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Sexual behavior stigma and HIV/STI biospecimen self-collection among cisgender gay, bisexual, and other sexually minoritized men in the United States

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Abstract

Introduction Disparities in HIV and other sexually transmitted infections (STIs) persist among cisgender sexually minoritized men in the United States, driven in part by sexual behavior stigma, which is a barrier to clinic-based HIV/STI testing. HIV/STI biospecimen self-collection (HSBS) is a novel testing approach that mitigates stigma by allowing for some testing-related procedures to be conducted by oneself in one's home or any private location rather than a facility that requires interpersonal interactions and exposure to other members of the public. HSBS has demonstrated acceptability, feasibility, and effectiveness in testing uptake, but the extent to which stigma persists in HSBS and the quantification of stigma's role in HSBS is limited.

Methods From 2019–2020, a nationwide sample of sexually minoritized men completed an online biobehavioral survey. Those who agreed to be recontacted ($N=4147$) were invited to participate in HSBS; consented participants received self-collection kits that were laboratory-tested if completed. Sexual behavior stigma and HSBS associations were assessed with logistic regression.

Results Mean age of participants was 35 years, 58% (2421/4147) were non-Hispanic white, 82% (3391/4147) were gay-identifying, 47% (1967/4147) had at least a college degree, and 56% (2342/4147) earned \geq \$40,000 annually; 27% (1112/4147) expressed HSBS interest, and 67% (689/1034) completed HSBS. HSBS interest and completion were less common among non-Hispanic Black sexually minoritized men and sexually minoritized men of lower socioeconomic status. Stigma from family and friends was significantly, negatively associated with HSBS interest (aOR=0.72, 95% CI=0.56, 0.93). Among those who had not tested for HIV/STIs in the past year, anticipated healthcare stigma was marginally, negatively associated with HSBS completion (aOR=0.40, 95% CI=0.15, 1.07). Among those who had never previously tested for HIV/STIs, anticipated healthcare stigma was significantly, negatively associated with HSBS interest (aOR=0.32, 95% CI=0.14, 0.72).

Conclusions Sexual behavior stigma persists as an HIV/STI testing barrier, even in the case of HSBS, limiting its utilization. Increasing HSBS among sexually minoritized men in the US necessitates stigma mitigation efforts that directly address equity in implementation.

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Keywords HIV/STIs, Biospecimen self-collection, Sexual behavior stigma, Men who have sex with men, Sexual health disparities

Introduction

In the United States (US), cisgender sexually minoritized men,¹ including gay, bisexual, and other men who have sex with men, are disproportionately burdened by HIV and other sexually transmitted infections (STIs). Sexually minoritized men accounted for two thirds of all new HIV diagnoses in 2021 [1] and 45% of all male syphilis cases in 2022 [2]. In addition, 2022 data from the Center for Disease Control and Prevention's (CDC) Sexually Transmitted Disease Surveillance Network indicate that 21% of sexually minoritized men who tested for gonorrhea tested positive, well above that of men who have sex with women only (10%), and that more than 15% who tested for chlamydia tested positive, also above that of men who have sex with women only (13%) [2]. Moreover, HIV/STI coinfections have been increasing [3, 4]. STIs can exacerbate HIV risk by increasing HIV viremia in people with HIV and by increasing susceptibility to HIV infection through lowering immune functioning in people without HIV [5, 6]. Therefore, efforts to reduce the threat of both HIV and STIs remain urgently needed [7].

Understanding and mitigating sexual behavior stigma can support efforts to address HIV and STI epidemics in the US. Sexual behavior stigma – the process whereby individuals with sexual attractions, behaviors, or identities other than heterosexual are ascribed inferior status and targeted with societally-sanctioned mistreatment via internalized, anticipated, perceived, enacted, and structural mechanisms, including but not limited to discriminatory laws, policies, and acts of violence [8–13] – characterizes the lived experience of sexually minoritized men in the US. Sexual behavior stigma persists among sexually minoritized men across US regions, in urban and rural areas, in healthcare and civil/social service contexts, and within families and other social groups [14–16], shaping health outcomes and driving sexual health disparities among sexually minoritized men [17–20]. Sexual behavior stigma has been shown to affect condom use and high-risk sexual behaviors, utilization of HIV/STI testing services, and HIV care continuum and HIV

pre-exposure prophylaxis cascade outcomes, amplifying HIV/STI transmission risk [16, 21–24]. Sexual behavior stigma can also impact mental health, self-regulation, and substance use behaviors, which can likewise increase HIV/STI transmission risk behaviors [21, 25–27].

Among the various efforts to address sexual behavior stigma and increase testing among sexually minoritized men is HIV/STI biospecimen self-collection (HSBS), which provides a convenient, private, and confidential means of engaging with testing by allowing some testing-related procedures to be conducted in one's home (or a private location of one's choosing) [28, 29]. Specifically, HSBS involves self-collecting one's biospecimens, sending those to a laboratory for testing, and receiving the results later via another party (e.g., telephone call from healthcare staff) or mechanism (e.g., web portal, email) [28, 29]. Testing based on HSBS is comparable to clinician-collected biospecimen testing, highly acceptable and feasible among sexually minoritized men, and has been shown to increase testing frequency among sexually minoritized men [28, 30–37].

