex with women varied from 26.4% in 1996 to 47.6% in 2000.

Condom use during last sexual intercourse with the most recent male steady partner significantly increased from 24.3%

TABLE 1. Demographics, Knowledge of HIV Serostatus, Self-Identity, and Reported STI Symptoms Among MSM in Lima, Peru

	1996			1998			2000			2002			*P*
Age, years median [range]	24 [18–56]			25 [18–64]			25 [18–73]			25 [18–66]			0.002*
18–20, [n, N, %]	94	444	21.2	263	1211	21.7	328	1319	24.9	281	1328	21.2	
21–24	143	444	32.2	340	1211	28.1	329	1319	24.9	327	1328	24.6	
25–29	125	444	28.2	301	1211	24.9	289	1319	21.9	314	1328	23.6	
≥30	82	444	18.5	307	1211	25.4	373	1319	28.3	406	1328	30.6	<0.001†
Education, years [n, N, %]													
0–6	17	444	3.8	37	816	4.5	53	1316	4.0	83	1328	6.3	
7–11	204	444	46.0	486	816	57.4	873	1316	66.3	757	1328	57.0	
≥12	223	444	50.2	311	816	38.1	390	1316	29.6	488	1328	36.7	<0.001†
Knowledge of current HIV serostatus [n, N, %]													
Unknown HIV serostatus	253	431	58.7	657	1178	55.8	674	1257	53.6	377	1321	28.5	
HIV-negative	172	431	39.9	475	1178	40.3	485	1257	38.6	816	1321	61.8	
HIV-positive	6	431	1.4	46	1178	3.9	98	1257	7.8	128	1321	9.7	<0.001‡§
Self-identity [n, N, %]													
Heterosexual	28	435	6.4	168	1193	14.1	412	1290	31.9	149	1328	11.2	
Bisexual	101	435	23.2	95	1193	8.0	121	1290	9.4	362	1328	27.3	
Homosexual/gay	261	435	60.0	796	1193	66.7	661	1290	51.2	562	1328	42.3	
Transvestite	45	435	10.3	134	1193	11.2	96	1290	7.4	255	1328	19.2	<0.001†
STI symptoms during the past year [n, N, %]													
Urethral discharge	34	443	9.3		NA		85	1319	6.4	99	1321	7.5	
Genital or anal ulcer(s)	41	443	7.7		NA		156	1319	11.8	151	1321	11.4	
Genital or anal wart(s)	84	443	19.0		NA		75	1319	5.7	124	1321	9.4	
Rectal pain or discharge	30	443	6.8		NA		41	1319	3.1	124	1321	9.4	
Any symptom of STI	151	443	34.1	429	1206	35.6	309	1319	23.4	385	1321	29.1	<0.001‖

*Kruskal-Wallis test.
†χ^2 test for homogeneity among all subgroups.
‡Mantel-Haenszel χ^2 test for trends of knowledge of HIV serostatus.
§Mantel-Haenszel χ^2 test for trends of knowledge of being HIV-positive.
‖Mantel-Haenszel χ^2 test for trends.
NA indicates not available.

in 1996 to 54.1% in 2002 ($P < 0.001$). When stratified by participants' knowledge of their HIV serostatus, condom use increased significantly over time for those who did not know their HIV status (from 20.8% in 1996 to 51.9% in 2002; $P < 0.001$) and in HIV-uninfected men (from 27.8% in 1996 to 56.0% in 2002; $P < 0.001$) but not for those who knew they were HIV-positive. After stratifying by HIV diagnosis, reported condom use significantly increased from 25.7% to 54.2% among HIV-negative men ($P < 0.001$) and from 17.9% to 54.0% in 2002 among those with chronic HIV infection ($P < 0.001$). No significant trend was observed among those with recent HIV infection based on the less-sensitive EIA classification (see Table 4).

Notably, there is no clear indication that use of CASI in 2002 for behavioral data collection affected the reporting of sensitive behaviors; as shown in Table 4, for those variables resulting in statistical significant trends, trends remained significant even when data from the year 2002 survey were removed from the analyses (data not shown).

