

and community-based colleagues have described to the study authors the benefit of having the website to facilitate easy referral for persons interested in accessing PrEP. The utility of PrEP Locator is likely the reason that in absence of an advertising budget, the website has experienced over 150,000 unique users and over 290,000 page views in the 18 months since launch.

Overall, participants were likely to endorse positive statements about PrEP, unlikely to endorse negative statements, and likely to endorse PrEP self-efficacy statements. The primary exceptions were negative beliefs about PrEP costs and about self-efficacy to obtain a PrEP prescription. These issues have both been previously identified as barriers to care.<sup>13,14</sup> Not only were these issues identified at baseline, but they remained at the 1-month follow-up. In fact, compared with baseline, more PrEP Locator users at follow-up anticipated that they would not be able to get a PrEP prescription. It is possible that these changes in perception arose from an increased familiarity with PrEP, despite the availability of navigation programs that seek to minimize the cost of seeking PrEP.

This study is limited in that it is based on a small, convenience sample of users of a PrEP-seeking website, and there is no control condition to allow for comparison. These limitations prevent us from drawing any causal conclusions. Without a representative sample or a control group, and given known selection bias, it is possible that observed progress through the PrEP continuum is unrelated to PrEP Locator. Therefore, this study can only establish the possibility that the website may contribute to movement along the continuum. Conclusions drawn from data regarding the reported usefulness of the Locator, identification of cost as a problem, and reported low self-efficacy to obtain PrEP only seek to describe website users, and are not influenced by the lack of comparison with a control condition. In addition, the convenience sample may have also affected the endorsement of negative, positive, and self-efficacy beliefs because a sample that is using a PrEP location service, presumably either due to interest in PrEP or an intention to initiate PrEP, is likely to have more favorable views of PrEP than

the general population. Although it is possible that informal use of PrEP could influence one's PrEP perceptions, all our respondents on PrEP reported obtaining it through official sources, and therefore we do not suspect this to have occurred.

The study shows that a simple, geolocated service directory has the potential to help patients who seek care. Cost and difficulty of obtaining a prescription are common barriers in the PrEP continuum. Other low-cost interventions that remove barriers to seeking and remaining in PrEP care are needed. In addition, visitors to this and other service directory websites may benefit from enhanced service navigation.

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## Barriers to HIV Testing Among Men Who Have Sex With Men in India Reached Online: Implications for Interventions

To the Editors:

#### INTRODUCTION

Indian men who have sex with men (MSM) have a higher HIV prevalence than the general Indian population

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(4.3% vs. 0.3%)<sup>1</sup> and are designated a “high-risk group” by the National AIDS Control Organization of India and a priority population for targeted HIV-prevention interventions.<sup>1</sup> However, the effectiveness of HIV-outreach interventions for MSM has been limited, in part, because of stigma and criminalization of homosexuality.<sup>2–4</sup>

Globally and in India, MSM are increasingly using online social networking sites (SNSs), such as mobile dating applications or Facebook, to find community and seek partners. Although SNSs disrupt traditional face-to-face outreach, SNSs also provide access to hard-to-reach populations. Studies among SNS-using Indian MSM have found that up to 50% are unaware of their HIV status<sup>5,6</sup> but were limited to small localities or did not examine correlates of HIV testing.

Using SNSs for health interventions could improve HIV prevention and treatment efforts for Indian MSM. Because India is a heterogeneous country with more than 1 billion people, large socioeconomic and health disparities, and widely varying HIV prevalence across states, country-wide inferences cannot be made based on a few localities. We therefore conducted a national survey of SNS-using MSM to elucidate factors associated with HIV testing and serostatus awareness.

## METHODS

### Study Design, Setting, and Participants

Zero meters away was a cross-sectional, self-administered, anonymous survey conducted from January 6, 2017, to February 5, 2017. Indian MSM were recruited by advertisements on 3 MSM-specific mobile SNS and LGBTQ Facebook and Instagram groups. The survey was hosted by Surveygizmo (Boulder, CO) and began with study information and informed consent. We limited duplicate respondents using web browser cookies and restricting to single IP addresses. On completion, respondents were provided with HIV prevention and testing resources and given the option to enter contact information (unlinked to responses) for a chance to win a 1000 Indian rupee (approximately \$15 USD)

Amazon.co.in gift card. Inclusion criteria were (1) aged 18 years and older, (2) identifying as male (cis- or trans-), (3) anal sex with male or transgender partners in past 2 years, and (4) born in India and living there at the time of the study. Human subjects research review boards at the Humsafar Trust (an LGBTQ community-based organization in Mumbai, India) and Albert Einstein College of Medicine (Bronx, United States) approved the study.

