THERAPEUTIC ADVANCES in
Infectious Disease

Original Research

Social disparities on PrEP use and awareness among sexual and gender minorities using smartphones in India

Ther Adv Infect Dis

2024, Vol. 11: 1–13

DOI: 10.1177/20499361241299992

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Abstract

Background: Pre-exposure prophylaxis (PrEP) is a safe and effective HIV prevention strategy. However, in countries such as India where PrEP is driven by the private healthcare system and there is no centralized reporting, it is unknown which populations benefit from PrEP and which populations are being left behind.

Objectives: We examined and characterized PrEP use and awareness among the sexual and gender minorities using smartphones in India and found measures of association of PrEP use.

Design: This is a cross-sectional study design.

Methods: We used Grindr—a widely used geosocial mobile application—to conduct a national cross-sectional survey in India, including respondents who were 18 years or older and reported sex with men (those who identified as cis-gender females were excluded). We examined overall PrEP awareness and PrEP use, then calculated adjusted prevalence odds ratio and 95% confidence intervals to understand PrEP use correlation with socio-behavioral factors.

Results: Out of the total of 3116 eligible participants, 30.3% ($N = 947$) were aware of PrEP and 3.1% ($N = 97$) reported current PrEP use. Our multivariate regression model found that there was a statistically significant association of PrEP use with higher income, being employed, preferred language as English for survey, relationship status as single, and use of party drugs. At the same time, there was a statistically significant association of PrEP awareness with age group, having higher education as a graduate or above, higher income, use of party drugs, and multiple sexual partners.

Conclusion: We found overall low awareness and low PrEP use in our cross-sectional sample. PrEP use and awareness were higher among those who belonged to higher-income groups. Including PrEP in existing programmatic interventions by government and NGOs may contribute to PrEP scale-up, which is urgent to stop the HIV epidemic in India.

Plain language summary

PrEP use and awareness among gay and bisexual men and other sexual/gender minorities in India

In India, where the private healthcare system drives pre-exposure prophylaxis (PrEP) for HIV prevention without centralized reporting, it's unclear who benefits from PrEP and who misses out. So, we set out to study PrEP use and awareness among sexual and gender minorities in India using smartphones. We used Grindr, a popular app, for a national survey. We looked at PrEP awareness and use, and how it related to people's backgrounds

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and behaviors. We surveyed 3116 people, mostly men who have sex with men. Around 30% knew about PrEP, and only 3% were currently using it. Those with higher income, who preferred English, were single, used party drugs, or were open about their sexuality were more likely to use PrEP. Overall, PrEP awareness and use were low. Those with more money were more likely to use it. We suggest including PrEP in existing government and NGO programs to ramp up its use and fight the HIV epidemic in India.

Keywords: HIV, HIV in India, pre-exposure prophylaxis, PrEP in India, PrEP use in India, sexual reproductive health in India

Received: 11 November 2023; revised manuscript accepted: 29 October 2024.

Introduction

With an increase in the use of smartphones, and subsequent availability of social networking apps, seeking short or long-term sexual partners has become easier, especially for sexual and gender minorities (SGM) in India.[1,2] Simultaneously, smartphones have made it easier to access information about HIV on the internet, including seeking HIV prevention strategies like pre-exposure prophylaxis (PrEP), which is provided by many private or not-for-profit organizations in India. However, little is known about the extent to which SGM smartphone users in India are aware of or use PrEP, and if certain populations are underreached by public health efforts to promote PrEP in India.

Tenofovir-based oral PrEP is an effective HIV prevention method for populations with higher risk of HIV acquisition.[3] Systematic reviews have revealed that, if adherent, PrEP is effective in preventing HIV seroconversion with a reduction in relative risk of as much as 86%.[4] In India, PrEP is not yet a part of the prevention strategy of the government's National AIDS Control Organization. However, high rates of PrEP eligibility (described by the authors of the paper as participants screened positive for any of the following: condomless anal sex, sex work, >1 male partner (all past month), physician-diagnosed sexually transmitted infection (past-year), or alcohol use before last anal sex) at 92.9% and high willingness to use oral PrEP at 76.7% have been reported in India ($n = 197$) among men having sex with men (MSM).[5,6] A qualitative study conducted in two cities in India also reflects the willingness to use PrEP among SGM.[7]

There is a need to effectively implement PrEP in India,[8] but there is very little knowledge about PrEP use at a national level in India since PrEP is being provided through private practitioners with no centralized or consistent data reporting. Currently, most of the existing literature has findings limited to regional settings only.[5–7,9,10] We therefore aimed to evaluate the awareness and use of oral PrEP and examine the factors that were associated with PrEP awareness and use in a national cross-sectional convenience sample of SGM in India who used the Grindr application on a smartphone.