HSBS has consequently proliferated in the US in recent years, making HIV/STI testing more accessible, especially to stigmatized populations [33, 36, 38, 39]. However, the persistence of sexual behavior stigma in the context of HSBS and its role in HSBS uptake have not been adequately investigated or quantified. The primary aim of this study was to determine if sexual behavior stigma is associated with HSBS interest and with HSBS completion among sexually minoritized men in the US. Secondary aims were to assess HSBS test reactivity (i.e., testing positive) and its association with sexual behavior stigma. Findings can inform future research and practice to support HSBS and other novel modes of HIV/STI testing for sexually minoritized men and other marginalized groups.

Methods

Data source, participants, and procedures

The American Men's Internet Survey (AMIS) is a national cross-sectional survey of sexually minoritized men conducted online annually to monitor HIV trends among sexually minoritized men in the US [40, 41]. The current study draws data from the 2019–2020 cycle which collected data on sexual behavior, stigma, demographic characteristics, utilization of sexual health services, and other domains. Online survey results were collected from September to December 2019. Study eligibility was

¹ We use the term “sexually minoritized men” because it better encapsulates those who may be minoritized for any non-heterosexual aspect of sexuality (e.g., attraction, identity), not just behavior. Moreover, the term evokes the broader process of minoritization due to heterosexism, which promotes homonegativity. But this term is not without its own limitations; for example, the utility found in its broader encapsulation results in the loss of specific, important self and group identity terms (e.g., gay, bisexual) and the associated meanings and significance that accompany them.

limited to cisgender men who were at least 15 years of age, resided in the US, were able to complete the survey in English, and either reported a history of anal sex with another man or identified as bisexual or gay. Participants who completed the survey, reported a history of oral or anal sex with a man, and agreed to be recontacted in the future were later emailed invitations to participate in HSBS. Those who indicated interest in response to the invitations completed a brief screener and online consent form, and provided mailing address details to receive the HSBS kit. Consented participants were sent HSBS kits between February and July 2020 that were laboratory-tested if completed and returned. There was no a priori plan to assess HSBS uptake and completion among different racial/ethnic groups, nor were there any quotas or recruitment targets with regard to different racial/ethnic groups. The original survey and HSBS sub-study were approved by the Emory University Institutional Review Board, and the present secondary analysis of de-identified data was approved by the Johns Hopkins University Institutional Review Board.

Measures

Demographic characteristics

Age was recorded as a continuous variable in years. Race was determined using a multi-select option: American Indian or Alaska Native; Asian; Black or African American; Native Hawaiian or other Pacific Islander; and white. Individuals were also asked if they considered themselves to be Hispanic or Latino. For analysis, race and ethnicity were combined to create a four-level categorical variable: non-Hispanic white, non-Hispanic Black or African American, Hispanic, and non-Hispanic multiracial/other race (due to small cell sizes). Sexual identity (gay or homosexual; bisexual; heterosexual, straight, or another sexual identity [combined due to small cell sizes]), education (high school diploma, general equivalency diploma, or less; some college, associate's degree, or technical degree; and college degree, post-graduate, or professional school), and annual household income (\$0 to \$19,999; \$20,000 to \$39,999; \$40,000 to \$74,999; and \$75,000 or more) were also categorical variables.

Sexual behavior stigma

The independent variable of interest was sexual behavior stigma, which was measured via 13 items previously validated among sexually minoritized men in the US through both a prior AMIS cycle and a prior National HIV Behavioral Surveillance cycle [15, 42]. Prior psychometric research with these items yielded three stigma domains comprised of 12/13 original items: stigma from family and friends (3 items, Cronbach's $\alpha=0.70$), anticipated healthcare stigma (2 items, Cronbach's $\alpha=0.83$),

and general social stigma (7 items, Cronbach's $\alpha=0.70$) [42]. All stigma items could be reported as experienced within the last six months or more than six months ago. To align with the prior studies that created the aforementioned subscales, these answers were collapsed to create a binary lifetime stigma variable for each item. Stigma scores were calculated in several steps: (1) values were mean-imputed for participants with <50% missingness on a given subscale (those with higher missingness were excluded), (2) responses to a given stigma item were multiplied by corresponding factor loadings retrieved from prior factor analytic work (1, yes; 0, no; or mean of non-missing responses if imputed), and (3) the mean value of item responses for each stigma domain was calculated.

HSBS interest, completion, and reactivity

Participants who completed AMIS and agreed to be recontacted in the future were emailed invitations and a link to complete a brief screener if they wished to participate in HSBS. Those who clicked the link and completed the screener were considered to have indicated HSBS interest. Consented participants were sent HSBS kits, which contained materials for participants to provide dried blood spot samples to test for HIV and syphilis, and urine containers and oral and anal swabs to test for gonorrhea and chlamydia. HSBS kits were shipped between February and July 2020, with all returned test kits received by August 2020. Participants who returned completed test kits were considered to have completed HSBS. HSBS kits were furnished, mailed, and processed by Molecular Testing Labs (Vancouver, WA). HIV screening and confirmation were conducted on serum from reconstituted blood spots via the GS HIV Combo Ag/Ab Enzyme Immunoassay and the Geenius HIV 1/2 Supplemental Assay. Syphilis screening was conducted on serum from constituted blood spots via Trinity Biotech's Trep-Sure Enzyme Immunoassay. Chlamydia and gonorrhea screening were conducted via the Cobas CT/NG 4800 Assay. Confirmatory reactive test results were considered indicative of the presence of a given STI in the tested biospecimen sample.

