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## High willingness to use novel HIV and bacterial sexually transmitted infection partner notification, testing, and treatment strategies among gay and bisexual men

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### Abstract

**Objectives:** We sought to determine willingness of gay and bisexual men (GBM) to give HIV self-testing (HIVST) kits with patient-delivered partner therapy (PDPT) and engage in geosocial sexual networking (GSN) app-based partner notification.

**Methods:** A nationwide sample of GBM who self-tested HIV-negative ( $n=786$ ) were asked about their willingness to give recent sex partners (main and casual) PDPT with an HIVST kit (PDPT+HIVST) after hypothetical bacterial sexually transmitted infection (BSTI) diagnosis. Men were also asked about their willingness to notify sexual partners met on GSN apps using an anonymous app function after BSTI diagnosis. We examined associations of relationship status and condomless anal sex with casual partners, recent BSTI diagnosis, and perceived risk of HIV on PDPT+HIVST and anonymous app-based partner notification willingness (dichotomized) using

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#### CONTRIBUTORS

SAJ was responsible for manuscript conceptualization, data analysis, data interpretation, literature search, and manuscript writing. JTP, CG, and HJR were the Principal Investigators (PIs) of the parent study. The PIs' roles included conceptualizing the study design, measures development, participant recruitment, data management, day-to-day operations, and oversight of all scientific decisions. CG, TJR, HJR, and JTP provided feedback on data analysis, result interpretation, and manuscript revisions. All authors provided intellectual content to the manuscript and approved the final manuscript.

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binary logistic regressions, adjusting for age, race/ethnicity, education, and US region. From the partner's perspective after receiving an app-based referral, frequency measures were used to report intentions for obtaining subsequent HIV/BSTI counseling and testing, engaging in HIVST if provided a free voucher, and obtaining BSTI treatment from a pharmacy with prescription voucher.

**Results:** Most (90.1%) were willing to give PDPT+HIVST to recent sex partners after STI diagnosis, and nearly all (96.4%) were willing to notify sex partners met online using an anonymous function within GSN apps. Regardless of casual partner condomless anal sex engagement, partnered GBM had higher odds of reporting willingness to give PDPT+HIVST compared to single men who recently engaged in condomless anal sex with a casual partner. If anonymously notified via an app, 92.5% reported they would likely obtain counseling and testing, 92.8% would engage in HIVST if provided a free voucher, and 93.4% would obtain treatment from a pharmacy with prescription voucher.

**Conclusions:** GBM generally found novel partner notification, testing, and treatment strategies acceptable, indicating the need for feasibility and cost-effectiveness evaluations.

### Keywords

sexually transmitted infections; partner notification; patient-delivered partner therapy; geosocial sexual networking; expedited partner therapy; men who have sex with men

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## INTRODUCTION

Incidence rates of HIV and bacterial sexually transmitted infections (BSTIs) are disproportionately higher among gay, bisexual, and other men who have sex with men (GBM) compared to men who have sex with women only.<sup>1,2</sup> Patient-delivered partner therapy (PDPT) is a practice wherein patients diagnosed with a BSTI are provided medication-in-hand to give directly to their partner.<sup>3</sup> Compared to simple partner referral practices, PDPT increased the number of partners notified and treated, reduced repeat infections, and lowered community prevalence.<sup>3,4</sup> However, concerns about PDPT have centered around missed opportunities for HIV testing,<sup>5</sup> which could be alleviated by including rapid HIV self-testing (HIVST) kits with PDPT.<sup>6</sup> Combining PDPT with HIVST kits for GBM could allow PDPT to be used in the way it was intended—a supplemental approach for treatment when a partner is unlikely to obtain subsequent clinic-based testing and treatment.