Methods

Study design

We conducted a cross-sectional survey among a convenience sample of Indian SGM who used the social networking app Grindr between May and June 2022. The survey was pilot tested among 10 community members and revisions were made based on their feedback. The survey was administered through Qualtrics and was sent to all Grindr users in India was available in Hindi and English and contained 37 questions regarding demographics, behavior, HIV testing, and PrEP use. Participants completed the survey once and no follow-ups were conducted. The reporting of this study conforms to the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) statement.[11] Additional details of the study design are described in more detail elsewhere.[12]

Study population

Our study population was defined as adult (⩾18 years) Grindr users living in India, who identified as SGM and sexually engaged with a male-identifying partner. We excluded individuals

identifying as cisgender women, those assigned female sex at birth (including those with same-sex sexual partners); or those individuals who were not sexually active with a male-identifying partner. For the purposes of this article, when we use the term SGM, we are referring to those who meet the criteria defined here.

PrEP awareness and use

Apart from questions around socio-demographics (such as education, income, caste, etc) and sexual behavior questions (such as condom use, transactional sex, and substance use) that have been previously described,[12] we also included questions about PrEP awareness: "Have you heard about Pre-exposure Prophylaxis or PrEP?" with answers "Yes" and "No"; along with PrEP use: "Have you ever used PrEP?" with answers "Yes in the past", "Yes currently on PrEP" and "Never."

Outcomes, predictor, and covariates

Our primary outcomes were PrEP use and PrEP awareness. The predictors of the outcomes included age, education, sexual orientation, language selected to take the survey, monthly income, employment, area (rural or urban), caste, sexual preference, relationship status, multiple sexual partners, use of party drugs, transactional sex, condom usage, if they were touch in NGOs providing HIV/AIDS services, if they were open about their sexual orientation and if they attended LGBTQ events. We drew directed acyclic graphs (DAGs)—illustrated in images 1 and 2—based on prior knowledge to select covariates for each outcome and predictor combination.[13,14]

Data cleaning and statistical analysis

We imported the completed and cleaned dataset in the Google Colab environment and used Python for data manipulation and analysis. Any rows with missing data were excluded. The flowchart (Figure 1) illustrates the number of people excluded at each stage based on inclusion and exclusion criteria. We created frequency tables and then converted the outcome variables of PrEP use into "any PrEP use," combining past and current use into one variable. We ran logistic regression models to first calculate prevalence odds ratios (PORs) and 95% confidence intervals (CIs) between PrEP use, and PrEP heard with the demographic and sexual behavior variables. Then, we calculated the adjusted PORs, and their 95% CIs after considering the effect of covariates.

Ethics approval and consent to participate

We obtained IRB approvals from The University of North Carolina at Chapel Hill Institutional Review Board (IRB Number: 22-0727) and from the Sigma IRB in India (IRB Number: 10099/IRB/21-22). All participants provided electronic informed consent before starting the survey. No personally identifiable information was collected from any of the participants.

To align our research with the principles of the TRUST Code for Equitable Research Partnerships, the authors ensured local relevance by collaborating with local community members and testing the survey with them. Additionally, we incorporate informed consent practices tailored to the local context, following principles of honesty and care by providing clear, understandable information to all participants in Hindi and English.

Results

We included 3116 eligible participants in this analysis; 56.4.% ($N=1758$) belonged to the 25–34 age group. More than half identified as gay (53.8%, $N=1674$). Out of 36 states and union territories of India, Maharashtra state contributed to 30.7% ($N=959$) of respondents, followed by Uttar Pradesh at 11.03% ($N=344$) and Delhi and Gujarat at around 6%. Rajasthan and Madhya Pradesh states both contributed to approximately 5% of the total sample size. People from Haryana constituted 4.6% of the sample. The southern state of Karnataka also had 4.6% of the total sample size while Tamil Nadu constituted 3.6%. Most other states contributed to less than 2% of the total sample.

Our sample consisted of more educated participants, with 70.4% ($N=2192$) having a graduate degree or higher. This survey was taken in English by 52.1% of participants($N=1625$); the remaining participants preferred to take the survey in Hindi. At the same time, 70.6% ($N=2199$) reported living in urban areas. Our sample had 60.6% ($N=1885$) participants belonging to the general caste, with 25% ($N=780$), 10.8% ($N=338$), and 3.6% ($N=113$) belonging to

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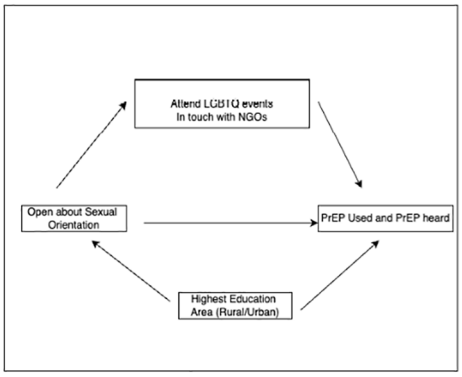

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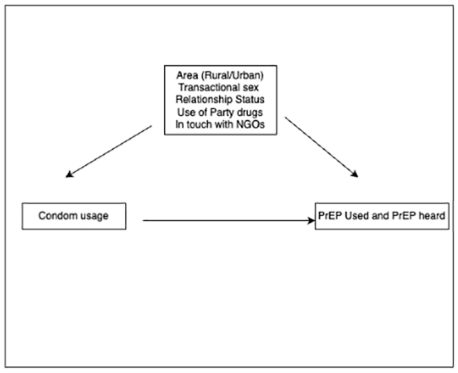

