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ORIGINAL PAPER

A Latent Profile Analysis of Online Dating Patterns Among Single Young Men Who Have Sex with Men

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Abstract

Despite the increased use of geosocial networking applications for finding sexual partners among young men who have sex with men (YMSM), few studies have examined the intricate patterns of online dating behaviors. In order to advance understanding of online dating patterns among YMSM, various factors, including how frequently and how much time is spent within partner-seeking sites, need to be examined concurrently. Therefore, we used latent profile analysis to identify online dating patterns and logistic regressions to examine their associations with sexual behaviors and relationship characteristics among single YMSM (N = 180; ages 18–24). We found three online dating patterns: discouraged users (N = 93, 52%), date seekers (N = 67, 37%), and instant lovers (N = 20, 11%). Discouraged users were less likely to seek sexual sensational activities, while date seekers were more likely to seek sexual sensational activities. Moreover, instant lovers were less likely to pursue committed romantic relationships, while they reported a higher number of condomless anal intercourse. Given that online dating patterns are not homogeneous, HIV prevention interventions may benefit from tailored approaches based on YMSM's different online dating profiles.

Keywords Dating · Hooking-up · Relationship characteristics · Sexual behaviors · Sexual minority · Youth

Introduction

Geosocial networking (GSN) applications have become a prominent venue for meeting sexual partners among young men who have sex with men (YMSM) [1], leading researchers to examine the association between GSN use and HIV risk behaviors. For example, a meta-analysis found that odds for any unprotected anal intercourse (UAI), seroconcordant UAI, and serodiscordant UAI were higher among MSM within online platforms [2]. Researchers have also noted that YMSM who use GSN applications reported a higher number of recent and lifetime sexual partners and were twice as likely to be diagnosed with a sexually transmitted infection (STI) than non-users [3]. In a review of the literature examining MSM's internet use, however, Grov et al. [4] cautioned about making causal inferences between the use of GSN applications and HIV risk behaviors, as other studies [5, 6] have not found associations between online partner-seeking and HIV risk behaviors or any robust evidence indicating that YMSM's HIV risk behaviors with partners met online are different from those met offline. The diverse findings across these studies may be the result of the increasing heterogeneity across GSN applications that have emerged over the past decade for different partner-seeking arrangements (e.g., making friends, hooking-up, or dating).

Alongside the frequency and the time spent on online venues for finding partners [7–9], researchers have acknowledged that YMSM may navigate multiple GSN applications concurrently [10], hold competing for partner-seeking motivations (i.e., dating patterns shift from finding a date to a hookup) [11–13], and pursue different experiences with potential partners online (i.e., MSM in a relationship use GSN to find a hook up) [14]. Therefore, various factors, including how frequently and how much time is spent within partner-seeking sites and what drives users' online partner-seeking behaviors, need to be examined concurrently in order to advance our understanding of the association between online dating platforms and YMSM's partner-seeking behaviors. For example, single YMSM often classify their sexual partners into different

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partner typologies (e.g., friends with benefits only, hooking-up only, or romantic interests only) [11]. Sullivan et al. [13], however, noted that these classifications were often malleable, with YMSM's intent with a partner met online shifting from dating to hooking-up and vice versa. Given these complex and interrelated processes and motivations, there is a need for research to consider these various factors in a multi-faceted characterization of individuals—as opposed to assuming that YMSM's partner-seeking behaviors can be attributed to a single characteristic or variable.

Traditional variable-centered approaches are limited in their ability to explain the multidimensional nature of human behaviors. Recent person-centered approaches (e.g., mixture cluster analysis, latent profile analysis, or latent class analysis), however, emphasize the multidimensionality of human behavior and have allowed researchers to identify unmeasured memberships based on distributions of several factors simultaneously. A limited number of studies utilized these person-centered approaches to understand relationship patterns among MSM. For instance, Janulis et al. [15] used latent class analysis to identify general sexual partner typologies among YMSM using several indicators: partnership role (i.e., current partner, hookup, and other), means of dating (online/offline), length of partnerships, sexual risk behaviors, age difference, and closeness of the relationship. The study resulted in four different sexual partner typologies: casual partner, older partners met online, much older partner, and serious relationship. Despite the burgeoning of online dating among YMSM, at present, there are no studies that we are aware of that have employed person-centered approaches to explore dating patterns in an online setting among YMSM. Therefore, this study examined individuals' heterogeneity in online dating patterns among YMSM using latent profile analysis (LPA).