### Survey Development and Measures

We partnered with the Humsafar Trust to adapt an online survey of MSM and HIV,<sup>7</sup> translate the survey into Hindi, and refine it to ensure conceptual accuracy.<sup>8</sup> We assessed sexual identity with categories used in India (panthi, kothi, double decker, gay/homosexual, bisexual, and straight/heterosexual),<sup>9–11</sup> but because very few respondents selected panthi, kothi, or double decker, we reclassified these as gay/homosexual. We asked about past 6-month anal sex and condomless anal sex (CAS), and about past 12-month number and types of sexual partners, drug/alcohol use during sex, and sexually transmitted infections. We measured perceived HIV stigma by calculating mean responses to the following items,<sup>12</sup> which ask agreement on a 5-point scale: “Most people in my area would (1)...discriminate against someone with HIV, (2)...think that people who got HIV through sex or drug use deserve what they have gotten, and (3)...support the rights of a person with HIV to live and work wherever they wanted.” We asked about monthly household income and classified  $\leq 10,000$  rupees/month as living in poverty and between 10,001 and 20,000 as low income. To assess our primary outcome, we dichotomized responses to “Have you ever been tested for HIV?” as yes vs. no/don’t know. Among those responding yes, we assessed how long ago and setting of last HIV test. For those never tested, we assessed reasons for not HIV testing.<sup>13,14</sup>

### Analysis

We excluded responses with missing data and characterized the sample using summary statistics. We performed

bivariable and multivariable analysis to determine factors associated with ever HIV testing, using generalizing estimating equations for logistic regression to account for clustering by state. We included all variables significant ( $P < 0.1$ ) in bivariable analysis in multivariable models and report adjusted odds ratios and 95% confidence intervals. We conducted sensitivity analyses to explore how missing data ( $n = 2458$  with incomplete surveys) affected estimates, using multiple imputation with chained equations.<sup>15</sup> Because models run with multiple imputation yielded similar results, only results from complete case analyses are presented. We used Stata SE, version 15 (StataCorp, College Station, TX).

## RESULTS

### Participant Characteristics

Of 6637 MSM meeting inclusion criteria, 4179 (63%) completed all items used in the present analysis. Median age was 26 years (interquartile range 23–30), most (83%) completed college, many lived in poverty (15%) or were low income (21%), 18% responded in Hindi, and 0.4% ( $n = 17$ ) identified as transgender MSM. Respondents came from all Indian states (range,  $n = 5$  to  $n = 1124$ ), including 17% rural/semirural.

Most respondents identified as either gay/homosexual (49%) or bisexual (46%). Most (75%) had past 6-month anal sex and 42% had CAS, with 41% reporting more than 6 partners in the past 12 months and 67% reporting casual male partners. Although most (60%) had disclosed sex with/attraction to men to someone, only 23% had disclosed having sex with men to a doctor. Regarding access to HIV testing, only 37% indicated that it was easy/very easy to access free HIV testing, although 47% indicated being aware of a laboratory where they would feel comfortable obtaining testing. Mean score on the 3 questions assessing perceived HIV stigma was  $2.5 \pm 0.81$  (range 1–5; higher scores indicate greater stigma).

### Factors Associated With HIV Testing

Almost half (47%) had never been HIV tested, with those reporting CAS

**TABLE 1.** Sociodemographic, Behavioral, and Structural Characteristics Associated With HIV Testing Among Online MSM in India