An estimated 64% of GBM reported using geosocial networking apps (GSN) to meet sexual partners in 2011.<sup>7</sup> App-based sexual networking creates new challenges for BSTI and HIV prevention because of a changing risk landscape. A meta-analysis of GSN app use among GBM found app use associated with two-fold higher odds of having a BSTI compared to non-app using GBM,<sup>8</sup> suggesting higher network-level prevalence of BSTIs in this population. Many apps were designed to support communication between GBM—even beyond sexual networking<sup>9</sup>—and are now used for other types of disclosure (e.g., HIV-status, undetectable viral load, and PrEP use).<sup>10</sup> Nonetheless, no known research has studied

how responsive GBM would be to using anonymous GSN app-based partner referral strategies.

In this paper, our primary research objectives were to: (1) determine willingness of GBM to give HIVST kits with PDPT to sexual partners after hypothetical BSTI diagnosis, and (2) determine willingness of GBM to notify sexual partners met on apps using a built-in anonymous app function after hypothetical BSTI diagnosis. We were also interested in measuring how responsive GBM would be to an anonymous app-based BSTI exposure referral. As such, we sought to determine engagement in the following behaviors after receiving an app-based referral: (1) obtaining subsequent HIV/BSTI counseling and testing, (2) engaging in HIVST if provided a free voucher, and (3) obtaining BSTI treatment from a pharmacy with prescription voucher.

## METHODS

Data for this analysis were collected as part of the *One Thousand Strong* study, a nationwide cohort of GBM who tested HIV-negative at baseline.<sup>11</sup> Briefly, 1,071 HIV-negative GBM—confirmed at baseline by digital photo of the OraQuick In-Home HIV Test—were recruited to reflect census data on same-sex households in the United States (US) based on age, race/ethnicity, and US geography in 2014 using Community Marketing and Insights, a marketing firm with a panel of over 22,000 GBM throughout the US. An additional sample of 133 non-White GBM (of  $n = 222$  screened eligible) were added to the cohort using the same recruitment strategy between November 2016 and February 2017 to increase the sample diversity of non-White participants. Data for this analysis were collected as part of an optional survey of all participants in 2017. Study procedures were approved by the Institutional Review Board (IRB) of the City University of New York (IRB protocol number 354377-3).

Of the 1,204 GBM enrolled in the cohort, 825 completed the mid-2017 optional survey. Thirty-eight men were excluded because of a technological error that resulted in partial survey completion. One additional participant was excluded because he self-reported an HIV-positive test result since the last assessment wave. This resulted in a final analytic sample of 786 HIV-negative GBM. Compared to those who did not take the optional survey or were excluded, GBM in the analytic sample were older ( $OR_{age} = 1.02, p < 0.001$ ), more likely to be White ( $\chi^2_{race/ethnicity} = 8.69, p = 0.03$ ), and more likely to have higher educational attainment ( $\chi^2_{education} = 11.17, p < 0.01$ ). No missing data were present in our analytic sample.

## Measures

**Demographics.**—Participants self-report demographic characteristics including age, race/ethnicity, highest educational attainment, and geographical region coded from their postal ZIP code.

**Sexual behavior characteristics, recent BSTIs, and perceived risk of HIV.**—We asked individuals to report their current relationship status and engagement in condomless anal sex (CAS) with casual sex partners in the past six months, which we coded into a four-

category variable based on single/partnered and engagement in any CAS with casual sex partners (yes/no). Men were also asked to report recent (past six months) BSTI diagnoses of chlamydia, gonorrhea, and syphilis, which was dichotomized (yes/no) into any BSTI diagnoses in the past six months. Perceived risk of HIV was assessed using a single item: “What is your gut feeling about how likely you are to get infected with HIV?”<sup>12</sup> Five-point response categories ranged *1 – extremely unlikely* to *5 – extremely likely*.