Latent profile analysis is a person-centered statistical method that estimates unmeasured profiles with multiple continuous factors to explain the multidimensionality of human behaviors [16]. We applied this person-centered approach to classifying YMSM's use of GSN applications for finding sexual partners with four indicators (frequency of online dating to find a date, usefulness of online dating in finding a date, frequency of online dating to find a hookup, and usefulness of online dating in finding a hookup) into distinct typologies. Recognizing that YMSM may use GSN applications differently, we then examined whether YMSM's assignment to a given typology was associated with their sociodemographic characteristics (i.e., age, race/ethnicity, and education), partner-seeking correlates (i.e., commitment ideation, limerence, and sexual sensation seeking), and/or HIV-related sexual behaviors (i.e., decisional balance to use condoms, number of sexual partners, and condomless anal sex). Based on our findings, we discussed the need to acknowledge the variability in GSN application use in ongoing research and intervention efforts tailored to YMSM.

Methods

Data for this analysis come from the baseline survey of a web-based, HIV-prevention prospective randomized controlled trial (RCT) for single YMSM. A detailed protocol for the myDEx Project has been previously outlined elsewhere [17]. All study procedures were approved by the Institutional Review Board at the University of Michigan. Participants were recruited across the United States through advertisements on online social media and sexual networking platforms. Social network advertisements were viewable only to men who fit our age range and who lived in the United States.

In order to participate, participants had to self-report the following: (1) male sex at birth and gender identity; (2) an age of 18 to 24 years; (3) an HIV-negative or HIV-unaware serostatus; (4) single relationship status; (5) prior use of online dating mobile applications; and (6) report condomless anal intercourse (CAI) with at least one male partner in the prior 6 months. Upon completion of an online informed consent form, eligible participants completed a 30-min web-based baseline questionnaire ascertaining their sexual and online behaviors, mental health, and demographic information. A sample of 180 single YMSM was recruited between November 2016 and January 2017.

Procedures

Upon entering the study site, individuals were asked to complete a study screener. If eligible, they created a study account and received a consent form. Consented participants then answered a baseline questionnaire, which included questions about sociodemographic characteristics, partner-seeking behaviors, psychosocial behaviors, and HIV-related sexual risk behaviors. We used best practices [18, 19] to identify falsified entries and duplicates by checking participants' email and IP addresses, operating system, browser information, answer patterns, and survey completion duration [17]. Participants were compensated with a $30 gift card upon completion of the baseline questionnaire. Study data were protected with a 256-bit SSL encryption and kept within a university firewalled server.

Measures

Online Dating Patterns

Four indicators were included to define online dating patterns. Participants were asked the frequency and the

usefulness of online dating to find a date, respectively, and the same set of questions to find a hookup. The frequency of using online dating had six response options ranging from "Never" to "About once a day." The usefulness of using online dating employed a 4-point Likert-type scale from "Not at all" to "Very much."

Demographic Variables

We asked participants to report their age, race, and ethnicity. In addition, participants were asked to report their highest level of educational degree (some high school, graduated high school, technical school, associate degree, some college, college, some graduate school, and graduate degree). We considered the education variable as a continuous variable in our study.

Relationship Characteristics

Commitment Ideation We used the commitment sub-scale of the Triadic Love Scale to assess YMSM's perceived importance of having a committed relationship [20]. The commitment sub-scale has six items ($\alpha = 0.82$) that ask participants to indicate their endorsement in desiring a committed relationship in the future (e.g., "To feel a sense of responsibility towards your relationship") using a 4-point scale (1 = "Not at all important" to 4 = "Very important"). We computed a mean commitment score, where higher scores indicate greater ideation on having a committed romantic relationship in the future.

Sexual Sensational Seeking The Sexual Sensation Seeking Scale was used to gauge an individual's propensity to seek out a novel or risky sexual stimulation [21]. This 10-item instrument employs a 5-point scale with response options ranging from 1 = "Not at all like me" to 5 = "Extremely like me." The sum of 10 items was ranged from 0 to 40, where higher scores indicate a higher propensity to seek out sexual stimulation ($\alpha = 0.77$).

