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Validation of the HIV Risk Assessment of Sexual Partnerships (H-RASP): Comparison to a Two Month Prospective Diary Study

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Abstract

The HIV Risk Assessment of Sexual Partnerships (H-RASP) was developed in order to create a retrospective measure of sexual risk taking that can account for the differing contexts of sexual partnership(s) within a specified period of time. In order to validate the H-RASP relative to other methods of measuring sexual risk taking, measurements from the H-RASP were compared to data from a prospective diary study of 95 young men who have sex with men (YMSM) over the same two month period. We found that the H-RASP was not significantly different at measuring participants' total number of sexual partners and total number of anal sex partners in comparison to the diaries. The two measures were significantly different in measurement of total number of condomless anal sex (CAS) partners and number of CAS acts within partnerships, such that participants on average estimated more CAS partners and acts in the H-RASP. The two measures shared 40.8% of variance on measurement of CAS partners and 44.6% of variance on CAS acts within partnerships. These results suggest that even though the H-RASP is not a perfect replication of prospective diary data, it captures a moderate proportion of the same variance, and, in the case of CAS acts within partnerships, a proportion of the variance that likely would not be measured by retrospective measures that do not ask about behaviors specific to partnerships.

Keywords

YMSM; gay; measurement; condomless anal sex

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Compliance with Ethical Standards:

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. This article does not contain any studies with animals performed by any of the authors.

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INTRODUCTION

The CDC estimates that more than 1.2 million people in the United States are currently living with HIV (CDC, 2015). Of those living with HIV, 54% are men who have sex with men (MSM). Sexual risk taking behaviors (e.g., number of sex partners, condomless sex) are commonly studied in MSM and other populations at risk for sexual transmission of HIV as proximal predictors of HIV/STI incidence (Beyrer et al., 2012; Herbst et al., 2008; Koblin et al., 2006; Schechter et al., 1986; Seage et al., 1992; Vittinghoff et al., 1999). Measurement of sexual risk taking behaviors is complicated by recall bias and contextual factors (e.g., partner characteristics, alcohol and drug use prior to sex) that, when unmeasured, can make participant responses appear inconsistent (Leigh & Stall, 1993; Schroder, Carey, & Venable, 2003). The HIV Risk Assessment of Sexual Partnerships (H-RASP) (Mustanski, Starks, & Newcomb, 2014) was developed in order to address both of these complications and to couch sexual risk taking within the context of the sexual partnership(s) in which it occurs. The H-RASP has been validated in comparison to data collected from an interviewer administered interview (Hogan et al., 2016), however, the H-RASP to this point has not been validated relative to methods more proximal to the sexual risk taking event, such as diaries. Diary studies, which have been considered the closest the field has to a gold standard for their ability to capture both partner-level and event-level data on sexual encounters (Schroder et al., 2003), are ideal for establishing the validity of the H-RASP.

The most common measures of sexual risk taking used in the literature have been retrospective global reports that assess the frequency of sexual risk behaviors or sexual encounters/partnerships in the participant's lifetime or within a specified recall period (Mustanski et al., 2014; Schroder et al., 2003). The primary advantage to using a global measure of sexual risk is the ease of administration, because it typically only requires one or two questions to measure risk. The criticism of these measures is that they collapse risk across different partnerships and sexual events and therefore assume that factors associated with sexual risk, such as condom use, are consistent in every context (Mustanski et al., 2014). Past research has not found support for this within-individual stability assumption in condom use (Cooper, 2010; Grov, Golub, Mustanski, & Parsons, 2010). For instance, there is evidence that the likelihood of condomless anal sex (CAS) is greater in serious relationships compared to casual partnerships (Dudley, Rostosky, Korfhage, & Zimmerman, 2004; Mustanski, Newcomb, & Clerkin, 2011; Sullivan, Salazar, Buchbinder, & Sanchez, 2009), when substance use occurs prior to sex (Vosburgh, Mansergh, Sullivan, & Purcell, 2012), and when sexual partners are older or perceived to be non-monogamous (Newcomb, Ryan, Garofalo, & Mustanski, 2014). These differences would all be obscured by a global measurement of risk.