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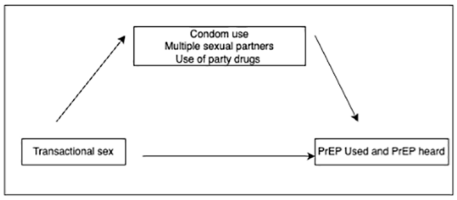

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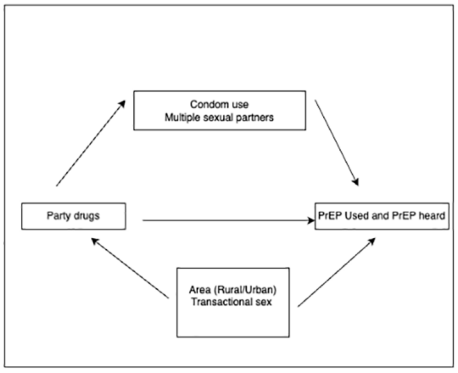

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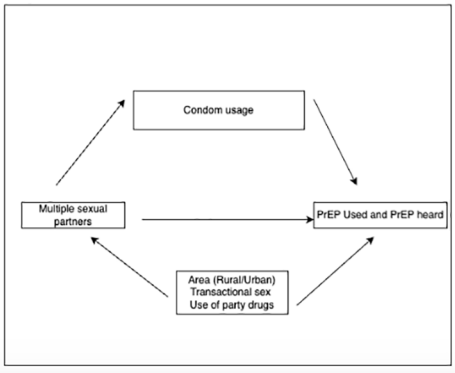

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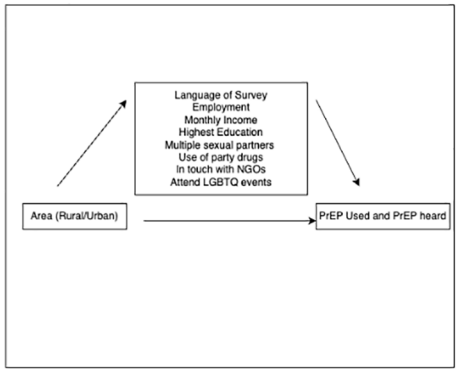

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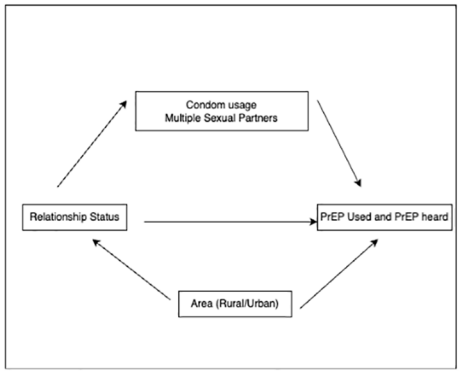

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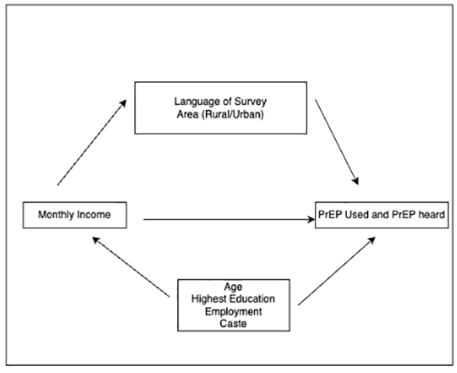

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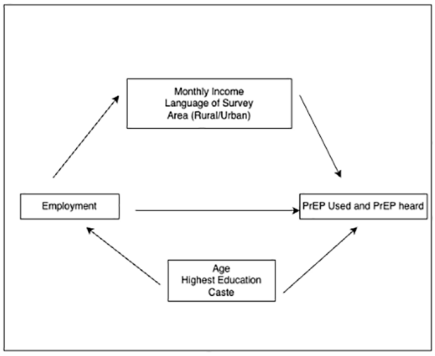

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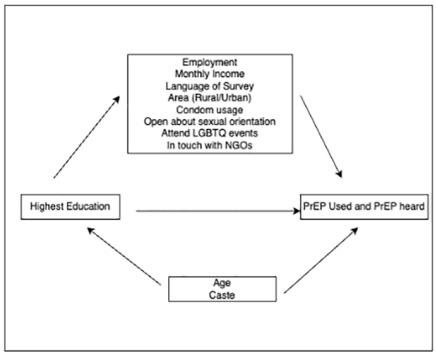

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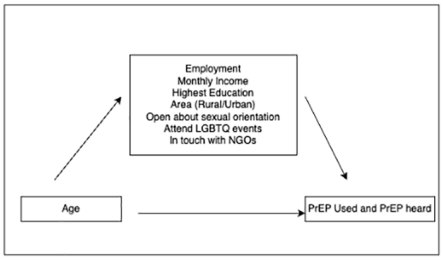