Limerence Limerence measure was used to measure the intense feelings of dependence, insecurity, and doubt about a relationship and experiences with intrusive and intense thoughts about partners [22]. Participants were asked to answer eight items using a 5-point scale ranging from 1 = "Strongly disagree" to 5 = "Strongly agree." The scale includes statements such as "I think about how being in a relationship would solve my problems," "I have sex to feel loved," and "I obsess about a specific person even though it may not work out." The sum of eight items ranging from 8 to 40 was used in this study. Higher scores indicate greater limerence ($\alpha = 0.83$).

Decisional Balance to Condom Use We used the Decisional Balance Scale to examine participants' decisional balance for pleasure and emotional connection vis-à-vis condom use with partners [23]. Participants were asked to answer the seven paired statements: the first statement referred to sex without condoms, followed by an identical statement asking about sex with condoms. Items included "Sex [with/without] condoms is very intimate to me" and "Sex [with/without] condoms makes me feel close to my partner." Participants responded to each item using a 4-point scale ranging from "Strongly disagree" to "Strongly agree." A net difference for decisional balance items was created by summing the net difference between condom use and condomless sex scores across the items. This resulted in seven net scores ranging from -3 to 3. Then, the total decisional balance to use condoms score was computed by creating a mean score of these seven items. Scores close to zero indicate a decisional balance between sex with and without condoms. Positive scores reflect decisional balance to use condoms with a partner ($\alpha = 0.89$).

Sexual Behaviors

We used an adapted version of the Sexual Practices Assessment Schedule [11, 24] to quantify the number of male partners in the past 30 days. After participants answered their total number of male sexual partners, they were asked how many of those men had receptive and insertive anal sex, respectively. Participants were then asked to indicate the number of partners with whom they did not use a condom. We created a continuous variable to measure the number of sex partners, the number of insertive anal intercourse with/without condoms, and the number of receptive anal intercourse with/without condoms.

Data Analytic Strategy

Latent profile analysis was used to identify the number of online dating profiles based on the individuals' distribution on four sub-constructs. We used the four sub-constructs mean scores: internet time spent to find a date, usefulness of internet to find a date, internet time spent to find a hookup, and usefulness of internet to find a hookup. The best-fitting model was selected using the Akaike Information Criteria (AIC), Bayesian Information Criteria (BIC), Vuong–Lo–Mendell–Rubin Likelihood Ratio Test (LRT), and entropy [25]. Lower AIC and BIC scores indicate a better model, and a higher entropy score suggests a greater class separation. The significant LRT between the *k*-1 profile model and the *k* profile model indicates the model fit improved from the *k*-1 profile to the *k* profile. After selecting the best fitting model, we defined each profile based on

the distributions of four sub-constructs mean scores. Mplus version 8 was used to conduct LPA [26].

Finally, we used logistic regression models to assess the associations between latent online dating profiles and YMSM's demographic variables, relationship characteristics, and sexual behaviors. In binary logistic regression (see Table 4), categorical *k* profile was coded as a dummy variable, and each dummy variable was used as an outcome of each model. Variables identified as significant ($p < 0.1$) in bivariate analyses across profiles were included in our multivariable analyses (see Table 5). Of note, we did not include the number of sex partners in the multivariable models because of its high correlation with CAI. Logistic regression analyses were conducted in SAS 9.4 [27].

Results

Sample Characteristics

The sample characteristics are shown in Table 1. Participants had a mean age of 21.67 (SD = 1.81). The majority of the participants self-identified their race as White (74%), Black (14%), Asian (9%), and Other (9%). Thirty percent of participants (N = 54) self-identified as Hispanic/Latino. The majority of participants (79%) reported more than some college education.

Class Enumeration

We iteratively compared models with increasing numbers of profile solutions using AIC and BIC. AIC and BIC get smaller as the number of classes increases. Entropy was similar across the different solutions. The difference in LRT between a 4-class solution and a 3-class solution was not statistically significant (two-times-the-log likelihood difference = 44.64, df = 5, $p = 0.053$) (see Table 2). Therefore, a 3-class latent profile solution was selected from the empirical and theoretical perspective as the optimal model; the results of the 3-profile solution are shown in Fig. 1 and Table 3.