Another approach to collecting data on sexual behavior from individuals involves assessing sexual behavior and relationship characteristics within a single sexual partnership (e.g., most recent sexual partner) (Kim et al., 2016; Leigh, 2002), but this approach also assumes stability of sexual behaviors within individuals over time. One of the alternatives to global single event measurement is the "one-with-many" design (Mustanski et al., 2014), which includes prospective diary approaches and retrospective timeline followback (TLFB). In a one-with-many design, participants are asked to report on multiple incidences in which a

sexual behavior occurred. The advantage to this type of measure is that risk behavior is connected back to the contextual factors that surround and perhaps differentiate events or partnerships. In measures of sexual risk, one-with-many designs typically take an event-level approach in which participants are asked to report on their last few sexual encounters in a set period of time.

The prospective behavioral diary methodology is one example of a one-with-many design (Glick, Winer, & Golden, 2013; Stalgaitis & Glick, 2014), and both daily and weekly assessment frequencies have been used to measure sexual risk behavior over time. Diaries are advantageous because they can capture data on each sexual encounter and the context of the sexual encounter shortly after they have occurred, which not only makes it possible to identify within-person differences, but also reduces recall bias (Leigh, 1993; Leigh, Gillmore, & Morrison, 1998; Schroder et al., 2003). In comparison to diary methods, global measures can lead to under- or over-reporting of sexual behaviors (Coxon, 1999; Downey, Ryan, Roffman, & Kulich, 1995; Jaccard, McDonald, Wan, Dittus, & Quinlan, 2002; Ramjee, Weber, & Morar, 1999) and are especially problematic for sexual behaviors that are not stable across sexual encounters (Hoppe et al., 2008). The disadvantages are that it can be difficult to maintain a high retention for a diary study that lasts 30 days or longer, it is burdensome for both the researcher and the participant, and some evidence suggests systematic behavior change occurs over time (Newcomb et al., 2016; Schroder et al., 2003). All of these issues may compromise the validity of the diary data.

Originally developed to assess alcohol use at the event-level (Sobell & Sobell, 1992), the timeline followback (TLFB) method is a retrospective calendar-based assessment in which participants report on specific behaviors during a specified period of time. This approach has been adapted to measure sexual behavior (Weinhardt et al., 1998), and it has been used extensively to assess sexual risk behavior and its correlates among MSM (e.g., Irwin, Morgenstern, Parsons, Wainberg, & Labouvie, 2006; Parsons, Kowalczyk, Botsko, Tomassilli, & Golub, 2013). In fact, a recent study compared TLFB and diary data in a sample of highly sexually active MSM and found substantial convergence when examining the event-level association between substance use and sexual risk behavior (Rendina, Moody, Ventuneac, Grov, & Parsons, 2015). The TLFB is an attractive alternative to the diary methodology because it is administered retrospectively at a single time point, which makes it less burdensome to administer. However, this approach is also substantially more resource intensive than global retrospective reports of sexual behavior because it is interviewer-administered and gathers a large amount of data, and it is possible that participants may under-report their sexual behavior in order to minimize this burden.

The H-RASP is a one-with-many design that capitalizes on the strengths of the diary and TLFB approaches in gathering within-persons partner-level data while minimizing burden. It is a partner-level measure that asks participants to report on their three most recent sexual partners during a specified period of time (e.g., past six months). The primary innovations of the H-RASP are that measurement is shifted from the event-level to the partner-level and that we can evaluate more than one sexual partnership that has occurred within a period of time. This allows for partner-level detail over a longer period than most diary or TLFB methods, and it does so by identifying the characteristics unique to partnerships that can last

much longer than a single sexual occurrence. Similar to the TLFB, the H-RASP is an attractive alternative to the diary approach because it can be fully administered in a single assessment time point or as part of a longitudinal study with assessments at regular time intervals (e.g., bi-annually, annually). It is also an attractive alternative to the TLFB because measuring risk at the partner-level allows for assessment of behavior during a longer recall period.