**Partner notification and treatment strategies.**—Willingness to use PDPT+HIVST was assessed using the following: “Imagine you were diagnosed with chlamydia or gonorrhea today. How willing would you be to give recent sex partners (last 3 months) medications for treatment AND an at-home, rapid HIV test kit (assuming your healthcare provider gave them to you for free)?” Five-point response categories ranged *1 – not at all willing* to *5 – extremely willing*; all individuals who expressed some level of willingness (i.e., *2 – slightly willing*) were coded as willing because of the right-skewed response distribution ( $M = 3.87$ ,  $SD = 1.34$ , skewness =  $-0.94$ , kurtosis =  $2.63$ ). Willingness to notify sex partners via anonymous app function was assessed using the following: “Imagine you’ve met sexual partners on a phone app (e.g., Grindr, Scruff, Tindr, Growlr) and you were diagnosed with an STI today. How willing would you be to notify recent sex partners (last 3 months) met on this app so that they could go get testing and treatment using an anonymous function built into the app?” Similarly, response categories ranged *not at all willing* to *extremely willing* with any level of willingness coded as willing because of data distribution ( $M = 3.99$ ,  $SD = 1.18$ , skewness =  $-0.96$ , kurtosis =  $2.89$ ).

**Intentions after app-based partner notification.**—We assessed various intentions after a hypothetical scenario wherein the participant was anonymously notified of an exposure to a BSTI (i.e., “Imagine that you were anonymously contacted through a phone app (e.g., Grindr, Scruff, Tindr, Growlr) about potential exposure to an STI.”). The three intentions measured were: 1) “How likely would you be to obtain subsequent HIV/STI counseling and testing?” 2) “If you were given a voucher through the app to obtain a free at-home, rapid HIV test kit, how likely would you be to use this method of HIV testing?” and 3) “If you were given a voucher/prescription through the app to obtain medications for treatment of a bacterial STI (e.g., gonorrhea) from a local pharmacy, how likely would you be to use this method of treatment?” Five-point response categories ranged *very unlikely* to *very likely* and individuals were coded as intending if they responded *likely willing* or *very likely*.

## Statistical Analyses

Descriptive data were assessed using frequency measures. Bivariate analyses were conducted using  $\chi^2$  comparisons and logistic regressions for categorical and continuous independent variables, respectively. We examined associations of relationship status, any CAS with casual partners, recent BSTI diagnosis, and perceived risk of HIV on willingness to give a PDPT+HIVST kit to recent sex partners and notify sex partners via an anonymous app function using fully-adjusted binary logistic regressions.

## RESULTS

Descriptive statistics of the sample and bivariate results are listed in Table 1. Most (90.1%) GBM were willing to give PDPT+HIVST to recent sex partners after hypothetical BSTI diagnosis, with 46.8% of the overall sample reporting extreme willingness. In our fully-adjusted logistic regression model, partnered men who reported recent CAS with a casual partner had 3.21 times higher odds of being willing to give PDPT+HIVST to recent sex partners compared to those who were single and reported CAS with a casual partner. Partnered men who did not report recent CAS with a casual partner similarly had higher odds (i.e., AOR = 2.41) of being willing to give PDPT+HIVST to recent sex partners compared to single men with recent casual partner CAS. Men in the Northeast, Midwest, and West had lower odds of being willing to give PDPT+HIVST to recent partners compared to GBM in the South (see Table 1).

Most (96.4%) GBM were also willing to engage in app-based partner referral for sex partners met online via sexual networking apps, with 66.9% of the overall sample reporting extreme willingness. In multivariable analysis, partnered men who did not report recent CAS with casual partners had 3.54 times higher odds of being willing compared to single men with recent casual partner CAS in the fully-adjusted model. Nonetheless, 93.8% of single men who reported recent casual partner CAS were willing to give PDPT+HIVST to recent partners. Willingness differed by geographical region in multivariable analysis only; GBM in the West had lower odds of being willing to give PDPT+HIVST to recent sex partners compared to men in the South (see Table 1).

We were also interested in determining how GBM would respond to being notified anonymously about a BSTI exposure through an anonymous GSN app function. If anonymously notified, 92.5% of GBM reported they would likely obtain counseling and testing, 92.8% would engage in HIVST if provided a free voucher, and 93.4% would obtain treatment from a pharmacy with prescription voucher.