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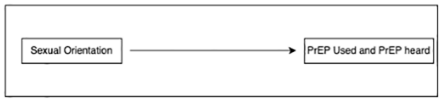

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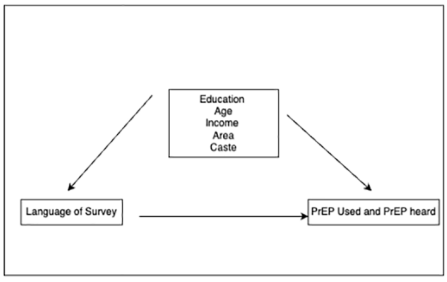

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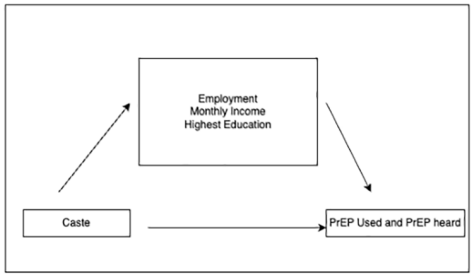

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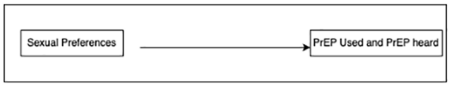

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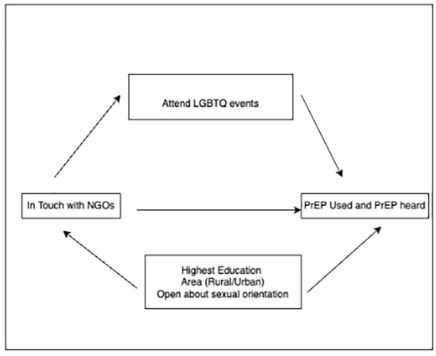

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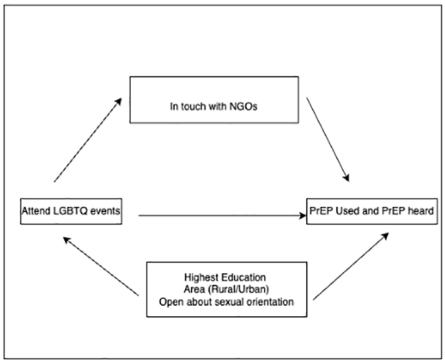

Image 1 and 2. Directed acyclic graphs (DAGs) used for selecting covariates for multivariate analysis.