The first profile accounted for half of the sample (N = 93, 52%) and was characterized as a "discouraged users"; that is, YMSM who try to find a date over a hookup a few times per month, but perceive that GSN applications are not reliable in helping find dates or hookups. Young men who have sex with men in this profile reported spending some time on app dating to find a date (32.2% used at least two times a week), but not much to find a hookup (18.3% used at least two times a month). However, most participants in the profile considered app dating as not at all or somewhat useful to find both a date and a hookup (83.9% and 96.8%, respectively).

Table 1 Sample characteristics of single young men who have sex with men (n = 180)

	Mean (SD)/N (%)
Demographic characteristics	
Age	21.67 (1.81)
Race	
White	133 (73.9%)
Black	26 (14.4%)
Native	5 (2.8%)
Asian	16 (8.9%)
Middle Eastern	1 (0.6%)
Pacific	1 (0.6%)
Other	17 (9.4%)
Ethnicity—Latino	54 (30.0%)
Education	
Some high school	5 (2.8%)
Graduated high school	19 (10.6%)
Technical school	5 (2.8%)
Associate degree	9 (5.0%)
Some college	72 (40.0%)
College	53 (29.4%)
Some graduate school	14 (7.8%)
Graduate school	3 (1.6%)
Online dating patterns	
Frequency of online dating to find a date	
Never	17 (9.4%)
Once a month or less	30 (16.7%)
2–3 times a month	49 (27.2%)
About once a week	17 (9.4%)
2–6 times a week	29 (16.1%)
About once a day	38 (21.1%)
Usefulness of online dating to find a date	
Not at all	53 (29.4%)
Somewhat	73 (40.6%)
Moderately	34 (18.9%)
Very much	20 (11.1%)
Frequency of online dating to find a hookup	
Never	32 (17.8%)
Once a month or less	57 (31.7%)
2–3 times a month	57 (31.7%)
About once a week	14 (7.8%)
2–6 times a week	11 (6.1%)
About once a day	9 (5.0%)
Usefulness of online dating to find a date	
Not at all	43 (23.9%)
Somewhat	53 (29.4%)
Moderately	41 (27.8%)
Very much	43 (23.9%)
Relationship characteristics	
Committed romantic relationship	3.70 (0.39)
Sexual sensational seeking	20.21 (5.81)
Limerence	22.96 (6.55)

Table 1 (continued)

	Mean (SD)/N (%)
Sexual behaviors	
Decisional balance to use condoms	− 0.47 (0.95)
Number of sex partners	2.47 (2.67)
Receptive anal intercourse	1.16 (1.86)
Condomless receptive anal intercourse	0.79 (1.92)
Insertive anal intercourse	0.89 (1.43)
Condomless insertive anal intercourse	0.52 (0.97)
Condomless anal intercourse total	1.31 (2.18)

Young men who have sex with men in the second profile were classified as "date seekers" given their desire to use GSN applications to find a date over a hookup weekly, yet perceive that GSN applications are more useful for hooking-up than dating. The second profile accounted for 37% of the sample (N = 67); 40% of YMSM in this profile used at least two times a week to find a date, while 100% of those used less than once a week to find a hookup. However, they consider app dating as a useful tool to find a hookup (98.6%) than a date (49.3%).

The third profile (N = 20, 11% of the sample) was characterized as "instant lovers" because they are more likely to pursue hookups than dates and perceive GSN applications as useful for hooking-up instead of dating. Young men who have sex with men in this profile used a dating app at least two times a week to find a hookup (100%). Relatively, fewer numbers in this profile used a dating app to find a date (50% at least two times a week). Moreover, YMSM in this profile considered a dating app as a useful tool to find a hookup (75%), but not a date (30%).

