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Discordance in Objective and Self-perceived HIV Risk: A Potential Barrier to Pre-exposure Prophylaxis in Young Gay and Bisexual Men

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Pre-exposure prophylaxis (PrEP) for HIV prevention is highly effective and well-tolerated among groups at high risk for HIV infection, including young men who have sex with men (YMSM; Centers for Disease Control and Prevention, 2017; Hosek et al., 2017; Volk et al., 2015). However, uptake of PrEP for HIV prevention has been limited, and increasing attention has been placed on addressing barriers to PrEP utilization by target populations (Hosek et al., 2016, 2017). Recent work has relied on the PrEP care continuum, a schematic developed by Kelly et al. (2015) to conceptualize and assess PrEP initiation and adherence across five sequential benchmarks: (a) at-risk for HIV, (b) aware/willing to use PrEP, (c) have access to health care, (d) likely to receive a PrEP prescription, and (e) adherent to an effective PrEP regimen.

Studies and interventions have largely focused on the latter steps of the PrEP continuum (e.g., PrEP delivery, adherence; Krishnaratne, Hensen, Cordes, Enstone, & Hargreaves, 2016; Marcus et al., 2014). However, some scholars have suggested revisions to the continuum that place greater emphasis on early stages related to being at-risk for HIV and aware/willing to use PrEP (Nunn et al., 2017; Parsons et al., 2017). Nunn et al. (2017) developed a nine-step model, which included identifying individuals at high risk for HIV, increasing HIV risk awareness, enhancing PrEP awareness, facilitating PrEP access, linking to PrEP care, prescribing PrEP, initiating PrEP, adhering to PrEP, and retaining PrEP users in care. Additionally, Parsons et al. (2017) developed a five-step continuum that was more firmly grounded in a motivational stage of change framework and considered factors that

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may influence HIV prevention behavior change. The five stages in this model were PrEP precontemplation (unwilling to take PrEP or does not identify as a good candidate), PrEP contemplation (willing to take PrEP and identifies as a good candidate), PrEP preparation (has a provider and intends to initiate PrEP), PrEP action and initiation (spoke to a provider about PrEP and initiated PrEP), and PrEP maintenance (adherent to PrEP and routine HIV testing). These continua present patient-centered models that consider individual self-perceived HIV risk, self-identification as a PrEP candidate, and motivations to initiate PrEP. Diagrams of the three proposed PrEP continuum models are presented in Figure 1.

Overall, revisions to the original continuum suggest that psychosocial factors, including patient perceptions of their own HIV risk and candidacy for PrEP, warrant investigation as potential barriers to PrEP uptake. Thus, the purpose of our study was to explore the relationship between objective HIV risk (PrEP indication as informed by Centers for Disease Control and Prevention [CDC] guidance; Centers for Disease Control and Prevention, 2017) and self-perceived HIV risk, PrEP awareness, PrEP interest, and PrEP use in a diverse sample of YMSM.

Method

We used a secondary analysis of data from a baseline survey for an experimental study that assessed the impact of race on HIV and sexually transmitted infection (STI) risk perceptions among YMSM and was conducted at three Midwestern universities in the United States (Hill, Rosentel, & Hebert, 2019). YMSM were recruited from July 2015 to June 2016 using flyers and electronic advertisements. Inclusion criteria for the parent study included: (a) self-identifying as gay, bisexual, or a man who has had sex with men; (b) being ages 18 to 24 years; and (c) being able to read and write in English. Participants were prescreened prior to survey administration to ensure eligibility. Because the analysis was focused on HIV prevention perceptions and behaviors, participants who reported that they were living with HIV were excluded from the analytic sample. All participants provided informed consent and received \$30 for participation. The Biological Sciences Division/University of Chicago Medical Center Institutional Review Board approved all study procedures.

Measures

The baseline survey included measures assessing participant characteristics (e.g., age, race/ethnicity) and sexual behaviors/history, including ever trading sex for money or drugs (transactional sex; *yes/no*); number of male partners for penile–anal intercourse (PAI) in the past 3 months (measured continuously); condom use during most recent PAI with a male partner (*yes/no*); intoxication during most recent sex (*yes/no*); and previous diagnosis of an STI (*yes/no/never tested*).