Additional HIV/STI information

Participants answered self-report items about past-year HIV/STI testing history (yes/no), current HIV status (positive, negative, unknown), and past-year diagnoses of chlamydia, gonorrhea, and syphilis by healthcare personnel (yes/no). Past-year HIV/STI testing history was used for sub-analyses (described below), and HIV status and STI diagnostic information were used to distinguish between new and pre-existing (or potentially pre-existing) HIV/STI reactivity in the HSBS results.

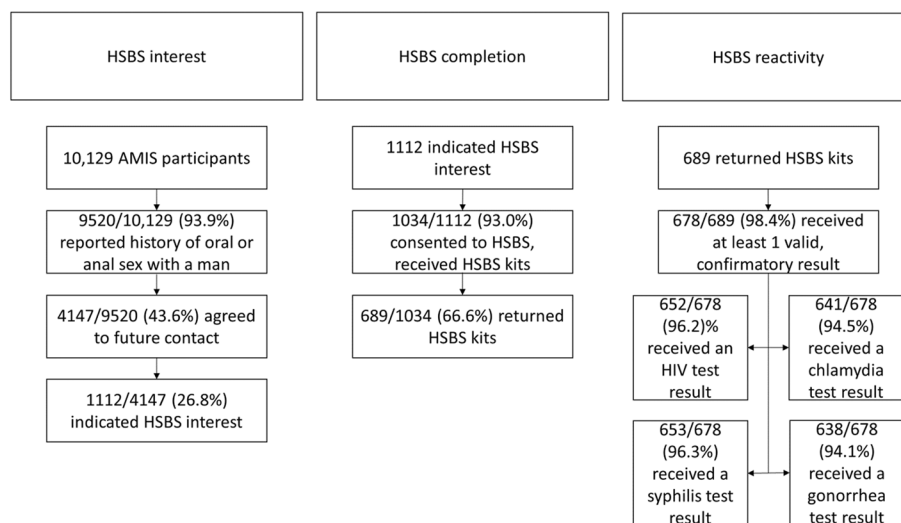


Fig. 1 Sample construction for HSBS interest, completion, and reactivity among sexually minoritized men in the US, 2019–2020. HSBS, HIV/STI biospecimen self-collection; HIV, human immunodeficiency virus; STI, sexually transmitted infection; US, United States; AMIS, American Men’s Internet Survey

Statistical analyses

Descriptive statistics for variables of interest were calculated, and chi-square tests and Welch’s t-tests were used to compare differences in demographic characteristics by HSBS status. Separate unadjusted logistic regression models yielded odds ratios that were used to assess associations between each stigma domain and HSBS status. Associations significant at $p < 0.10$ were subsequently examined in multivariable models that adjusted for age, race/ethnicity, sexual identity, education, and annual income. This analysis was repeated in two sub-groups: those who had not tested for HIV or STIs in the past year and those who had never previously tested for HIV/STIs. If statistically indicated, (e.g., parameter estimate increased from non-significance to significance in adjusted models), effect measure modification was assessed via stratified analysis. Wald tests, with statistical significance set at $p < 0.05$, and 95% confidence intervals were calculated and examined for all regression models. A sensitivity analysis was performed to examine associations between sexual behavior stigma and agreeing to be recontacted in the future (i.e., one’s eligibility for HSBS participation) to assess possible self-selection bias. It was speculated that participants with greater stigma had been more likely to agree to be recontacted, and that this self-selection, at least in part, might have limited the extent to which associations with sexual behavior stigma could be detected in the main analysis. Analyses were conducted using Rstudio version 2022.07.2+576 and Stata v. 15 (StataCorp, College Station, TX).

Results

Sample characteristics

In total, 10,129 individuals completed the AMIS survey. During data-cleaning, 609 participants (6.0%) who reported never having previously had anal sex with a man were excluded, leaving 9520, all of whom reported lifetime and past-year oral or anal sex with a man. Of these, 4147/9520 (43.6%) agreed to be recontacted; 1112/4147 (26.8%) expressed interest in HSBS, and 1034/1112 (93.0%) consented and were sent HSBS kits. Of these, 689/1034 (66.6%) returned the kits, and 678 (65.6%) received at least one valid, confirmatory result (Fig. 1).

Overall ($N = 4147$) mean age of participants was 34.9 years (median = 29 years). Most participants (58.4%) identified as non-Hispanic white, 8 in 10 identified as gay/homosexual, 5 in 10 had at least a college degree, and 3 in 10 earned $\geq \$75,000$ annually (Table 1). HSBS interest tended to be more common among non-Hispanic white, gay-identifying, or more educated participants and less common among non-Hispanic Black, bisexual-identifying, or less educated participants. HSBS completion tended to be more common among older, non-Hispanic white, more educated, or high-income participants, and less common among younger, non-Hispanic Black, less educated, or low-income participants (Table 1).