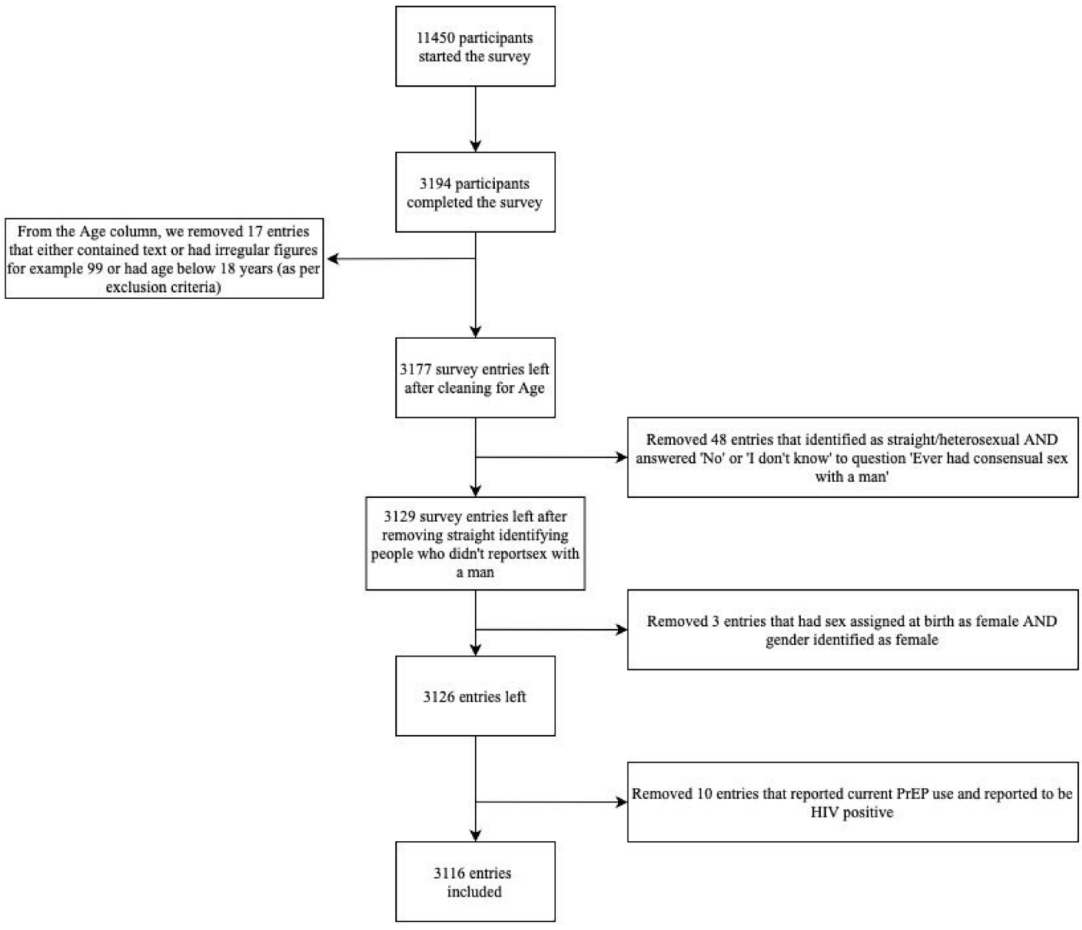

Figure 1. Applying inclusion and exclusion criteria for survey participants.

Other Backward Classes, Scheduled Castes, and Scheduled Tribes, respectively. Fifty-five percent of ($N=1726$) participants who not out to anyone about their sexual orientation. Further, 81.3% ($N=2534$) had never participated in any LGBTQIA+ events. Only 16.1% ($N=501$) were in touch with nonprofits providing HIV or sexual health-related services. Prevalence of use of party drugs was at 6.3% ($N=196$), and 15.1% ($N=473$) of participants reported engaging in transactional sex.

We describe PrEP use and PrEP awareness according to socio-behavior characteristics in Table 1 along with crude and adjusted prevalence odds ratio and CIs. Prevalence of current PrEP use was 3.1% ($N=97$); 3.9% ($N=122$) had used PrEP in the past but were not using it anymore. Concurrently, 30.3% ($N=947$) reported being aware of PrEP.

Higher odds of PrEP heard were among those who belonged to age group 18–25 (aPOR 1.33 [1.025, 1.74]), chose English as the preferred option for survey (aPOR 4.92 [4.05, 5.99]), had an income of more than 21,000 INR (aPORs in Table 1), lived in urban area (1.24 [1.01, 1.52]), had multiple sexual partners (aPOR 2.18 [1.85, 2.57]), used party drugs (aPOR 4.68 [3.39, 6.46]), were open about their sexual orientation (aPOR 2.00 [1.70, 2.37]), were in touch with NGOs (aPOR 2.49 [2.00, 3.10]) and who attended LGBTQ events (aPOR 2.5 [0.71, 1.12]).

For PrEP use, we observed higher odds among those who chose English (aPOR 2.04 [1.53, 2.75]) as their survey language, were employed (aPOR 1.94 [1.24, 3.05]), had an income more than INR 41,000 (aPORs in Table 1), were single (aPOR 2.26 [1.38, 3.70]), used party drugs (aPOR 4.38 [3.02, 6.35]), had transactional sex

Table 1. Unadjusted and adjusted prevalence odds ratio for PrEP use and PrEP awareness.

Independent variable	*N* (%)	PrEP use in group *N* (%)	Ever used PrEP		PrEP Heard in group *N* (%)	Heard of PrEP	
			Unadjusted prevalence odds ratio and CI	Adjusted prevalence odds ratio and CI		Unadjusted prevalence odds ratio and CI	Adjusted prevalence odds ratio and CI
Age group (years)							
18–24	671 (21.5)	48 (7.1)	Ref		172 (25.6)	Ref	
25–35	1758 (56.4)	126 (7.1)	1.00 [0.71, 1.41]	1.01 [0.66, 1.56]	532 (30.2)	1.26 [1.03, 1.54]*	1.33 [1.025, 1.74]*
Above 35	687 (22.0)	45 (6.5)	0.91 [0.59, 1.39]	0.85 [0.50, 1.44]	233 (34)	1.49 [1.18, 1.88]***	1.27 [0.92, 1.75]
Sexual orientation							
Straight/ Heterosexual	180 (5.8)	10 (5.5)	Ref		42 (23.3)	Ref	
Gay	1674 (53.8)	120 (7.1)	1.31 [0.68, 2.56]	—	528 (32.1)	1.56 [1.09, 2.23]*	—
Bisexual	877 (28.1)	62 (7)	1.29 [0.65, 2.57]	—	258 (29.4)	1.37 [0.94, 1.99]	—
Queer, Pansexual, Asexual, Fluid et al.[a]	385 (12.3)	27 (7.5)	1.28 [0.61, 2.71]	—	99 (25.7)	1.14 [0.75, 1.72]	—
Highest education							
Up to intermediate	924 (29.6)	71 (7.6)	Ref	—	187 (20.2)	—	—
Graduate or above	2192 (70.4)	148(6.7)	0.87 [0.65, 1.17]	0.72 [0.51, 1.01]	750 (34.2)	2.05 [1.71, 2.46]***	1.09 [0.87,1.37]*
Language							
Hindi	1491 (47.85)	70 (4.6)	Ref		193 (12.9)	Ref	
English	1625 (52.15)	149 (9.1)	2.04 [1.53, 2.75]***	2.19 [1.58, 3.03]***	744 (45.8)	5.68 [4.74, 6.80]***	4.92 [4.05, 5.99]***
Employment							
Unemployed	556 (17.8)	23 (4.1)	Ref		115 (20.7)	Ref	
Student	549 (17.6)	40 (7.2)	1.82 [1.08, 3.08]*	1.53 [0.85, 2.74]	171 (31.1)	1.73 [1.32, 2.28]***	1.26 [0.91, 1.75]
Employed (Self or at a company)	2011 (64.6)	156 (7.7)	1.94 [1.24, 3.05]**	1.79 [1.00, 3.18]*	651 (32.4)	1.83 [1.47, 2.3]***	0.76 [0.54, 1.07]
Monthly income							
I don't have an income	1182 (37.9)	71 (6)	Ref		275 (23.2)	Ref	
Up to INR 21,000	883 (28.3)	64 (7.2)	1.22 [0.86, 1.73]	1.04 [0.64, 1.70]	198 (22.4)	0.95 [0.78, 1.17]	1.23 [0.90, 1.70]