Table 2 Fit indices for online dating latent profile analysis

The number of profiles	AIC	BIC	Entropy	Vuong–Lo–Mendell–Rubin likelihood ratio test			
				Loglikelihood	2LL difference[a]	df	Adjusted *p* value
2 profiles	2234.834	2276.342	0.879	− 1104.417	125.732	5	< 0.0001
3 profiles	2203.006	2260.479	0.873	− 1083.503	41.83	5	0.0412
4 profiles	2168.364	2241.802	0.876	− 1061.183	44.64	5	0.0532

AIC Akaike Information Criteria, *BIC* Bayesian Information Criteria, *df* degree of freedom

[a]Vuong–Lo–Mendell–Rubin two-times-the-log likelihood difference between the *k*−1 profile model and the *k* profile

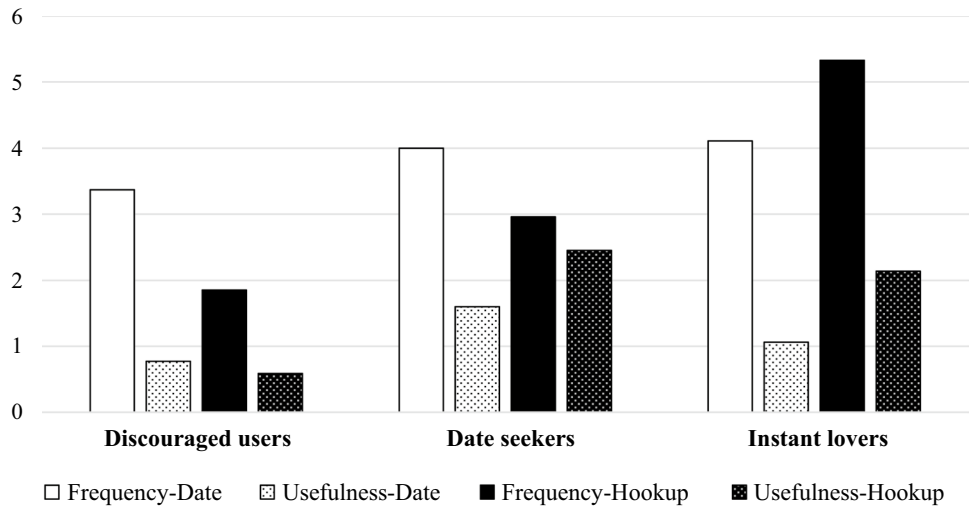

Fig. 1 Mean scores for the four online dating indicators by online dating patterns. *Note* The frequency of online dating to find a date/hookup employed a 6-point scale with response options ranged from 1 = "Never" to 6 = "About once a day." The usefulness of using online dating to find a date/hookup employed a 4-point scale with response options ranged from 0 = "Not at all" to 3 = "Very much." Discouraged users are defined as "YMSM who try to find a date over a hookup a few times per month, yet perceive that GSN applications are not reliable in helping find dates or hookups." Date seekers are defined as "YMSM who try to find a date over a hookup weekly, yet perceive that GSN applications are more useful for hooking-up than dating." Instant lovers are defined as "YMSM who try to find a hookup over a date several times a week, and perceive that GSN applications are more useful for hooking-up instead of dating."

Table 3 Indicators of online dating latent profiles

	Discouraged user (n = 93)	Date seeker (n = 67)	Instant lover (n = 20)
Frequency of online dating to find a date			
Never	14 (15.0%)	2 (3.0%)	1 (5.0%)
Once a month or less	22 (23.7%)	4 (6.0%)	4 (20.0%)
2–3 times a month	18 (19.4%)	28 (41.8%)	3 (15.0%)
About once a week	9 (9.7%)	6 (9.0%)	2 (10.0%)
2–6 times a week	15 (16.1%)	11 (16.4%)	3 (15.0%)
About once a day	15 (16.1%)	16 (23.9%)	7 (35.0%)
Usefulness of online dating to find a date			
Not at all	38 (40.9%)	8 (11.9%)	7 (35.0%)
Somewhat	40 (43.0%)	26 (38.8%)	7 (35.0%)
Moderately	13 (14.0%)	18 (26.9%)	3 (15.0%)
Very much	2 (2.1%)	15 (22.4%)	3 (15.0%)
Frequency of online dating to find a hook up			
Never	32 (34.4%)	0 (0%)	0 (0%)
Once a month or less	44 (47.3%)	13 (19.4%)	0 (0%)
2–3 times a month	15 (16.1%)	42 (62.7%)	0 (0%)
About once a week	2 (2.2%)	12 (17.9%)	0 (0%)
2–6 times a week	0 (0%)	0 (0%)	11 (55.0%)
About once a day	0 (0%)	0 (0%)	9 (45.0%)
Usefulness of online dating to find a hook up			
Not at all	42 (45.2%)	0 (0%)	1 (5.0%)
Somewhat	48 (51.6%)	1 (1.4%)	4 (20.0%)
Moderately	3 (3.2%)	32 (47.8%)	6 (30.0%)
Very much	0 (0%)	34 (50.8%)	9 (45.0%)