Characteristic	Total		Ever Tested	Odds of Association With Ever Testing for HIV			
	N	%	n (%)	OR	95% CI	aOR§	95% CI
Total	4179	100	2215 (53)				
<b>Sociodemographic</b>							
Age							
18–23	1116	26.7	415 (37)	ref		ref	
24–29	1780	42.6	966 (54)	2.03‡	1.72 to 2.41	<b>1.65‡</b>	<b>1.44 to 1.88</b>
30–39	1035	24.8	665 (64)	2.99‡	2.40 to 3.73	<b>2.25‡</b>	<b>1.81 to 2.79</b>
40–49	206	4.9	145 (70)	3.53‡	2.60 to 4.78	<b>3.15‡</b>	<b>2.29 to 4.33</b>
50+	42	1.0	24 (57)	2.40‡	1.17 to 4.90	2.11	0.76 to 5.89
Language survey taken							
Hindi	790	18.3	362 (48)	0.83*	0.71 to 0.96	0.89	0.79 to 1.72
English	3522	81.7	1853 (54)	ref		ref	
Highest education							
Less than high school	110	2.6	43 (39)	ref		ref	
High school	270	6.5	103 (38)	0.96	0.63 to 1.47	1.06	0.57 to 1.97
Some college	322	7.7	144 (45)	1.27	0.81 to 1.98	1.62	0.84 to 3.14
College	2896	69.3	1546 (53)	1.78‡	1.37 to 2.33	1.62	0.97 to 2.68
Graduate school	580	13.9	378 (65)	2.92‡	1.99 to 4.28	<b>2.07*</b>	<b>1.17 to 3.64</b>
Household income (Indian Rs/mo)							
≤10,000	629	15.1	253 (40)	ref		ref	
10,001–15,000	413	9.9	185 (45)	1.19*	1.00 to 1.42	1.07	0.82 to 1.41
15,001–20,000	468	11.2	267 (57)	1.96‡	1.50 to 2.56	<b>1.59†</b>	<b>1.20 to 2.12</b>
20,001–40,000	903	21.6	471 (52)	1.62‡	1.32 to 1.98	1.15	0.85 to 1.55
>40,000	1766	42.3	1039 (59)	2.11‡	1.82 to 2.46	<b>1.31*</b>	<b>1.04 to 1.66</b>
City size							
Rural	415	9.9	145 (44)	ref		ref	
Semirural	385	9.2	200 (51)	1.42*	1.08 to 1.87	1.29	0.92 to 1.81
Urban	1194	28.6	614 (51)	1.41†	1.10 to 1.80	1.08	0.81 to 1.45
Metropolis	2179	52.2	1256 (56)	1.77‡	1.38 to 2.26	1.12	0.83 to 1.52
<b>Behavioral</b>							
Sexual identity							
Gay/homosexual	2034	48.7	1168 (57)	ref		ref	
Bisexual	1910	45.8	970 (51)	0.77†	0.64 to 0.92	0.96	0.84 to 1.09
Straight/heterosexual	230	5.5	72 (31)	0.34‡	0.25 to 0.45	<b>0.65†</b>	<b>0.49 to 0.85</b>
Anal sex in past 6 mo	3180	75.4	1742 (55)	1.4‡	1.26 to 1.55	<b>1.53‡</b>	<b>1.36 to 1.73</b>
CAS in past 6 mo	1771	42.4	882 (50)	0.80‡	0.71 to 0.90	<b>0.68‡</b>	<b>0.58 to 0.80</b>
>6 sex partners in past 6 mo	1690	40.6	973 (58)	1.48‡	1.33 to 1.65	1.07	0.86 to 1.33
Sex partner: casual male	3223	66.8	1749 (67)	1.05	0.95 to 1.17		
Sex partner: transgender woman	70	1.7	35 (50)	0.89	0.63 to 1.25		
Sex partner: wife or girlfriend	954	22.8	515 (54)	1.05	0.87 to 1.27		
Sex partner: paid male	323	7.7	199 (62)	1.46†	1.14 to 1.88	1.17	0.97 to 1.42
Sex partner: paid female	85	2	36 (42)	0.65†	0.46 to 0.90	<b>0.59†</b>	<b>0.38 to 0.84</b>
Drug or alcohol use with sex in past 12 mo	1246	29.8	786 (63)	1.80‡	1.49 to 2.16	<b>1.43†</b>	<b>1.17 to 1.76</b>
Diagnosed with STI in past 12 mo	286	6.8	203 (71)	2.29‡	1.68 to 3.10	<b>1.78†</b>	<b>1.25 to 2.53</b>
<b>Structural</b>							
“Out” to anyone about sex with or attraction to men	2508	60	1483 (59)	1.86‡	1.59 to 2.18	<b>1.35‡</b>	<b>1.18 to 1.54</b>
Disclosed having sex with men to a doctor	938	22.4	740 (79)	4.64‡	3.74 to 5.76	<b>3.55‡</b>	<b>2.76 to 4.58</b>
Easy to access free HIV testing	1559	37.3	953 (61)	1.69‡	1.51 to 1.88	1.11	0.95 to 1.30
Aware of a comfortable HIV-testing site	1965	47	1363 (69)	3.60‡	3.13 to 4.14	<b>3.01‡</b>	<b>2.63 to 3.45</b>
Perceived HIV stigma   (mean ± SD)	2.5	±0.81	2.45 (0.80)	0.84‡	0.79 to 0.90	<b>0.85†</b>	<b>0.76 to 0.94</b>

\*P < 0.05.