(Continued)

Table 1. (Continued)

Independent variable	*N* (%)	PrEP use in group *N* (%)	Ever used PrEP		PrEP Heard in group *N* (%)	Heard of PrEP	
			Unadjusted prevalence odds ratio and CI	Adjusted prevalence odds ratio and CI		Unadjusted prevalence odds ratio and CI	Adjusted prevalence odds ratio and CI
Between INR 21,000 to INR 41,000	432 (13.8)	24 (5.5)	0.92 [0.57, 1.48]	0.74 [0.39, 1.33]	151 (34.9)	1.77 [1.39, 2.25]***	1.67 [1.164, 2.39]**
Between INR 41,000 to INR 62,000	229 (7.34)	22 (9.6)	1.66 [1.00, 2.74]*	1.30 [0.68, 2.47]	100 (43.7)	2.56 [1.90, 3.43]***	2.14 [1.42, 3.23]***
Above INR 62,000	390 (12.5)	38 (9.7)	1.69 [1.11, 2.55]*	1.36 [0.75, 2.45]	213 (54.6)	3.97 [3.12, 5.05]***	2.98 [2.05, 4.35]***
Area							
Rural	917 (29.4)	85 (9.2)	Ref		227 (24.8)	Ref	
Urban	2199 (70.6)	134 (6)	0.64 [0.48, 0.84]**	0.62 [0.46, 0.84]*	710 (32.3)	1.45 [1.22, 1.73]***	1.24 [1.01, 1.52]*
Caste							
Scheduled Tribe	113 (3.6)	7 (6.2)	Ref		36 (31.9)	Ref	
Scheduled Caste	338 (10.8)	18 (5.3)	0.85 [0.35, 2.10]	0.89 [0.36, 2.20]	90 (26.6)	0.77 [0.49, 1.24]	0.84 [0.52, 1.35]
Other Backward Classes	780 (25)	52 (6.6)	1.08 [0.48, 2.44]	1.12 [0.49, 2.53]	195 (25)	0.71 [0.46, 1.09]	0.678 [0.43, 1.06]
General	1885 (60.6)	142 (7.5)	1.23 [0.56, 2.70]	1.21 [0.55, 2.70]	616 (32.7)	1.04 [0.69, 1.56]	0.91 [0.59, 1.39]
Sexual preferences							
Side (Doesn't indulge in penetrative sex)	390 (12.5)	12 (3)	Ref		138 (35.4)	Ref	
Bottom (Receptive sexual positioning)	687(22)	58 (8.4)	2.9 [1.54, 5.48]***	—	210 (30.6)	0.80 [0.62, 1.05]	—
Top (Insertive Sexual Positioning)	934 (30)	66 (7.1)	2.40 [1.28, 4.48]**	—	245 (26.2)	0.65 [0.50, 0.84]***	—
Versatile(Both receptive and Insertive sexual positioning)	1105 (35.6)	83 (7.5)	2.56 [1.38, 4.74]**	—	344 (31.1)	0.83 [0.65, 1.05]	—
Relationship status							
I am in a relationship	506 (16.2)	18 (3.5)	Ref		148 (29.2)	Ref	
I am single	2610 (83.8)	201 (7.7)	2.26 [1.38, 3.70]**	2.21 [1.35, 3.63]*	789 (30.2)	1.05 [0.85, 1.29]	1.04 [0.84, 1.30]

(Continued)

Table 1. (Continued)