## DISCUSSION

Most GBM found using HIVST kits with PDPT acceptable, and nearly all GBM were willing to notify recent sex partners met through GSN apps via an anonymous app function. Although the South has the highest rates of HIV in the US,<sup>1</sup> GBM residing in this region had the highest percentage of men willing to engage in these partner referral strategies, important for targeting intervention work to reduce disparities.

These data support prior feasibility data about using PDPT with GBM. In a pilot study, 83.1% of GBM randomized to the PDPT arm notified at least one recent sexual partner and more than half (53.5%) notified all recent partners.<sup>13</sup> Secondary distribution of HIVST kits is also acceptable and feasible among GBM in the US,<sup>14,15</sup> suggesting the integration of these two components is practical in real-world settings. Despite our promising findings, further study is needed to determine how including HIVST kits with PDPT affects partner testing and treatment rates compared to PDPT only and standard partner referral practices.

Our findings support prior reports indicating the acceptability of other electronic partner notification methods. The use of “Suggest a Test,” a partner notification method with electronic methods available (e.g., email), was found to be feasible in prior research.<sup>16</sup> The anonymous function associated with Suggest a Test—in particular—was deemed valuable because 88% of partner referrals were sent anonymously.<sup>16</sup> (and correction) GBM were also responsive to the integration of sexual health features into GSN apps,<sup>9</sup> indicating the importance of embedding these features into existing app environments. Additional mixed-methods work is needed to support intervention development based on the difficulties in recruiting GBM in the US into a prior electronic partner referral efficacy trial;<sup>17</sup> subsequent use of the actual partner notification system (i.e., “inSPOT”) among enrolled participants was also low in this prior study,<sup>17</sup> demonstrating the need to tailor services to GBM for better uptake potential.

PDPT+HIVST and anonymous app function partner referral willingness findings by relationship status and casual partner CAS could be the result of differential beliefs in the importance of partner treatment, since men with main partners may be more invested in their partners’ health. Nonetheless, concerns about infidelity and potential for intimate partner violence were salient within HIV/BSTI clinic patient interviews,<sup>6</sup> suggesting the need for added counseling components to ensure patient safety and support patients with PDPT +HIVST for use when appropriate. An anonymous app function may help notify partners, but GBM diagnosed with BSTIs could still require counseling to support them should partners confront them or they desire follow-up discussions with their partners.

Most GBM in our sample reported intentions to obtain follow-up testing and treatment through the three strategies we indicated after hypothetical app-based partner referral. One of these strategies included the provision of a prescription voucher for BSTI treatment, aligning with prescription-based PDPT. These data are supported by research among GBM assessing intentions to obtain follow-up HIV testing after PDPT provision, where researchers found 86% of GBM would seek HIV testing after BSTI treatment via PDPT.<sup>18</sup> Nonetheless, data were limited on actual partner HIV testing rates following PDPT provision among GBM in the US and an experimental study comparing multiple forms of partner referral is needed with supporting cost-effectiveness research.

## Limitations

Our study has several limitations. First, our sample includes HIV-negative GBM who previously engaged in HIVST as part of the study procedures upon enrollment. Generalizability of our findings should be limited only to GBM who recently tested HIV-negative, since acceptance rates might be higher than actual among GBM due to our sampling. Second, GBM who enrolled in the cohort but were excluded and/or did not take the optional survey were more likely to be younger, non-White, and of lower educational attainment, potentially limiting the generalizability of our findings. Third, it is unknown if hypothetical willingness and intentions will result in actual uptake. Further research is needed.