Sexual behavior stigma associations with HSBS

Greater stigma from family and friends was marginally, negatively associated with HSBS interest in the unadjusted model (OR = 0.81, 95% CI = 0.64, 1.03; $p = 0.083$) but significantly, negatively associated with HSBS interest

Table 1 Demographic characteristics by HSBS interest and completion among sexually minoritized men in the US, 2019–2020

	HSBS interest sample (N=4147)			HSBS completion sample (N=1034)		
	No (n=3035)	Yes (n=1112)	Total/Overall	No (n=345)	Yes (n=689)	Total/Overall
Age						
Mean (SD)	34.7 (15.3)	35.5 (14.8)	34.9 (15.2)	33.9 (13.8)	36.2 (14.9)	35.4 (14.6)
Missing	1 (<0.1)	0 (0.0)	1 (<0.1)	0 (0.0)	0 (0.0)	0 (0.0)
t-test statistic	-	-1.49	-	-	-2.46*	-
Race/ethnicity						
NH white	1669 (55.0)	752 (67.6)	2421 (58.4)	209 (60.6)	489 (71.0)	698 (67.5)
NH Black/African-American	582 (19.2)	103 (9.3)	685 (16.5)	44 (12.8)	54 (7.8)	98 (9.5)
Hispanic	487 (16.0)	161 (14.5)	648 (15.6)	57 (16.5)	91 (13.2)	148 (14.3)
NH multiracial or another race	297 (9.8)	96 (8.6)	393 (9.5)	35 (10.1)	55 (8.0)	90 (8.7)
χ ² test statistic	-	73.09***	-	-	12.54**	-
Sexual identity						
Gay/homosexual	2453 (80.8)	938 (84.4)	3391 (81.8)	285 (82.6)	586 (85.1)	871 (84.2)
Bisexual	510 (16.8)	145 (13.0)	655 (15.8)	49 (14.2)	87 (12.6)	136 (13.2)
Straight, another identity	51 (1.7)	24 (2.2)	75 (1.8)	9 (2.6)	13 (1.9)	22 (2.1)
Missing	21 (0.7)	5 (0.4)	26 (0.6)	2 (0.6)	3 (0.4)	5 (0.5)
χ ² test statistic	-	9.55**	-	-	1.16	-
Education						
≤ High school or equivalent	583 (19.2)	145 (13.0)	728 (17.6)	58 (16.8)	72 (10.4)	130 (12.6)
Some college	1094 (36.0)	344 (30.9)	1438 (34.7)	116 (33.6)	206 (29.9)	322 (31.1)
≥ College degree	1346 (44.3)	621 (55.8)	1967 (47.4)	169 (49.0)	411 (59.7)	580 (56.1)
Missing	12 (0.4)	2 (0.2)	14 (0.3)	2 (0.6)	0 (0.0)	2 (0.2)
χ ² test statistic	-	46.40***	-	-	13.10**	-
Household income						
\$0 to \$19,999	447 (14.7)	148 (13.3)	595 (14.3)	61 (17.7)	79 (11.5)	140 (13.5)
\$20,000 to \$39,999	669 (22.0)	223 (20.1)	892 (21.5)	72 (20.9)	136 (19.7)	208 (20.1)
\$40,000 to \$74,999	794 (26.2)	320 (28.8)	1114 (26.9)	88 (25.5)	206 (29.9)	294 (28.4)
\$75,000 or more	874 (28.8)	354 (31.8)	1228 (29.6)	103 (29.9)	226 (32.8)	329 (31.8)
Missing	251 (8.3)	67 (6.0)	318 (7.7)	21 (6.1)	42 (6.1)	63 (6.1)
χ ² test statistic	-	6.73	-	-	8.89*	-

HSBS HIV/STI biospecimen self-collection, HIV human immunodeficiency virus, STI sexually transmitted infection, US United States, SD standard deviation, NH non-Hispanic, some college includes those with an associate's or technical degree

* $p < 0.05$

** $p < 0.01$

*** $p < 0.001$; except for mean (SD), all values are n's with accompanying percentages in parentheses, columns for each variable total to equal each No/Yes value in the heading row, and accompanying percentages total to 100

in the adjusted model (aOR=0.72, 95% CI=0.56, 0.93; Table 2). Given this change from marginal to statistical significance, effect measure modification was explored by adding each covariate one at a time in the regression model, which revealed race/ethnicity to be driving the change from marginality to significance. Specifically, stratification revealed that, for non-Hispanic white sexually minoritized men, greater stigma from family and friends was significantly, negatively associated with HSBS interest (aOR=0.67, 95% CI=0.49, 0.90); for Hispanic sexually minoritized men, greater stigma from family and friends was marginally, negatively associated with

HSBS interest (aOR=0.53, 95% CI=0.26, 1.09; $p=0.086$); and for non-Hispanic Black sexually minoritized men (aOR=1.27, 95% CI=0.58, 2.80) and multiracial sexually minoritized men or those of another race (aOR=1.22, 95% CI=0.51, 2.92), there was no statistically significant association (Supplemental Table 1).