Independent variable	*N* (%)	PrEP use in group *N* (%)	Ever used PrEP		PrEP Heard in group *N* (%)	Heard of PrEP	
			Unadjusted prevalence odds ratio and CI	Adjusted prevalence odds ratio and CI		Unadjusted prevalence odds ratio and CI	Adjusted prevalence odds ratio and CI
Multiple sexual partners in last 3 months							
No	1859 (59.6)	104 (5.6)	Ref		424 (22.8)	Ref	
Yes	1257 (40.4)	115 (9.1)	1.70 [1.29, 2.24]***	1.40 [1.04, 1.87]*	513 (40.8)	2.3 [2.00, 2.72]***	2.18 [1.85, 2.57]***
Condom usage							
Always	1597 (51.2)	134 (8.3)	Ref		529 (33.1)	Ref	
Sometimes	926 (29.8)	64 (6.9)	0.81 [0.59 1.1]	0.90 [0.65, 1.23]	256 (27.6)	0.77 [0.65, 0.92]**	0.83 [0.69, 1.00]*
Not at all	593 (19)	21 (3.5)	0.4 [0.25, 0.64]***	0.47 [0.29, 0.76]*	152 (25.6)	0.69 [0.56, 0.86]***	0.77 [0.61, 0.96]*
Use of party drugs							
No	2920 (93.7)	176 (6)	Ref		809 (27.7)	Ref	
Yes	196 (6.3)	43 (21.9)	4.38 [3.02, 6.35]***	3.42 [2.30, 5.13]***	128 (65.3)	4.91 [3.62, 6.66]***	4.68 [3.39, 6.46]***
Transactional sex							
No	2643 (84.9)	162 (6.1)	Ref		776 (29.4)	Ref	
Yes	473 (15.1)	57(12)	2.10 [1.52, 2.89]***	1.46 [1.03, 2.07]*	161 (34.0)	1.24 [1.09, 1.53]*	0.84 [0.66, 1.05]
Open about sexual orientation							
Not at all	1726 (55.3)	97 (5.6)	Ref		369 (21.3)	Ref	
Out to either friends, family, or everyone	1390 (44.7)	122 (8.7)	1.62 [1.22, 2.13]***	1.40 [1.05, 1.87]*	568 (40.9)	2.54 [2.17, 2.97]***	2.00 [1.70, 2.37]***
In Touch with NGOs							
No	2615 (83.9)	143 (5.4)	Ref		669 (25.6)	Ref	
Yes	501 (16.1)	76 (15.1)	3.09 [2.30, 4.16]***	2.35 [1.70, 3.27]***	268 (53.5)	3.35 [2.75, 4.07]***	2.49 [2.00, 3.10]***
Attend LGBTQ events							
Never	2534 (81.3)	141 (5.5)	Ref		618 (24.4)	Ref	
Others	582 (18.7)	78 (13.4)	2.63 [0.67, 1.26]***	1.78 [0.24, 0.91]***	319 (54.8)	3.76 [1.14, 1.51]***	2.5 [0.71, 1.12]***

[a]Other includes Queer, Pansexual, Asexual, and other gender identities identifiable in the Grindr application.
***$p < 0.001$. **$p < 0.01$. *$p < 0.05$.
PrEP, pre-exposure prophylaxis.

(aPOR 2.10 [1.52, 2.89]), were open about their sexual orientation (aPOR 1.62 [1.22, 2.13]), were in touch with NGOs (aPOR 3.09 [2.30, 4.16]) and attended LGBTQ events (aPOR 2.63 [0.67, 1.26]).

Discussion

Our study reports overall low awareness and use of PrEP, even as other studies report a high willingness and eligibility to use PrEP among sexual and gender minority groups in India.[6,15–18] However, PrEP awareness reported in our study is higher than a systematic review that reported PrEP awareness among MSM and Transgenders to be 18.7%). Sethi and colleagues in their cross-sectional analysis of MSM and transgender in the capital city of Delhi also found relatively lower PrEP awareness at 14.5%.[17,19] Another analysis conducted in Telangana state found PrEP awareness to be further low at 7%. These differences could be a result of the way responses were collected—since we used app users who had access to smartphones and the internet, we likely reached people who are more connected.[18]

Further, we found that both PrEP use and awareness were restricted to higher strata of society such as those who had higher incomes and those who chose English as their language for the survey. This reflects a wider economic disparity in PrEP use in India. However, we did not find any correlations with caste.

Modeling studies estimating the benefits of PrEP use predict that it would reduce new infections[20] and be a cost-effective strategy to handle HIV/AIDS in India.[21,22] Amidst these potential benefits, low awareness and low use of PrEP elicit a need for further awareness campaigns around PrEP, and for PrEP to become accessible to individuals who are at high risk of HIV infection—not just those who are in higher-income brackets. That being said, cost-associated barriers are preventing PrEP use both locally and globally. In the Netherlands, 45.6% ($N=159$) reported to be using PrEP once the generic PrEP was introduced for the MSM community; similarly to our study, better economic situation was associated with higher PrEP use.[23] Another study in Italy reported high knowledge of PrEP—87.2% ($N=171$) among MSM but only 7.5% ($N=15$) ever used, reporting the high cost of PrEP as a key reason for not using.[24]

Interestingly, those who preferred receiving anal sex (either strictly or as one of other preferences) had higher odds of using PrEP. We did not find significant correlations for those who preferred to penetrate, indicating this population may have a lower risk perception. In our own sample, we found that 24% of the participants reporting to live with HIV preferred to penetrate, indicating that this misconception among this population should be targeted by interventions.