The H-RASP is versatile in that it has been adapted for use with different samples, including YMSM (Mustanski et al., 2011; Newcomb et al., 2014), more broad samples of sexual and gender minorities (SGM) (e.g., young sexual minority women; Whitton, Newcomb, Messinger, Byck, & Mustanski, 2016), and heterosexual adolescent samples (Mustanski, Byck, et al., 2013). It has also been utilized to evaluate a diverse array of research questions related to sexual risk including the characteristics of sexual partnerships that are associated with sexual risk-taking (Newcomb et al., 2014), the effects of HIV-related knowledge and behavioral skills on engagement in sexual risk behaviors (Mustanski, Byck, et al., 2013), predictors of intimate partner violence in SGM relationships (Whitton et al., 2016), the effects of developmental change on sexual risk-taking (Newcomb & Mustanski, 2014), and randomized controlled trials of sexual health interventions (Mustanski, Garofalo, Monahan, Gratzler, & Andrews, 2013).

Current Study

Given that diary methods are likely the most accurate in capturing sexual risk behavior due to substantially reduced risk of recall bias (Schroder et al., 2003), the goal of the present study was to test the validity of the H-RASP by comparing it to a two-month prospective diary study of sexual behavior in a sample of YMSM. We sought to determine the accuracy of the H-RASP in: 1) measuring participants' total number of sex partners and CAS partners, and 2) measuring the number of CAS acts within partnerships. We also explored whether comparisons were different for CAS acts within serious and casual partnerships. We hypothesize that more commonplace and frequent sexual behaviors may be more difficult to accurately estimate compared to rare or unique sexual encounters. For this reason, over or under estimation of sex acts may be more common with a serious partner than a casual partner.

METHODS

Participants

Participants were a subsample of YMSM recruited from eDAPT, a two-month long prospective diary study designed to assess the effects of self-monitoring on substance use and sexual behavior (total $N = 370$) (Newcomb et al., 2016). Participants from the parent study were recruited using national online advertisements posted on Facebook, and participants came from 44 states across the U.S. and the District of Columbia. Eligibility criteria included: 1) assigned male at birth and current male gender identity, 2) oral or anal sex with another man in the previous six months, 3) at least one instance of binge drinking (i.e., 5 or more drinks on a single occasion) or illicit drug use (cocaine, heroin, methamphetamines, opiates, non-prescription depressants, non-prescription stimulants,

psychedelics, ecstasy, GHB, ketamine, or inhalants) in the previous month, 4) aged 16 to 29, and 5) HIV-negative or unknown serostatus. In order to validate the H-RASP relative to the most reliable diary data from this sample, we administered the H-RASP to a subset of eDAPT participants who met the following criteria: 1) completed the post-test for the parent study within one week of completing their last diary survey; 2), had a diary completion rate of 75% or higher; and 3) were not assigned to the eDAPT control group that did not complete diaries (total analytic $N=95$).

The Facebook ads linked to a screener that was used to determine eligibility. Participants who were eligible and consented to participate were sent a link via email to a baseline survey. After completing the baseline, they were randomized into one of the three conditions (daily diary, weekly diary, or control). Participants in the diary conditions were sent survey links for the duration of the two month diary period and a final follow up survey was sent out to all participants at the end of two months. All surveys were administered online in English via a custom-built survey platform and could be completed from a computer, tablet, or smart phone. Participants who completed the follow up survey within seven days and who met the H-RASP criteria were sent an additional link to the H-RASP survey and were given seven days to respond. Participants could earn up to \$75 for their participation: \$15 for completing the baseline, \$15 for completing 50% of diaries, \$15 for completing 85%, \$15 for completing the two-month follow-up, and \$15 for completing the H-RASP survey. The protocol for the study was approved by the institutional review board at Northwestern University. For further details on recruitment and design see: Newcomb, Swann, Mohr, and Mustanski (2017).