Condom use during last sexual intercourse with the most recent male casual partner did not statistically increase over time. After stratifying by participants' knowledge of their HIV

TABLE 2. HIV-1 and STI Trends Among MSM in Lima, Peru

	1996				1998				2000				2002			
	n	N	%	95% CI	n	N	%	95% CI	n	N	%	95% CI	n	N	%	95% CI
HIV infection	82	444	18.5	15.0 to 22.4	215	1211	17.8	15.6 to 20.0	268	1357	19.7	17.7 to 22.0	303	1358	22.3	20.1 to 24.6
Syphilis	71	444	16.0	12.7 to 19.7	212	1211	17.5	15.4 to 19.8	201	1357	14.8	13.0 to 16.8	168	1358	12.4	10.7 to 14.2
Early syphilis	38	444	8.6	6.1 to 11.6	83	1205	6.9	5.5 to 8.5	40	1357	2.9	2.1 to 4.0	46	1358	3.4	2.5 to 4.5
Urethritis			NA		75	1207	6.2	4.9 to 7.7	100	1354	7.4	6.0 to 8.9	98	1042	9.4	7.7 to 11.3
Rectal gonorrhea	18	350	5.1	3.1 to 8.0	5	991	0.5	0.2 to 1.2	2	1159	0.2	0.0 to 0.6			NA	

All trends statistically significant ($P < 0.05$) by Mantel-Haenszel χ^2 test for trends.
NA indicates not available.

TABLE 3. HIV-1 and STI Trends Among MSM in Lima, Peru by Self-Reported Sexual Orientation

	1996			1998			2000			2002		
	n	N	%	n	N	%	N	N	%	n	N	%
HIV infection												
Heterosexual	2	28	7.1	14	168	8.3	20	412	4.9	18	149	12.1
Bisexual	16	101	15.8	10	95	10.5	25	121	20.7	48	362	13.3
Homosexual/gay	47	261	18.0	144	796	18.1	172	661	26.0	147	562	26.2*
Transvestite	15	45	33.3	46	134	34.3	43	96	44.8	82	255	32.2
Syphilis												
Heterosexual	1	28	3.6	11	168	6.5	25	412	6.1	7	149	4.7
Bisexual	12	101	11.9	13	95	13.7	14	121	11.6	11	362	3.0*
Homosexual/gay	35	261	13.4	132	796	16.6	122	661	18.5	86	562	15.3
Transvestite	23	45	51.1	53	134	39.6	34	96	35.4	62	255	24.3*
Early syphilis												
Heterosexual	0	28	0.0	3	168	1.8	1	412	0.2	3	149	2.0
Bisexual	2	101	2.0	9	95	9.5	4	121	3.3	4	362	1.1†
Homosexual/gay	23	261	8.8	53	796	6.7	28	661	4.2	28	562	5.0‡
Transvestite	13	45	28.9	15	131	11.5	6	96	6.3	11	255	4.3*
Rectal gonorrhea												
Heterosexual	0	8	0.0	1	89	1.1	0	334	0.0		NA	
Bisexual	3	61	4.9	1	64	1.6	0	94	0.0§		NA	
Homosexual/gay	12	234	5.1	3	698	0.4	2	604	0.3*		NA	
Transvestite	3	40	7.5	0	128	0.0	0	92	0.0‖		NA	
Urethritis												
Heterosexual		NA		16	168	9.5	30	412	7.3	10	95	10.5
Bisexual		NA		12	95	12.6	16	120	13.3	29	283	10.2
Homosexual/gay		NA		36	793	4.5	41	660	6.2	40	433	9.2*
Transvestite		NA		11	133	8.3	10	96	10.4	16	208	7.7

*$P \leq 0.001$; †$P = 0.024$, ‡$P = 0.012$, §$P = 0.028$, ‖$P = 0.003$, all by Mantel-Haenszel χ^2 test for trends.
NA indicates not available.

serostatus previous to the survey and by HIV diagnosis made at each survey, no significant trends were observed over time.