Greater anticipated healthcare stigma was marginally, negatively associated with HSBS completion in the unadjusted model (OR=0.72, 95% CI=0.50, 1.04), but this association was not significant in the adjusted model (Table 3). Among those who had not tested for HIV/STIs in the past year (past-year non-testers), greater

Table 2 Sexual behavior stigma scores and associations with HSBS interest among sexually minoritized men in the US, 2019–2020

Full sample (N=4147)	Mean stigma score		Association with HSBS interest	
<i>Stigma domain</i>	HSBS interest n=1112	No HSBS interest n=3035	OR (95% CI)	aOR (95% CI)
Stigma from family and friends	0.32	0.34	0.81 ~ (0.64, 1.03)	0.72 ^a (0.56, 0.93)
Anticipated healthcare stigma	0.21	0.23	0.88 (0.73, 1.08)	–
General social stigma	0.23	0.24	0.94 (0.55, 1.58)	–
Past-year non-testers (n=749)	Mean stigma score		Association with HSBS interest	
<i>Stigma domain</i>	HSBS interest n=190	No HSBS interest n=559	OR (95% CI)	aOR (95% CI)
Stigma from family and friends	0.33	0.31	1.17 (0.67, 2.05)	–
Anticipated healthcare stigma	0.21	0.22	0.87 (0.54, 1.40)	–
General social stigma	0.25	0.23	1.86 (0.56, 6.15)	–
Never-testers (n=489)	Mean stigma score		Association with HSBS interest	
<i>Stigma domain</i>	HSBS interest n=91	No HSBS interest n=398	OR (95% CI)	aOR (95% CI)
Stigma from family and friends	0.25	0.31	0.53 (0.24, 1.18)	–
Anticipated healthcare stigma	0.17	0.29	0.34 ^{**} (0.16, 0.71)	0.32 ^{**} (0.14, 0.72)
General social stigma	0.18	0.21	0.17 (0.02, 1.44)	–

HSBS HIV/STI biospecimen self-collection, US United States, HIV human immunodeficiency virus, STI sexually transmitted infection, OR odds ratio, aOR adjusted odds ratio, CI confidence interval

^a Race/ethnicity primarily drove this change from marginal to statistical significance; associations by race/ethnicity are reported in main text and in Supplemental Table 1

~ $p < 0.10$

* $p < 0.05$

** $p < 0.01$

Table 3 Sexual behavior stigma scores and associations with HSBS completion among sexually minoritized men in the US, 2019–2020

Full sample (n=1034)	Mean stigma score		Association with HSBS completion	
<i>Stigma domain</i>	HSBS completion n=689	HSBS incompleteness n=345	OR (95% CI)	aOR (95% CI)
Stigma from family and friends	0.32	0.34	0.80 (0.52, 1.23)	–
Anticipated healthcare stigma	0.20	0.24	0.72 ~ (0.50, 1.04)	0.74 (0.50, 1.10)
General social stigma	0.23	0.24	0.54 (0.20, 1.43)	–
Past-year non-testers (n=181)	Mean stigma score		Association with HSBS completion	
<i>Stigma domain</i>	HSBS completion n=116	HSBS incompleteness n=65	OR (95% CI)	aOR (95% CI)
Stigma from family and friends	0.34	0.33	1.08 (0.39, 3.00)	–
Anticipated healthcare stigma	0.18	0.27	0.48 ~ (0.20, 1.15)	0.40 ~ (0.15, 1.07)
General social stigma	0.25	0.25	1.24 (0.14, 10.74)	–
Never-testers (n=77)	Mean stigma score		Association with HSBS completion	
<i>Stigma domain</i>	HSBS completion n=45	HSBS incompleteness n=32	OR (95% CI)	aOR (95% CI)
Stigma from family and friends	0.23	0.32	0.32 (0.06, 1.65)	–
Anticipated healthcare stigma	0.17	0.16	1.19 (0.26, 5.44)	–
General social stigma	0.17	0.19	0.36 (0.01, 28.58)	–

HSBS HIV/STI biospecimen self-collection, US United States, HIV human immunodeficiency virus, STI sexually transmitted infection, OR odds ratio, aOR adjusted odds ratio, CI confidence interval

~ $p < 0.10$

Those who were interested but did not consent to HSBS were excluded from each sample/subsample (full sample, n=78; past-year non-testers, n=9; never-testers, n=14)

anticipated healthcare stigma was marginally, negatively associated with HSBS completion in the unadjusted (aOR=0.48, 95% CI=0.20, 1.15, $p=0.098$) and adjusted models (aOR=0.40, 95% CI=0.15, 1.07; $p=0.068$; Table 3). Among those who had never previously tested

for HIV/STIs (lifetime never-testers), greater anticipated healthcare stigma was significantly, negatively associated with HSBS interest in both unadjusted (aOR=0.34, 95% CI=0.16, 0.71) and adjusted models (aOR=0.32, 95% CI=0.14, 0.72; Table 2).

Table 4 Results of HSBS among sexually minoritized men in the US, 2019–2020

	Received valid, confirmatory test result	Tested reactive	Self-reported living with HIV or past-year STI diagnosis	Presumed newly reactive
Full sample				
HIV	652	53 (8.1%)	45 (6.9%)	8 (1.2%)
Chlamydia	641	42 (6.6%)	5 (0.8%)	37 (5.8%)
Gonorrhea	638	23 (3.6%)	2 (0.3%)	21 (3.3%)
Syphilis	653	65 (10.0%)	19 (2.9%)	46 (7.0%)
Past-year non-testers				
HIV	110	10 (9.1%)	9 (8.2%)	1 (0.9%)
Chlamydia	112	12 (10.7%)	0 (0.0%)	12 (10.7%)
Gonorrhea	113	0 (0.0%)	0 (0.0%)	0 (0.0%)
Syphilis	110	5 (4.5%)	0 (0.0%)	5 (4.5%)
Lifetime never-testers				
HIV	44	0 (0.0%)	0 (0.0%)	0 (0.0%)
Chlamydia	40	3 (7.5%)	0 (0.0%)	3 (7.5%)
Gonorrhea	40	0 (0.0%)	0 (0.0%)	0 (0.0%)
Syphilis	44	0 (0.0%)	0 (0.0%)	0 (0.0%)