Participants were categorized as PrEP indicated or not PrEP indicated based on criteria informed by the Centers for Disease Control and Prevention, 2017. The CDC offers guidance for health care providers to assess risk of sexual HIV acquisition in men who have sex with men and recommended behavioral indicators for PrEP candidacy, including inconsistent condom use, history of commercial sex work, high number of sexual partners, and previous STIs (Centers for Disease Control and Prevention, 2017). The guidance was

designed as a decision aid for providers rather than a decision calculator or eligibility criteria. Although the CDC guidance also includes a recommended assessment of sexual behaviors as a tool for providers, the questions in our sample assessment did not fully encompass all CDC recommended indicators for PrEP candidacy. We categorized participants as PrEP-indicated based on measures the investigators determined most indicative of the CDC outlined criteria rather than only using the measures in the CDC sample behavioral assessment. The measures we used included: (a) no condom use during most recent PAI, (b) transactional sex (ever), (c) five or more male PAI partners in the past 3 months, and (d) previously tested positive for an STI (ever). If a participant met any of these criteria, he was classified as PrEP-indicated and categorized as having objective HIV risk.

Self-perceived HIV risk was assessed by asking participants how likely they were to become infected with HIV from current sexual practices (*very unlikely, unlikely, somewhat likely, likely, very likely*). Consistent with other studies, participants who indicated somewhat likely or higher were categorized as perceiving themselves to be at moderate to high risk for HIV (Kesler et al., 2016; MacKellar et al., 2007). PrEP awareness and use was assessed by asking whether participants had ever heard of PrEP as a way to prevent HIV infection (*yes/no*) and whether they were currently taking PrEP (*yes/no*). PrEP initiation interest was assessed by asking participants how likely they were to start taking PrEP in the next 6 months (*very unlikely, unlikely, somewhat likely, likely, very likely, taking PrEP*); participants were categorized as interested in initiating PrEP if they indicated *somewhat likely to very likely*.

Data Analysis

Descriptive statistics were used to describe the sample. Chi-square tests, Fisher exact tests, and *t*-tests were used to assess associations between PrEP-indication (objective risk) and sociodemographic characteristics, such as ethnicity, college attainment, monthly income, and sexual orientation, as well as PrEP continuum variables, including self-perceived risk, PrEP awareness, PrEP initiation interest, and PrEP use. *T*-tests were used for pairwise comparisons of continuous variables including age. Chi-square tests were used for pairwise comparisons of categorical variables when crosstab expected cell counts were all greater than or equal to five. Fisher exact tests were used for pairwise comparisons of categorical variables when any expected cell counts were less than five. The tests used for each statistical comparison are delineated in Tables 1 and 2.

Results

Overall, 135 YMSM participated in the study; 130 were included in the analytic subset after people living with HIV were excluded (Table 1). The mean age of the sample was 20.7 years ($SD = 1.76$). The sample was racially diverse: 56.2% non-Hispanic/Latino White, 20% Black/African American, 16.2% Hispanic/Latino, and 15.4% Asian. Most participants (87.7%) reported having some college education or higher. More than half (52.3%) reported earning less than \$1,000 per month. A majority (69.2%) described themselves as gay/homosexual and 30.0% as bisexual.