Estimated HIV, Sexually Transmitted Infections, and Condom Use Trends

After adjustment for age, educational level, and self-reported sexual orientation, HIV seroprevalence significantly increased over the 8-year period, with an annual OR of 1.06 (95% CI: 1.02 to 1.11), indicating that the odds of having HIV infection among MSM in Lima increased by 6% compared with each previous year. The adjusted OR of syphilis decreased by 9% (OR = 0.91, 95% CI: 0.86 to 0.95) and that of early syphilis decreased by 18% (OR = 0.82, 95% CI: 0.77 to 0.88) each year. From 1996 to 2000, the adjusted odds of having rectal gonorrhea decreased by 64% each year. No changes were expected to occur in urethritis between 1998 and 2002 (Table 5). After including self-reported transactional sex (ie, self-defined sex worker) in the analysis (1998–2002), the adjusted ORs resulted in an increase of 10% in HIV prevalence (OR = 1.10, 95% CI: 1.04 to 1.16), a decrease in syphilis of 12% (OR = 0.88, 95% CI: 0.82 to 0.93), and a decrease in early syphilis of 19% (OR = 0.81, 95% CI: 0.73 to 0.90) each year.

After adjustment for age, educational level, self-reported sexual orientation, and knowledge of HIV serostatus, condom use during last sexual intercourse with the most recent steady partner increased by 26% each year (OR = 1.26, 95% CI: 1.18 to 1.36) over the 8-year study period (see Table 5). The inclusion of self-reported identification as a sex worker did not significantly change (OR = 1.27, 95% CI: 1.17 to 1.37) the trends in condom use between 1998 and 2002.

Since 1998 to 2002, among non–sex workers, condom use during last sexual intercourse with a casual partner significantly increased by 10% each year (OR = 1.11, 95% CI: 1.03 to 1.19) after adjustment for age, educational level, and self-reported sexual orientation (see Table 5), whereas among sex workers, condom use decreased by 25% (OR = 0.75, 95% CI: 0.63 to 0.88).

DISCUSSION

This first analysis of trends from data collected by second-generation HIV sentinel surveillance among MSM in Latin America involving collaborative efforts of the Peruvian government, NGOs, and US institutions indicates that between 1996 and 2002, HIV prevalence increased by 6% per year among MSM in Lima, whereas declines were observed in bacterial STIs, including syphilis (by 9% each year), early syphilis (by 18%), and rectal gonorrhea (by 64%). The behavioral data indicate that among MSM in Lima, condom use during last sexual intercourse increased by 26% each year

TABLE 4. Sexual Behavior and Condom Use Among MSM in Lima, Peru

	1996			1998			2000			2002		
	n	N	%	N	N	%	n	N	%	n	N	%
Received money/gifts in exchange for sex with men	156*	444	35.1	424†	1216	34.9	411†	1319	31.2	439†	1216	30.2
Sex with women	117*	444	26.4		NA		621*	1305	47.6	429‡	1452	29.6
Self-perception as sex worker		NA		173	1211	14.3	132	1319	10.0	243	1327	18.3
Condom use during last sexual intercourse with the last/current male steady partner	42	173	24.3	224	688	32.6	215	476	45.2	193	357	54.1§
According to knowledge of HIV serostatus												
Unknown HIV serostatus	20	96	20.8	103	366	28.1	71	191	37.2	40	77	51.9§
HIV-negative	20	72	27.8	100	282	35.5	105	219	47.9	131	234	56.0§
HIV-positive	1	2	50.0	13	24	54.2	33	49	67.3	21	44	47.7
According to participant HIV diagnosis at the surveillance												
No HIV infection	35	136	25.7	183	574	31.9	140	242	40.9	142	262	54.2§
Recent HIV infection	2	8	25.0	2	10	20.0	11	23	47.8	4	8	50.0
Chronic HIV infection	5	28	17.9	39	104	37.5	64	111	57.7	47	87	54.0§
Condom use during last sexual intercourse with the last male casual partner		NA		524	995	52.7	577	1115	51.7	222	399	55.6
According to knowledge of HIV serostatus												
Unknown HIV serostatus		NA		262	544	48.2	256	596	43.0	62	102	60.8
HIV-negative		NA		225	387	58.1	244	396	61.6	143	263	54.4
HIV-positive		NA		24	36	66.7	46	67	68.7	15	31	48.4
According to participant HIV diagnosis at the surveillance												
No HIV infection		NA		419	825	50.8	451	912	49.5	174	309	56.3
Recent HIV infection		NA		9	16	56.3	21	41	51.2	9	15	60.0
Chronic HIV infection		NA		96	154	62.3	105	162	64.8	39	75	52.0