Table 4 Results from the bivariate logistic regression models for online dating profiles

	Discouraged users (n = 93)		Date seekers (n = 67)		Instant lovers (n = 20)	
	M (SD)/N (%)	OR (95% CI)	M (SD)/N (%)	OR (95% CI)	M (SD)/N (%)	OR (95% CI)
Demographic characteristics						
Age	21.7 (1.8)	1.02 (0.87, 1.20)	21.5 (1.8)	0.93 (0.78, 1.09)	22.1 (2.1)	1.15 (0.88, 1.51)
Non-hispanic White	55 (59.1%)	1.23 (0.68, 2.23)	37 (55.2%)	0.66 (0.33, 1.29)	10 (50.0%)	0.74 (0.29, 1.88)
Education*	68 (73.1%)	0.82 (0.67, 1.00)	58 (86.6%)	1.15 (0.94, 1.42)	16 (80.0%)	1.20 (0.85, 1.69)
Relationship characteristics						
Committed romantic relationship	3.7 (0.4)	1.41 (0.66, 3.03)	3.7 (0.3)	1.39 (0.62, 3.13)	3.5 (0.6)	0.90 (0.11, 0.79)[a]
Sexual sensational seeking	18.6 (5.5)	0.90 (0.85, 0.95)[b]	22.0 (5.7)	1.10 (1.04, 1.16)[b]	21.7 (5.7)	1.05 (0.97, 1.14)
Limerence	22.9 (6.0)	1.00 (0.95, 1.04)	23.5 (7.3)	1.02 (0.97, 1.07)	21.7 (6.8)	0.97 (0.90, 1.04)
Sexual behaviors						
Decisional balance to use condoms	− 0.3 (1.0)	1.49 (1.07, 2.07)[a]	− 0.6 (0.8)	0.73 (0.52, 1.03)	− 0.7 (0.9)	0.76 (0.46, 1.28)
Number of sex partners	1.4 (1.3)	0.49 (0.37, 0.64)[b]	2.7 (1.4)	1.03 (0.95, 1.11)	6.7 (5.4)	1.37 (1.18, 1.60)[b]
Condomless anal intercourse	0.8 (1.1)	0.69 (0.54, 0.89)[b]	1.5 (2.5)	1.07 (0.93, 1.23)	2.9 (3.8)	1.25 (1.05, 1.50)[a]

OR odds ratio (the ratio of the odds of A in one profile and the odds of A in the other two profiles), *CI* confidence interval

*At least some college education in the frequency column and modeling as continuous variable

[a] $p \leq 0.05$

[b] $p \leq 0.01$

Table 5 Results from the multivariable logistic regression models for online dating profiles

	Discouraged users (n = 93) OR (95% CI)	Date seekers (n = 67) OR (95% CI)	Instant lovers (n = 20) OR (95% CI)
Demographic characteristics			
Education*	0.85 (0.69, 1.06)	1.14 (0.92, 1.42)	1.12 (0.78, 1.62)
Relationship characteristics			
Committed romantic relationship	1.35 (0.57, 3.19)	1.34 (0.57, 3.17)	0.28 (0.09, 0.84)[a]
Sexual sensational seeking	0.91 (0.86, 0.99)[b]	1.09 (1.03, 1.16)[b]	1.03 (0.93, 1.13)
Sexual behaviors			
Decisional balance to use condoms	1.17 (0.80, 1.72)	0.82 (0.57, 1.19)	0.83 (0.47, 1.47)
Condomless anal intercourse	0.77 (0.59, 1.01)	0.98 (0.84, 1.14)	1.19 (1.00, 1.42)[a]

OR odds ratio, *CI* confidence interval

*Modeling as continuous variable

[a] $p \leq 0.05$

[b] $p \leq 0.01$

Online Dating Patterns, Relationship Characteristics, and Sexual Behaviors

Bivariate Logistic Regression

We examined the associations between each profile (discouraged users, date seekers, and instant lovers) and participants' sociodemographic characteristics, relationship motivations, and sexual behaviors using binary logistic regressions (see Table 4). Demographic characteristics were not associated with any of the profiles. Participants reporting greater sexual sensating seeking desires were less likely to be classified as discouraged users [Odds Ratio (OR) 0.90, 95% Confidence Intervals (CI) 0.85, 0.95] and more likely to be classified as date seekers (OR 1.10, CI 1.04, 1.16). Instant lovers were less likely to desire a committed romantic relationship in the future (OR 0.90, CI 0.11, 0.79) compared to peers in the other profiles. Limerence was not associated with any profile.