HSBS HIV/STI biospecimen self-collection, US United States, HIV human immunodeficiency virus, STI sexually transmitted infection

Table 5 Associations between sexual behavior stigma and HSBS test reactivity (presumed newly reactive) among sexually minoritized men, 2019–2020

	Chlamydia	Syphilis	Gonorrhea	HIV	Any reactive test
<i>Stigma domain</i>	OR (95% CI)	OR (95% CI)	OR (95% CI)	OR (95% CI)	OR (95% CI)
Stigma from family and friends	0.67 (0.21, 2.05)	1.33 (0.56, 3.14)	0.45 (0.09, 1.87)	0.90 (0.35, 2.26)	0.62 (0.29, 1.29)
Anticipated healthcare stigma	1.17 (0.46, 2.72)	0.74 (0.33, 1.55)	0.47 (0.09, 1.71)	0.44 (0.15, 1.08)	0.74 (0.38, 1.42)
General social stigma	4.87 (0.46, 44.61)	0.28 (0.02, 2.49)	0.25 (0.01, 5.83)	1.10 (0.12, 8.54)	0.44 (0.07, 2.59)

HSBS HIV/STI biospecimen self-collection, HIV human immunodeficiency virus, STI sexually transmitted infection, OR odds ratio, aOR adjusted odds ratio, CI confidence interval, all unadjusted associations were $p > 0.10$

HSBS test reactivity and associations with sexual behavior stigma

Among those who completed HSBS and received a valid test result, prevalence of newly testing reactive for HIV was 1.2% (8/652); chlamydia, 5.8% (37/641); gonorrhea, 3.3% (21/638); and syphilis, 7.0% (46/653). Among those who did not test for HIV/STIs in the past year, prevalence of newly testing reactive for HIV was 0.9% (1/110); chlamydia, 10.7% (12/112); and syphilis, 4.6% (5/110). There were no reactive test results for gonorrhea among past-year non-testers. Among lifetime never-testers, prevalence of newly testing reactive for chlamydia was 7.5% (3/40). There were no reactive test results for HIV, syphilis, or gonorrhea among lifetime never-testers (Table 4). Stigma was not associated with HSBS test reactivity in the full sample (Table 5). Associations between stigma and HSBS test reactivity among past-year non-testers and never-testers were not examined due to the small number of HSBS reactive test results.

Sensitivity analysis

Stigma from family and friends (aOR = 1.56, 95% CI = 1.33, 1.83), anticipated healthcare stigma (aOR = 1.14, 95% CI = 1.00, 1.30), and general social stigma (aOR = 5.29, 95% CI = 3.59, 7.79) were all significantly, positively associated with agreeing to be recontacted in the future (not displayed).

Discussion

The primary aim of this study was to determine sexual behavior stigma’s association with cisgender sexually minoritized men’s interest in participating in HIV/STI biospecimen self-collection (HSBS) and with completing (i.e., returning) HSBS kits. The secondary aim was to assess HSBS test reactivity and its association with sexual behavior stigma. Overall, participants who reported greater stigma from family and friends were less likely to express interest in HSBS. Among participants who had never previously tested for HIV/STIs, those reporting

greater anticipated healthcare stigma were less likely to be interested in HSBS. Likewise, participants who had not tested for HIV/STIs in the past year were less likely to complete HSBS when reporting greater anticipated healthcare stigma. The most prevalent infection detected by HSBS was syphilis, followed by chlamydia, gonorrhea, and HIV; no significant associations were identified between sexual behavior stigma and HSBS test reactivity among participants.

The observed association between greater sexual behavior stigma from family and friends and lower odds of HSBS interest was driven primarily by non-Hispanic white participants. Prior research has shown non-Hispanic white sexually minoritized men to be more likely to disclose their sexuality to family and to be more likely to report family stigma than those of other racial/ethnic groups [14, 43] and may thus explain the observed association here. For Hispanic participants, the negative association between sexual behavior stigma from family and friends and HSBS interest was marginal; the lack of significance was likely due to the much smaller sample size ($n=648$ vs $n=2421$) and lower HSBS interest (25% vs 31%) relative to non-Hispanic white participants, as the difference in mean stigma score between those interested and not interested in HSBS among both non-Hispanic white and Hispanic participants was the same (0.03). The lack of significance among other racial/ethnic groups was reflected in the comparable mean stigma scores between those with and without HSBS interest, which may indicate the need for more targeted recruitment efforts to ensure greater diversity of stigma experiences among these groups. Of course, there also remains the possibility that stigma from family and friends is simply not associated with HSBS interest among these groups. This is an area for future research.