*During the past year.
†During the past 6 months.
‡During the past 3 months.
§$P < 0.001$ by Mantel-Haenszel χ^2 test for trends.
NA indicates not available.

with the most recent male steady partner and by 11% with the last male casual partner among non–sex workers.

These observed temporal increases in HIV prevalences, declines in bacterial STIs, and self-reported symptoms of STI in the past year may reflect increasing health-seeking behavior promoted by the MoH during the study period in public STI clinics, which provided free diagnosis and treatment for curable STIs. HSV-2 serologic testing in 2002 indicated an HSV-2 seroprevalence of approximately 50%. Possibly attributable to different compositions of study participants at each survey, a stratified evaluation by self-reported sexual orientation showed that HIV prevalence and presumptive urethritis increased only among those who self-identified as homosexuals/gays. Notably, although transvestites showed the highest STI prevalences over time among all MSM subgroups, consistent declines in the prevalences of bacterial STIs were also observed in this group. Transvestites in Peru are highly stigmatized, with poor access to health services before the

TABLE 5. Estimated HIV, STI, and Condom Use Trends Among MSM in Lima, Peru

	Annual Adjusted OR	95% CI		*P*
HIV-1 infection	1.06	1.02	1.11	0.005*
Syphilis seroreactivity	0.91	0.86	0.95	<0.001*
Early syphilis	0.82	0.77	0.88	<0.001*
Urethritis	1.04	0.95	1.14	NS*
Rectal gonorrhea	0.36	0.24	0.55	<0.001*
Condom use in the last sexual intercourse				
With the last/current male steady partner	1.26	1.18	1.36	<0.001†
With the last casual partner among non–sex workers	1.11	1.03	1.19	0.007*

1996 is the reference year for OR calculation, except for urethritis and condom use during last sexual intercourse with the last casual partner among non–sex workers, in which 1998 is the reference year.
*Adjustment made for age, educational level, and self-reported sexual orientation.
†Adjustment made for age, educational level, self-reported sexual orientation, and knowledge of HIV serostatus previous to the survey.
NS indicates not significant.

implementation of the decentralized MoH-sponsored STI clinics.

Interestingly, knowledge of current HIV-1 status among study participants increased significantly over time, which may reflect success of the voluntary counseling and testing programs conducted by the MoH and different NGOs working in HIV prevention activities. Stratified analysis for those reporting sex with a steady partner showed that condom use during most recent sexual intercourse increased over time among those who did not know their HIV serostatus and HIV-negative men. When the analysis included participants' HIV diagnosis made at each survey, condom use substantially increased among those with no HIV diagnosis and among those with suspected chronic HIV infection. Importantly, high rates of sex with women were reported, with the highest (47.6%) in the 2000 survey.

Considering that, by definition, all sex workers always have sex with casual partners, the validity of the estimated condom use decline (by 25%) among sex workers is difficult to assess in the context that we failed to identify whether or not the last partner was a client, which has important methodologic and epidemiologic considerations.