†P < 0.01.

‡P < 0.001.

§Multivariable logistic regression model adjusted for all other covariates in the column for which data are presented.

|| Increasing values indicate higher levels of perceived stigma on a scale of 1–5.

aOR, adjusted odds ratio; OR, odds ratio; STI, sexually transmitted infection.

less likely to have HIV tested than those reporting no CAS (44% vs. 50%,  $P < 0.001$ ). Among those with previous HIV testing ( $n = 2215$ ), 25% had last tested more than 12 months prior and 5.4% were HIV positive. Multivariable analysis (Table 1) revealed that younger age, lower income, less education, CAS, no drugs/alcohol during sex, no access to comfortable testing site, paid female sex partner, nondisclosure of sexual identity or behavior, and more perceived stigma were associated with never HIV testing ( $P < 0.01$  for all variables).

### Reasons for Not Testing

Most common reasons for not testing were low perceived risk (42%), feeling scared (20%), and not knowing where to test (15%). Reasons did not significantly differ by age, geography (rural vs. urban), income, education, or language of survey completion.

### DISCUSSION

Among a large, diverse sample of sexually active Indian MSM recruited online, we found that nearly half (47%) of more than 4000 respondents had never been tested for HIV. This estimate was higher among those reporting CAS (50%) than among those reporting no CAS (44%). We further found that modifiable factors, including access to free testing and availability of comfortable testing sites, were associated with HIV testing. Finally, we found that respondents who had disclosed their sexuality to doctors or others were more likely to have HIV tested.

This is the first study to characterize SNS-using MSM across India and describe their HIV-testing behaviors. Previous national or multicity samples of Indian MSM were recruited through physical venue-based approaches and demonstrated similar or higher rates of HIV testing, ranging from 51% to 82%.<sup>1,16</sup> Although the HIV-testing prevalence we observed is comparable with smaller studies of Indian MSM recruited online,<sup>5,6</sup> previous studies have not examined correlates of HIV testing. In addition, previous studies have not provided country-wide data needed to guide testing interventions for Indian MSM. Our finding that individuals having CAS

were less likely to have been HIV tested is consistent with previous studies and suggests that greater education about HIV is needed.<sup>17</sup>

There have been significant efforts toward scaling-up HIV testing across India, and the National AIDS Control Organization guidelines now recommend that sexually active MSM get HIV tested every 6 months.<sup>1</sup> Our results reveal significant gaps between these recommendations and current HIV-testing behaviors among Indian MSM. Scalable interventions that circumvent barriers to HIV testing might include online outreach to MSM to link them to confidential primary care and sexual health services, dissemination of information about MSM-sensitive HIV-testing and HIV-prevention services, and provision of HIV self-testing.<sup>18</sup> Online outreach could also be used to link individuals to offline community-vetted HIV-testing sites in addition to public integrated counseling-testing centers<sup>19</sup> because we found that most respondents sought testing in the private sector.

The generalizability of our findings is limited partially by high levels of education and income among respondents (eg, 69.3% completed college compared with 11.5% of Indian men overall).<sup>20</sup> In addition, our survey was cross-sectional, and causality cannot be inferred. Questions may have been misunderstood despite extensive piloting, and survey respondents had to be fluent in English or Hindi. Finally, the survey may have been inaccessible to some rural MSM because of limited or unstable Internet connectivity. Despite these limitations, our results underscore the need for rapid development and implementation of robust online HIV-prevention interventions for Indian MSM.

In conclusion, we found that nearly half of online MSM in India had not had an HIV test, despite high education and income levels. These results highlight the need for increased availability and ease of HIV testing. Because low-risk perception was a common reason for not testing, more HIV education is also needed. Finally, because social stigma may prevent access to HIV services, both online and structural interventions are needed to address stigma, foster social acceptance,

and increase availability of culturally competent and nonjudgmental health services for MSM.

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