A majority of the sample (54.6%) met indications for PrEP based on our CDC-informed criteria. Overall, 36.2% reported not using a condom during last PAI, 22.3% reported being diagnosed with an STI, 17.7% reported engaging in transactional sex, 5.4% reported having five or more PAI partners in the past 3 months, and 29.2% reported being intoxicated during last PAI. Self-perceived HIV risk was low, with 10.8% reporting a *somewhat likely* to *very likely* chance of becoming infected with HIV. PrEP awareness was moderate at 58.5%. PrEP initiation interest and use were low: 27.7% and 1.5%, respectively. Chi-square, Fisher exact, and *t*-tests comparing PrEP-indicated and non-indicated participants only revealed one significant association: a higher proportion of PrEP-indicated participants were Hispanic/Latino (23.9% vs. 6.8%; $p = .008$). No significant differences between PrEP-indicated and non-indicated participants were observed in self-perceived HIV risk (11.3% vs. 10.2%; $p = .841$), PrEP awareness (63.4% vs. 52.5%; $p = .212$), PrEP initiation interest (26.8% vs. 28.8%; $p = .795$), and PrEP use (2.8% vs. 0.0%; $p = .194$). Chi-square and Fisher exact tests assessing the relationship between PrEP continuum variables and individual PrEP-indication variables revealed only two significant associations (Table 2): Participants were more likely to be using PrEP if they reported a previous STI (6.9% vs. 0.0%; $p = .048$) or transactional sex (8.7% vs. 0.0%; $p = .030$).

Discussion

Consistent with other studies, our findings highlighted a stark discordance between objective HIV risk (PrEP-indication) and self-perceived HIV-risk among YMSM (Blumenthal et al., 2019; MacKellar et al., 2007). A majority of the sample was engaged in high-risk behaviors, indicating they were candidates for PrEP. However, only 11.3% of PrEP-indicated men reported being at least *somewhat likely* to become infected with HIV, making them no more likely to report a high risk for HIV than non-indicated participants. As the inclusion of HIV risk self-awareness and PrEP contemplation in recent PrEP care continuum models suggest, low HIV risk perception may present a barrier to PrEP uptake by YMSM (Nunn et al., 2017; Parsons et al., 2017). This was supported by findings from Blumenthal et al., (2019), which found that low perceived HIV risk was the most frequently cited reason for not initiating PrEP in their sample of YMSM. Accordingly, PrEP interventions may benefit from integrating patient education tools such as validated HIV risk calculators, visual aids to increase health literacy, and mobile health applications focused on HIV prevention, all of which may help YMSM more accurately understand risks associated with sexual behaviors (Blumenthal et al., 2019; Chen & Dowdy, 2014; Cho et al., 2018; Garcia-Retamero & Cokely, 2013; Milam et al., 2015).

We also found that PrEP awareness, initiation interest, and use were relatively low, and PrEP-indicated participants were no more likely to be aware of, interested in initiating, or using PrEP than non-indicated participants. Thus, interventions aimed at moving participants along the PrEP continuum, particularly those focused on linkage and initiation, may need to better target patients based on behavioral risk (e.g., condomless PAI) rather than solely relying on population membership (e.g., YMSM). Furthermore, intoxication during PAI was relatively common in our sample (29.2%) and may warrant consideration as a criterion for PrEP-indication, given how it may impair sexual decision-making (Allen, Myers, & Ray, 2015; Morgan et al., 2015).

Although no significant associations were observed between PrEP indication and PrEP awareness, initiation interest, and use, there were statistically significant associations between individual PrEP indication criteria and PrEP use. Participants who reported a previous STI and participants who reported transactional sex were significantly more likely to report using PrEP. This may be in part due to local efforts that aim to link individuals with a positive STI to PrEP as well as public health programs targeted to individuals involved in transactional sex work. Nevertheless, it should be noted that PrEP use was still low for individuals with a history of STI and those engaged in transactional sex work, at 6.9% and 8.7%, respectively.

Although our study offers insight into the relationship between objective PrEP-indication and self-perceived HIV risk, it was not without limitations. First, we used a secondary analysis of data from an experimental study in Chicago and mainly relied on descriptive statistics.

Additionally, although our sample was racially and socioeconomically diverse, it was small and non-representative. Thus, our sample cannot be generalized to all YMSM, and research is needed to assess how discordance between objective and self-perceived HIV risk may affect PrEP initiation. Our classification of PrEP-indication was informed by CDC guidance, which recommends assessing a number of behavioral criteria including inconsistent condom use, history of commercial sex work, high number of sexual partners, and previous STIs. However, our measures for assessing these factors may have differed from those used by some providers given that the CDC has not provided standardized measures for assessing the suggested criteria. Additionally, our classification of PrEP-indication did not incorporate one CDC-suggested criterion: having a sexual partner living with HIV (Centers for Disease Control and Prevention, 2017). Our survey did not assess the HIV status of participant sexual partners because previous studies have suggested that participant reports of partner HIV status may be unreliable (Grey, Rothenberg, Sullivan, & Rosenberg, 2014; MacKeller et al., 2006).