Worldwide, data on STI and HIV trends before the introduction of antiretrovirals are scarce. Since the increased availability of highly active antiretroviral therapy (HAART), however, different patterns of STI and HIV trends among MSM have been reported worldwide, showing heterogeneity by geographic area and age over time. Most of these reports show stable or decreasing HIV incidences[16] with corresponding increasing incidences of syphilis and gonorrhea,[17–21] including the occurrence of STI outbreaks, which can be explained by antiretroviral-treated HIV-infected individuals resuming sexual activity.[22] Increasing incidences of HIV and other STIs have been reported elsewhere, however.[23]

A limitation of this study is that sentinel surveillance surveys were convenience-based samples of the population of MSM in Lima every 2 years; MSM were recruited by experienced outreach workers but the composition of the population was not uniform across time. Although all surveys followed standard guidelines[6] and recruited large samples of diverse participants representing the diverse MSM subcultures in Lima, the recruiters' knowledge of and access to different subgroups of MSM in Lima are reflected in the varying composition of the samples mainly based on self-reported sexual identity (see Table 1). By extending the sentinel sites in 1998, the composition of the population might have diversified and become more heterogeneous. Additionally, men who participated in these surveys represent the MSM in Lima who visited socialization venues where study recruitment was conducted, who were aware of the conduct of these surveys, and who voluntarily accepted participation. Likewise, MSM perceiving themselves to be at higher risk for HIV or STI acquisition may have been more willing to participate in later surveys, which would provide higher incidence estimates. This scenario would explain the high proportion of men who self-reported as sex workers, reaching as high as 18.3% in 2002.

Surveys were not implemented during the same 3-month period, which could have led to seasonal variations in high-risk behaviors[24] and incidence of STIs,[25] including HIV. Sexual behavior data are subject to recall bias and the participants' willingness to provide personal information to interviewers or even CASI. Use of CASI in 2002 could have increased the accuracy of responses to survey questions, however, especially those related to self-identification and sexual practices. Although different clinics and personnel participated in all surveys, no major changes over time occurred in the structure of study clinics and procedures followed by study personnel.

Recognizing these limitations, HIV prevalence significantly increased and STI prevalence significantly decreased over time (see Table 5), with the exception of urethritis, which was based on less-specific criteria (eg, leukocytes in first-void urine). Even with substantial declines in syphilis and early syphilis, prevalences remained high in 2002 (12.4% and 3.4%, respectively). The high prevalence of syphilis and HSV-2 may contribute to the 6% annual increase in HIV prevalence and indicate high HIV incidence.[26] Our high estimated HIV incidence is corroborated by our longitudinal studies among MSM, which have shown high observed HIV incidences of 3.3 and 6.2 cases per 100 person-years between 1998 and 2000[27,28] and between 2002 and 2003,[29] respectively. Incident HIV infection was associated with newly acquired STIs, which cause genital or anorectal ulcers, and unprotected receptive anal sex with casual male partners.[27,28] The continued relatively low level of condom use (~55% in 2002), the potential effect of role segregation,[30] the lack of HSV-2 control measures, and high rates of sex partner concurrence[31] may all contribute to high HIV incidence among MSM in Lima.

Given the high rates of new HIV infections, our data suggest that MSM in Lima constitute an important target population for intensified and innovative biomedical interventions. Clinical trials of HSV-2 suppression, pre-exposure chemoprophylaxis, HIV vaccines, and male circumcision among Peruvian MSM are warranted. While these trials are underway, behavioral changes, such as condom use, fewer sexual partners, and voluntary counseling and testing for HIV and STIs, should be promoted. The identification of recent HIV seroconverters would provide a unique opportunity to reduce secondary sexual transmission, given their high viremia and correspondent probabilities of sexual transmission of HIV.[32]

From 2004, the MoH of Peru and the Global Fund to Fight AIDS, Tuberculosis, and Malaria have scaled up antiretroviral therapy access in Peru. Accordingly, HIV prevalence is likely to increase regardless of changes in the incidence of HIV infection, and second-generation HIV sentinel surveillance methodology needs to be updated. An innovative approach is needed to capture the dynamic nature of the epidemic in the HAART era. Because it is critical to guide prevention and treatment programs, an innovative and integrated approach of community-based surveillance of sexual behavior in high-risk populations should be linked to monitoring HIV incidence, primary and secondary antiretroviral resistance, and phylogenetic diversity in third-generation HIV sentinel surveillance model programs.[26]

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APPENDIX

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