Previous quantitative research has demonstrated that stigma from family and friends may act as a barrier to sexual healthcare engagement among sexually minoritized men and other sexually minoritized persons [16, 22, 44, 45]. Qualitative studies with sexually minoritized men have shown that sexuality-based stigma (e.g., family/friends' lack of acceptance of one's sexuality, lack of social support to maintain sexual health), at times in conjunction with HIV stigma (e.g., fearing loss of family relationships by testing positive, family's distancing to avoid HIV acquisition), dissuade sexually minoritized men from accessing clinic-based sexual health testing and other preventive care [46–48]. Similar dynamics may have been operating among participants in the present study with regard to HSBS. That is, a lack of acceptance and support from one's social network, combined with fear about the social implications of testing positive as a sexually minoritized man, may have affected participants' HSBS

interest. While HSBS might be seen as a way of encouraging sexually minoritized men who experience stigma and who are thus hesitant to attend a clinic or health center to access testing, our finding suggests that as family and friends can be an important source of stigma, this strategy may not address all concerns of stigma that drive a lack of interest in testing, at least for some populations of sexually minoritized men (e.g., those who live with such family or friends; those for whom a lack of social support constrains efforts to maintain sexual health).

Among participants who had never previously tested for HIV/STIs, those who reported greater anticipated healthcare stigma had lower odds of HSBS interest. Prior research with so-called never-testers has identified several potential predictors of never testing, some of which were controlled for (e.g., younger age, less education, non-gay sexual identity), and some of which were not assessed, such as greater internalized homonegativity and a preference for generic rather than sexually minoritized men-specific or specialty sexual healthcare services [49, 50]. This possible constellation of factors – anticipated healthcare stigma, internalized homonegativity, preference for care that does not specifically target sexually minoritized men – characterizing never-testers suggests a highly stigmatized population fearful of or uncomfortable with identification with the sexually minoritized men community. Anticipated healthcare stigma, then, in addition to other possible stigmas, may affect interest in any HIV/STI testing, regardless of the mode in which it may be accessed.

Additionally, among past-year non-testers, those who reported greater anticipated healthcare stigma had lower odds of HSBS completion. In other words, these participants indicated interest in HSBS and received an HSBS kit, but they did not return the HSBS kit (the extent to which these participants self-collected specimens without returning them is unknown). Anticipated healthcare stigma has not always been a barrier for these participants, since they had engaged in sexual health testing at some point prior (by self-report). Why this stigma emerged as a potential barrier in this scenario of HSBS completion is unclear. Participants could have incurred an experience of enacted stigma which then led to anticipated stigma [51], which, when combined with the prospect of visiting a clinic for treatment in the case of a reactive HSBS result, could have then led to HSBS non-completion. Alternatively, previous research with sexually minoritized men has documented stress and anxiety related to HSBS (e.g., waiting for results), physical discomfort with swabbing, difficulties with blood-collection, and concerns about fecal contamination in the case of anal swabbing [30, 52]. It is therefore possible that, in the present study, participants with high

anticipated healthcare stigma also experienced some of these concerns, which may confound the observed association with HSBS non-completion. Indeed, other studies examining HSBS among sexually minoritized men identified multiple barriers to HSBS completion (e.g., low self-efficacy to self-collect, biospecimen shipping concerns, confusion about kit instructions, feeling overwhelmed with self-collecting, lack of time) [30, 31, 53]. Because concerns such as these were not assessed in the present study, their potential role in HSBS non-completion cannot be determined, but they are important questions to address in future research.

The proportion of participants testing reactive for HIV via HSBS was comparable to what has been found in prior research [54, 55]; however, proportions of participants testing reactive for other STIs were lower than what has been reported in CDC surveillance research [2], though comparable to findings from research with convenience and community-based samples [35, 56]. A majority of STI reactive results appeared to have been new, possibly indicative of asymptomatic infection, symptom unfamiliarity, or testing limitations (e.g., lack of access; lack of provider competence) [57–60]. The HIV, chlamydia, and/or syphilis diagnoses among past-year non-testers and lifetime never-testers are concerning, as they are likely an indication of other undiagnosed HIV/STIs in this population (and may not have been detected at all had these individuals not participated in the study). Moreover, HSBS uptake was substantially much lower among these infrequent/never-testers, and yet notable proportions of new HIV/STI cases were detected nonetheless; reaching more underserved sexually minoritized men with HSBS would likely reveal even more new HIV/STI cases. Focused research is needed to evaluate whether HSBS is actually reaching the most underserved, as well as investigate how to better allocate resources to reach infrequent and never-testers for new HIV/STI case-detection and maximize cost-effectiveness of HSBS. Incorporating a follow-up qualitative component to studies like the present one – for both the larger survey and HSBS stages – would permit researchers to understand more about infrequent and never-testers who participated in HSBS and those who did not. This could help identify barriers and facilitators to testing, generally, and to utilizing HSBS, specifically, which could enable better tailoring and targeted implementation of HSBS.

No significant associations between general social stigma and HSBS interest or completion emerged. A prior study that examined the relationship between comparable experiences of social stigma and past-year use of HIV self-testing likewise found no association [61]. Reasons for this lack of a relationship are unclear, though several other non-significant associations also emerged

with other forms of stigma. That many of the examined associations were non-significant may reflect the fact that participants endorsing greater stigma tended to self-select into the HSBS participant pool. That is, participants who agreed to be recontacted for future studies, such as this HSBS study, had higher stigma compared to those who did not agree to be recontacted for such studies as demonstrated in our sensitivity analysis. Therefore, those with higher stigma were the ones invited to participate in HSBS, which could have led to difficulties detecting stigma-related associations with HSBS outcomes.