Discouraged users were more likely to report using a condom with their sexual partners (OR 1.49, CI 1.07, 2.07) and less likely to report a greater number of sexual partners (OR 0.49, CI 0.37, 0.64) and CAI (OR 0.69, CI 0.54, 0.98). Young men who have sex with men in the instant lover profile, on the other hand, reported a greater number of sexual partners (OR 1.37, CI 1.18, 1.60) and CAI (OR 1.25, CI 1.05, 1.50). We did not observe any association between date seekers and sexual behavior variables.

Multivariate Logistic Regression

We included variables (education, relationship commitment ideation, sexual sensation seeking, decisional balance to use condoms, and CAI) identified as significant in bivariate analyses ($p < 0.1$) across profiles in our multivariable analyses. In multivariate logistic regressions, the profile membership was associated with three variables (see Table 5): relationship commitment ideation, sexual sensation seeking, and CAI. Instant lovers were less likely to report a desire for committed romantic relationships in the future (OR 0.28, CI 0.09, 0.84) compared to peers in the other two profiles. Sexual sensation seeking desires were negatively associated with being classified in the discouraged user profile (OR 0.91, CI 0.86, 0.99) and positively associated with membership in the date seeker profile (OR 1.09, CI 1.03, 1.16). Instant lovers reported a greater number of CAI occasions (OR 1.19, CI 1.00, 1.42) compared to YMSM in the other two profiles. Educational attainment and decisional balance to use condoms were not associated with any profile.

Discussion

We used a person-centered approach based on YMSM's distributions of the frequency and the usefulness of GSN applications to find a date or a hookup, respectively, and identified three online dating profiles: discouraged users, date seekers, and instant lovers. The frequency of use of GSN applications to find a date was prevalent and comparable across the three online dating profiles observed in our sample, suggesting that the use of GSN for online dating has become a common means of dating among YMSM. As a result, the frequency of using online dating platforms cannot be the only factor defining online partner-seeking behaviors. Instead, when combined, the frequency of online dating to find a hookup and the perceived usefulness of both online dating to find a date and a hookup, respectively, offered greater potential to characterize and distinguish across online dating behaviors in our sample.

Comparisons across the three dating profiles also suggested differences in YMSM's desired relationship characteristics, personal traits, and sexual risk behaviors. These differences across profiles may help to explain some of the competing findings previously noted in the literature [4–6] and underscores the importance of relying on a person-centered approach to avoid generalization errors in online dating research. As opposed to relying on a single item or event to classify their samples (e.g., using Grindr), future research examining online dating patterns may benefit by examining how participants cluster together around a set of key variables. This effort may promote conceptual clarity and offer new strategies to tailor interventions aimed at encouraging preventive sexual behaviors and healthy relationships among YMSM.

Discouraged users comprised over half of our sample and were characterized by perceiving that both GSN applications for dating and hooking-up were not useful. Participants in this profile had lower sexual sensation seeking scores than YMSM in the other two profiles. On the other hand, YMSM in the date seekers profile—who were characterized by perceiving that GSN applications for hooking-up were useful and using GSN applications for dating more often than hooking-up—were more likely to report greater sexual sensation seeking scores compared to their counterparts. The difference between these two profiles regarding sexual sensation seeking is interesting given that sexual sensation seeking has been characterized as a willingness to engage in novel experiences, which may result in engaging HIV risk behaviors [28, 29]. However, after adjusting for sexual sensation seeking, we did not observe differences between these two profiles on YMSM's desire for a committed relationship in the future, their decisional balance to use condoms, or their recent condomless anal sex behavior. Thus, it is possible that the observed difference may indicate date seekers are more satisfied by GSN applications in helping them pursue novel experiences with partners met online than those in the discouraged user profile. Given the cross-sectional nature of our study, however, it is also possible that discouraged users' past experiences with GSN applications have disillusioned them from its perceived usefulness. Future prospective research, both qualitative and quantitative, examining the association between YMSM's experiences with GSN applications and sexual sensation seeking over time is warranted.