Conclusion

Overall, our findings suggest that interventions focused on improving accurate HIV risk perceptions in YMSM may be needed. Research should assess whether the incorporation of risk assessment and patient-centered education tools into clinical protocols increases the number of YMSM continuing along the PrEP continuum. Further, we have highlighted that additional factors may warrant consideration when assessing behavioral indicators for PrEP in YMSM, including substance use during PAI. Research exploring such factors may help to strengthen clinical guidance for providers who offer HIV education and PrEP consultation to YMSM.

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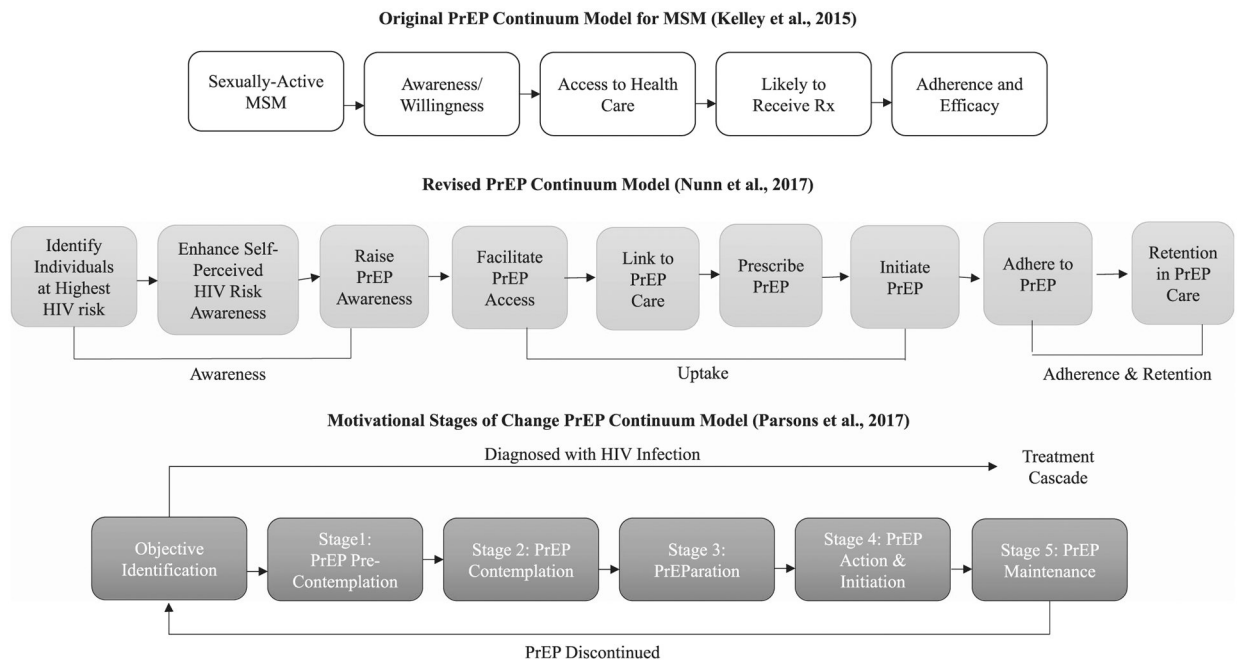


Figure 1. Three proposed models of the PrEP continuum. *Note.* MSM = men who have sex with men; PrEP = pre-exposure prophylaxis; Rx = prescription.