These findings should be considered in light of several limitations. This study assessed only sexual behavior stigma. Other unmeasured stigmas – e.g., based on race, class, HIV status – may play a role in HSBS as well and yield a more complete picture of how intersecting stigmas operate on HSBS. Relatedly, internalized sexual behavior stigma was not assessed, which could have also played a role in the examined relationships. Second, current living situation was not assessed; this information could be valuable in understanding the association between stigma from family and friends and HSBS. Third, the race/ethnicity survey items may have affected the representation of Latinx participants, as having a multi-select racial identity item and a separate Hispanic/Latino item may have been confusing for those who consider their race to be Latinx. Additionally, such options could single out some participants as an ethnicity and racialize them by forcing a response from race categories that may not be salient. Fourth, the data are somewhat dated, being collected in 2019 and 2020. However, these data remain relevant given ongoing HIV and STI crises affecting sexually minoritized men in the US and can inform ongoing testing efforts. These data also provide an important assessment of pre-COVID-19 stigma-related testing challenges that were later exacerbated by COVID-19 [62, 63]. Fifth, social desirability or recall bias could have affected self-reports of stigma and biased the findings. Sixth, all data were collected online from a convenience sample of sexually minoritized men. Moreover, the majority of participants were non-Hispanic white, with comparatively small samples of sexually minoritized men of color. Findings may therefore not be generalizable. Finally, sensitivity analysis findings suggest some selection bias, as participants experiencing greater stigma tended to self-select into the participant pool for future studies, which may have biased findings toward the null.

Public health implications

Focused stigma-mitigation and targeted HIV/STI testing efforts to reach underserved sexually minoritized men are warranted. Peer mentoring, peer education, and peer delivery of HSBS kits are promising interventions

to increase awareness and utilization of HSBS in this population where experiences of sexual behavior stigma continue to shape willingness to engage in self-collection [64, 65]. Qualitative research with highly stigmatized and underserved sexually minoritized men may also be useful for understanding how stigma persists in the context of HSBS and for identifying specific intervention targets around which to adapt and build HSBS programming and other HIV/STI testing efforts. Moreover, whether qualitatively or quantitatively, assessing participants' motivations for utilizing HSBS could provide insights into the extent to which HSBS actually addresses reported social stigma (or other barriers) associated with testing. Given observed demographic differences in HSBS in this study and in other research, equity-promotive efforts to tailor HSBS to sexually minoritized men of color and low socioeconomic status must be considered to ensure testing is accessible by sexually minoritized men who experience multiple forms of marginalization [66, 67]. Application of an intersectional stigma framework may be useful for exploring the extent to which race/ethnicity, class, and sexually minoritized orientations interact to shape utilization of sexual health initiatives, including HIV/STI testing.

Conclusions

HIV and STI disparities among sexually minoritized men in the United States will remain intractable without stigma prevention and mitigation initiatives. They should be paired with targeted, innovative, equity-based, peer-led, comprehensive sexual health programs that include HIV/STI testing. HIV/STI biospecimen self-collection remains an effective and promising solution to help address sexual health disparities by fostering agency while simultaneously increasing testing frequency and timely diagnosis that can lead to treatment, but the privacy and anonymity afforded by self-collection are inadequate to fully counter stigma. Our findings therefore signal a need for ongoing evolution of self-collection initiatives to incorporate stigma mitigation, particularly for the most stigmatized and underserved. Engagement with diverse communities of gay, bisexual, and other sexually minoritized men to more deeply understand stigma barriers and to co-create self-collection programs that adequately address their concerns will be imperative in self-collection's evolution. Moreover, coupling these efforts with socioeconomic supports to ensure equitable implementation of self-collection must be considered to bring about sustained sexual health equity and contribute to ending HIV and STIs as public health threats in the United States.

Abbreviations

US	United States
HIV	Human immunodeficiency virus
STI(s)	Sexually transmitted infection(s)
CDC	Centers for Disease Control and Prevention
HSBS	HIV/STI biospecimen self-collection
AMIS	American Men's Internet Survey
OR	Odds ratio
aOR	Adjusted odds ratio
CI	Confidence interval
COVID-19	Coronavirus disease of 2019

Supplementary Information

The online version contains supplementary material available at <https://doi.org/10.1186/s12879-024-09801-3>.

Supplementary Material 1: Supplemental Table 1. Family stigma and associations with HSBS interest among racial/ethnic subgroups of sexually minoritized men in the US, 2019-2020.

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Authors' contributions

CRediT Roles: JMW & JCO, conceptualization, methodology, formal analysis, visualization, writing – original draft, review, & editing; SMM, supervision, writing – review & editing; SDB, funding acquisition, project administration, supervision, writing – review & editing; THS, funding acquisition, investigation, project administration, writing – review & editing. All authors reviewed and approved the manuscript.

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Availability of data and materials

The datasets analyzed in the current study are not publicly available to preserve confidentiality but are available from TH Sanchez on reasonable request.

Declarations

Ethics approval and consent to participate

All participants provided separate electronic consent to participate in both the online survey and in the HIV/STI biospecimen self-collection sub-study. Parental consent was waived for participants aged 15–17 years. Each original study was approved by the Emory University Institutional Review Board. The present study was a secondary analysis of de-identified data from these studies and was approved by the Johns Hopkins University Institutional Review Board.

Consent for publication

Not applicable.

Competing interests

The authors declare no competing interests.

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