Instant lovers, characterized by using both dating and hooking-up sites most frequently and noting that GSN applications are more useful for hooking-up than dating, was the smallest profile observed. Compared to the other two profiles, instant lovers were distinctive in their low desire to find a committed romantic relationship and their greater likelihood of engaging in CAI. Based on these findings, this profile would most align with prior research suggesting that online dating is associated with risky sexual behavior [3, 5, 6]. Our results, derived from a person-centered approach that considered the frequency and the usefulness of online dating to find a date/hookup, suggest that online dating can be considered a risky sexual behavior depending on individuals' dating patterns. Instant lovers are especially prone to using online dating in risky ways. Thus, instant lovers need intensified interventions that promote healthy relationships and safe sexual practices. Intervening instant lovers, who play a major role in exacerbating the propensity for risky behavior in other users, is a vital strategy to make online dating venues risk-free.

Although limerence and decisional balance to forego condoms have been linked to YMSM's HIV risk behaviors and the heterogeneity of how they classify their partners (e.g., hookups, romantic dates, friends with benefits, or a combination thereof) in prior studies, these two constructs were not statistically associated with the three online dating profiles. The absence of a statistically significant association across the latent profile analysis, however, should not be taken to suggest that these constructs are not important in future HIV prevention interventions for YMSM meeting partners online. Rather, our findings simply suggest that neither construct aided in discriminating between the three online dating profiles. Nevertheless, given the exploratory nature of this study and the small sample sizes within each profile, we cannot rule out that we had insufficient accuracy and sensitivity to detect differences across these constructs. Future studies with larger samples are warranted.

This study has several limitations. First, in exploratory person-centered study designs, the number of latent profiles is not specified. We have selected three profiles as an optimal model, but the number of latent online dating profiles and the distributions of four dimensions (i.e., frequency and usefulness of online dating to find a date and a hookup) could vary by study sample. Future studies applying a theoretically driven latent profile analysis (i.e., confirmatory latent profile analysis) and the placement of model constraints to facilitate a confirmatory structure [30] are warranted. Second, this study included the frequency and the usefulness of online dating to find a date and a hookup to characterize online dating patterns. However, each online dating platform has its own characteristics, and users' online dating patterns might differ based on these features. Third, our study had a small sample size which can increase high sampling errors. Past research has suggested a minimum sample size of 500 for mixture analysis [31]. However, recent studies found that high-quality indicators could compensate for a small sample size [32]. Future studies with a larger sample size are warranted. Fourth, this study is a cross-sectional study that cannot determine a causal relationship between baseline characteristics and online dating profiles. In addition, online

dating patterns may change over time as they engage in the intervention. Therefore, future research applying a group-based trajectory model, which identifies clusters of participants who shared similar trajectories in online dating over time, or latent transition analysis, which estimates changes in membership over time, is warranted. Fifth, we conducted binary logistic regressions to assess associations between latent online dating profiles and associated factors. Binary logistic regression cannot determine factor changes between online dating patterns when there are more than two online dating patterns. Multinomial logistic regression could supplement this; however, we could not conduct multinomial logistic regression due to unbalanced class size and lack of sample size. A future study with a larger sample is warranted to examine changes between the classes. Lastly, the study used self-reported sexual risk behavior measures, which can be biased because of recall and social desirability issues.

In spite of these limitations, the results of this study extend the understanding of online dating patterns among YMSM by examining how both the frequency and the perceived usefulness of GSN applications may help differentiate diverse types of users. This study's person-centered approach to characterize online dating provides an in-depth understanding of YMSM's online dating behaviors and acknowledges that these profiles might differ across relationship and sexual behavior motivations. These findings support the need for greater tailoring of HIV prevention intervention strategies when seeking to target YMSM who meet partners online. Future evaluation studies of HIV prevention interventions based on these profiles, or other similar person-centered approaches, are warranted.

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Declarations

Conflict of interest The authors declare that there are no conflicts of interest.

Ethical Approval All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

Informed Consent Informed consent was obtained from all individual participants included in the study.

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