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**Table 1**

Demographics, sexual risk behavior characteristics, and perceived risk of HIV and their associations with 1) willingness to give patient-delivered partner therapy with an HIV self-testing kit to recent sex partners and 2) willingness to notify sex partners via anonymous app function (n = 786)

Categorical Variables	Willing to give PDPPT+HIVST <sup>3</sup> kit to recent sexual partners					Willing to notify sex partners via anonymous app function						
	n	Column %	Row n	Row %	χ <sup>2</sup>	AOR	95% CI	Row n	Row %	χ <sup>2</sup>	AOR	95% CI
Race/ethnicity												
					1.1					1.6		
Black	80	10.2	74	92.5		1.38	0.55-3.44	76	95.0		0.61	0.19-1.97
Latino	121	15.4	107	88.4		0.91	0.47-1.76		115	95.0	0.67	0.24-1.86
White	514	65.4	462	89.9		--	--	498	96.9		--	--
Other/Multiracial	71	9.0	65	91.6		1.52	0.59-3.87	69	97.2		1.54	0.32-7.47
Education												
					0.4					0.9		
Less than Bachelor's degree	298	37.9	271	90.9		--	--	285	95.6		--	--
Bachelor's degree or more	488	62.1	437	89.6		0.81	0.49-1.35	473	96.9		1.27	0.58-2.76
Geographic region												
					13.8**					6.2		
Northeast	148	18.8	132	89.2		0.42*	0.20-0.90	143	96.6		0.50	0.14-1.81
Midwest	133	16.9	117	88.0		0.41*	0.19-0.88	128	96.2		0.47	0.13-1.68
South	284	36.1	270	95.1		--	--	279	98.2		--	--
West	221	28.1	189	85.5		0.31**	0.16-0.61	208	94.1		0.26*	0.09-0.75
Relationship status, and condomless anal sex (CAS) with casual partners (past 6 months)												
					13.0**					8.0*		
Single, no casual partner CAS	211	26.8	182	86.3		0.99	0.54-1.80	202	95.7		1.58	0.63-3.96
Single, casual partner CAS	192	24.4	166	86.5		--	--	180	93.8		--	--
Partnered, no casual partner CAS	283	36.0	265	93.6		2.41*	1.23-4.74	277	97.9		3.54*	1.23-10.18
Partnered, casual partner CAS	100	12.7	95	95.0		3.21*	1.17-8.82	99	99.0		6.61	0.84-52.38
Recent BSTI diagnosis (past 6 months) <sup>2</sup>												
					1.2					0.1		
No	746	94.9	674	95.0		--	--	719	94.9		--	--
Yes	40	5.1	34	4.8		0.69	0.26-1.85	39	5.2		1.88	0.23-15.37
<b>Continuous Variables</b>												
	<b>M</b>	<b>SD</b>	<b>OR</b>	<b>SE</b>		<b>AOR</b>	<b>95% CI</b>	<b>OR</b>	<b>SE</b>		<b>AOR</b>	<b>95% CI</b>
Age (Range: 20-82)	43.4	13.6	1.00	0.01		1.01	0.99-1.02	1.01	0.01		1.01	0.98-1.04

Categorical Variables	n	Column %	Willing to give PDPT+HIVST <sup>3</sup> kit to recent sexual partners				Willing to notify sex partners via anonymous app function					
			Row n	Row %	$\chi^2$	AOR	95% CI	Row n	Row %	$\chi^2$	AOR	95% CI
Perceived risk of HIV (range: 1-5)	1.9	0.8	0.94	0.13		1.07	0.78-1.46	1.13	0.28		1.41	0.84-2.37

\*  $p < 0.05$ ;

\*\*  $p < 0.01$ ;

\*\*\*  $p < 0.001$ ;

$M$  = mean;  $SD$  = standard deviation;  $SE$  = standard error;  $OR$  = odds ratio;  $AOR$  = adjusted odds ratio;  $CI$  = confidence interval;

<sup>1</sup> South including  $n=1$  from Puerto Rico;

<sup>2</sup> self-reported chlamydia, gonorrhea, and/or syphilis diagnosis;

<sup>3</sup> PDPT+HIVST = patient-delivered partner therapy with an HIV self-testing device.

Percentages may not add up to 100 because of rounding.