Table 1. Sociodemographic and PrEP Continuum Variables by PrEP-Indication Status (*N* = 130)

	All Participants (<i>n</i> = 130)			PrEP-Indicated (<i>n</i> = 71)	Not PrEP-Indicated (<i>n</i> = 59)	<i>p</i>
	<i>M</i> (<i>SD</i>)	<i>M</i> (<i>SD</i>)	<i>M</i> (<i>SD</i>)	<i>M</i> (<i>SD</i>)	<i>M</i> (<i>SD</i>)	
Sociodemographic variables						
Age ^a	20.7 (1.76)	20.9 (1.68)	20.4 (1.83)			.122
Race/ethnicity	% (<i>n</i>)	% (<i>n</i>)	% (<i>n</i>)			
Non-Hispanic/Latino White ^b	56.2 (73)	50.7 (36)	62.7 (37)			.170
Black/African American ^b	20.0 (26)	21.1 (15)	18.6 (11)			.725
Hispanic/Latino ^b	16.2 (21)	23.9 (17)	6.8 (4)			.008*
Asian ^b	15.4 (20)	12.7 (9)	18.6 (11)			.348
At least some college education ^b	87.7 (114)	85.9 (61)	89.8 (53)			.499
Monthly income <\$1,000 ^b	52.3 (68)	46.5 (33)	59.3 (35)			.144
Sexual orientation						
Gay/homosexual ^b	69.2 (90)	64.8 (46)	74.6 (44)			.229
Bisexual ^b	30.0 (39)	33.8 (24)	25.4 (15)			.299
Straight/heterosexual ^c	0.8 (1)	1.4 (1)	0.0 (0)			1.000
PrEP continuum variables						
Self-perceived to be at moderate to high risk for HIV ^b	10.8 (14)	11.3 (8)	10.2 (6)			.841
PrEP-aware ^b	58.5 (76)	63.4 (45)	52.5 (31)			.212
PrEP initiation interest ^b	27.7 (36)	26.8 (19)	28.8 (17)			.795
PrEP-using ^c	1.5 (2)	2.8 (2)	0.0 (0)			.500

Note. PrEP = pre-exposure prophylaxis.

^a *t*-test.

^b Chi-square test.

^c Fisher exact test.
* $p < .05$.

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Table 2. PrEP Continuum Variables by Centers for Disease Control and Prevention Behavioral Indicators for PrEP (N = 130)

PrEP Continuum Variables	Condom Use at Last PAI (n = 83)		No Condom Use at Last PAI (n = 47)		p
	% (n)		% (n)		
Self-perceived to be at moderate to high risk for HIV ^a	12.0 (10)		8.5 (4)		.532
PrEP-aware ^a	54.2 (45)		66.0 (31)		.192
PrEP initiation interest ^b	27.7 (23)		27.7 (13)		.995
PrEP-using ^b	0.0 (0)		4.3 (2)		.129
	No previous STI (n = 101)		Previous STI (n = 29)		
	% (n)		% (n)		p
Self-perceived to be at moderate to high risk for HIV ^b	10.9 (11)		10.3 (3)		1.000
PrEP-aware ^a	57.4 (58)		62.1 (18)		.655
PrEP initiation interest ^a	27.7 (28)		27.6 (8)		.988
PrEP-using ^b	0.0 (0)		6.9 (2)		.048*
	No history of transactional sex (n = 107)		History of transactional sex (n = 23)		
	% (n)		% (n)		p
Self-perceived to be at moderate to high risk for HIV ^b	10.3 (11)		13.0 (3)		.713
PrEP-aware ^a	58.9 (63)		56.5 (13)		.835
PrEP initiation interest ^a	26.2 (28)		34.8 (8)		.402
PrEP-using ^b	0.0 (0)		8.7 (2)		.030*
	Less than 5 PAI partners, past 3 months (n = 123)		5 or more PAI partners, past 3 months (n = 7)		
	% (n)		% (n)		p
Self-perceived to be at moderate to high risk for HIV ^b	11.4 (14)		0.0 (0)		1.000
PrEP-aware ^b	57.7 (71)		71.4 (5)		.699
PrEP initiation interest ^b	26.8 (33)		42.9 (3)		.395

101

14.3 (1)

0.8 (1)

PrEP-using^b

Note. PAI = penile–anal intercourse; PrEP = pre-exposure prophylaxis; STI = sexually transmitted infection.

^a Chi-square test.

^b Fisher exact test.

* $p < .05$.

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