Being out as an LGBTQIA+ person was positively correlated with PrEP use and awareness, linking the agency and confidence around self-identity with desire to self-care and remain safe from HIV. Similar to our findings, other studies also establish a link between self-acceptance of LGBTQIA+ identity with mental health-related outcomes.[25] A large study conducted among gay and other MSM in Brazil found that internalized homonegativity was associated with decreased use of PrEP.[26] Studies also suggest a correlation between minority stress and sexual stigma with HIV/AIDS-related outcomes.[21–23] This highlights the importance of fighting LGBTQIA+ and stigma in India to increase PrEP uptake.

Use of party drugs being positively correlated with PrEP use and awareness was a positive aspect since such individuals may be at higher vulnerability to acquire HIV.[27,28] While there is a call for harm-reduction interventions for those who use party drugs,[29] having increased PrEP use among these groups in India is a welcome sign.

As a cross-sectional study, our research is limited in its ability to establish causal relationships, which is a significant drawback. Another limitation is that the data was self-reported. While Grindr is a commonly used app in India with 8.66 million lifetime downloads in India (ranking third after the USA and Brazil),[30] our survey only targeted Grindr users, which may not be representative of all SGM who use smartphones in India. Our study also does not include other Grindr users who did not participate in our study. Hence, these findings are not generalizable to all SGMs in India.

Since this was a convenience sample where the goal was to reach as many people as possible who were using the Grindr application, we did not do a specific sample size calculation. Further, the survey was only provided in Hindi and English

which could limit participation from states that may have people not knowing any of the two languages, such as people in southern India. However, we noted that southern state of Karnataka (Kannada-speaking state) contributed similar numbers to the northern state of Rajasthan (Hindi-speaking state) with all the three states having overall similar populations.[31,32] However, providing the survey in these two languages only may have created some bias. Despite the limitations discussed, our research provides valuable insights into PrEP use, which has not been explored in detail.

Conclusion

Online SGMs in India continue to remain understudied and unreached by government or NGO interventions and are characterized by high prevalence but low awareness and use of PrEP. PrEP use is more common among those who have higher incomes, are employed, or are open about their sexual orientation. It is required to increase awareness about PrEP and make it accessible for those at high risk, considering that more novel long-acting formulations are on the way.

Declaration

Ethics approval and consent to participate

The study was approved by UNC-Chapel Hill IRB in The United States (IRB Number 22-0727) and Sigma IRB in India (IRB Number: 10099/IRB/21-22). The study participants provided informed consent electronically before they could access and start the survey. We did not collect any information that was personally identifiable and all data is reported aggregately.

Consent for publication

Since we did not collect any information such as images, case reports, etc., we did not require consent for publication from the participants.

Author contributions

Harsh Agarwal: Conceptualization; Data curation; Formal analysis; Investigation; Methodology; Project administration; Resources; Software; Writing – original draft; Writing – review & editing.

Karin Yeatts: Conceptualization; Formal analysis; Methodology; Project administration; Resources; Supervision; Writing – review & editing.

Stephanie R. Chung: Data curation; Investigation; Methodology; Project administration; Resources; Software; Writing – original draft; Writing – review & editing.

Jack Harrison-Quintana: Conceptualization; Data curation; Methodology; Resources; Software; Supervision; Writing – review & editing.

Thiago S. Torres: Conceptualization; Data curation; Formal analysis; Investigation; Methodology; Resources; Supervision; Validation; Writing – original draft; Writing – review & editing.

Acknowledgements

The authors express their gratitude to all study participants for their time and willingness to participate in this study. We are also thankful to Dr Siddharth Nandi in India for helping with data collection and community members who validated the survey. We thank Maria Esposito for her support with analysis and visualization. Further, we are thankful to NCTracs for providing support in facilitating the IRB process at UNC-Chapel Hill. Immense gratitude to consultants and team at ODUM Statistical Institute and other UNC-Chapel Hill staff members who helped the study. We also thank Grindr4equality to help disseminate our survey on Grindr app free of charge.

Funding

The authors received no financial support for the research, authorship, and/or publication of this article.

Competing interests

The authors declare that there is no conflict of interest.

Availability of data and materials

All relevant data related to this study have been included in the body of the manuscript and in Supplemental Tables. Study's final de-identified dataset and dictionary will be made available with the publication upon reasonable request. A proposal should be submitted to the corresponding author's e-mail, who will evaluate and approve the request.

TRUST code declaration

We confirm that the research has local relevance. The study was designed and conducted by the lead author who was born and brought up in India and identifies as gay. All those who met the ICMJE guidelines have been included as authors in this paper. This research posed no more than minimal risk, hence no special measures were taken as such. The survey was made available in both Hindi and English so that it was comprehensible to all. The authors confirm that all research was conducted to the highest possible ethical standards with approval from a local IRB.

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Supplemental material

Supplemental material for this article is available online.

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