Measures

Prospective Diaries—In the daily and weekly diary conditions, participants were asked to respond to the question “Did you do ANY of the following sexual activities with another person on [date]? Please choose all that apply” for each day of the two month assessment period. Response options included: “kissing,” “mutual masturbation/fondling,” “oral sex,” “vaginal sex,” “anal sex,” “other,” and “I didn’t have any sexual activity.” Participants who endorsed any of the first six options were asked to identify the first name and last initial of the partner they engaged in sexual activities with. If they did not know the name of the partner, they were asked to enter a nickname such as “guy from the birthday party.” Participants who endorsed having anal sex with their partner on that day were asked if they had used a condom. Follow up questions asked participants to identify the sex, approximate age, relationship status, and race/ethnicity of their sexual partner.

In order to calculate participants’ number of different sexual partners in the two month period, partners were identified as unique based on reported first name and last initial (more details on matching below). The number of total sexual partners for each participant was created as a sum of the number of unique partners that participants reported having oral, vaginal, or anal sex with. The number of anal sex partners was calculated as a sum of the number of unique partners that participants reported having anal sex with. Similarly, for the calculation of condomless anal sex partners, the participant had to respond “no” to the

question, “Did you use a condom when you were the receptive/insertive partner?” for that partner to be included.

The number of CAS acts within each partnership was calculated as a sum of the number of days in the two month study that the participant reported having CAS with that partner. We also calculated CAS acts separately for partnerships defined as “serious” and partnerships that fell in the other four categories that we termed “casual” (“casually dating but not serious,” “sleeping with this person but not dating,” “one night stand,” and “stranger or anonymous person”) in order to investigate differences in reporting accuracy by relationship type.

H-RASP—The H-RASP consists of three sections, the first two of which were used for comparison to prospective diary data (the third section asked about STI and HIV testing which were not components of the daily and weekly diaries). The H-RASP used in the current study consisted of seventy-seven items (50 of which are asked about a specific partner and are repeated for the up to two additional partners the participant can report), but that number can change depending on the number of partners researchers choose to ask about. Participants were first asked to identify the number of partners they had vaginal, anal, or oral sex with in their lifetime and in the previous two months. The measure then asked participants to report the number of those partners who were anal sex partners and the number of anal sex partners that they engaged in condomless anal sex with. Responses to these items for the two month period were used as our measures of total sexual partners, total anal sex partners, and total condomless anal sex partners for comparison to diary data.

The second section of the H-RASP asked about sexual behavior with up to three of the participant’s most recent sexual partners in the previous two months. Participants were asked to provide the first name and last initial of each partner or, if they did not know the partner’s name, to provide a nickname such as “guy/girl at my birthday party.” For each partner, they reported the number of times they had anal sex within the two month period and the number of times that anal sex with that partner was condomless. The item measuring condomless anal sex acts was used for comparison to diary data. Follow up questions asked about partner demographic characteristics including age, sex, race/ethnicity, and the participant’s relationship status with that partner. Separate variables were created for CAS acts with serious and CAS acts with casual partners using the same categories as the diaries.

ANALYTIC STRATEGY

Partner Matching

In the diaries, if the participant endorsed at least one sexual activity, they were asked to identify the full first name and last initial of the partner with whom they engaged in that activity. Partners with the same first name and last initial on multiple days in a participants’ diaries were treated as repeat partners. For CAS acts, number of days that the participant had CAS were summed across each day the partner appeared in the diaries. For partners where names appeared to be misspelled from one day to another or the participant did not provide the full first name and last initial (i.e., gave only the first name, reported first and last initial instead of the full first name and last initial, or reported a nickname for the partner), matches

were verified by confirming that the partner matched on reported race/ethnicity and age. In the H-RASP, participants were asked to report the full first name and last initial of their three most recent sexual partners. Partners identified in the H-RASP were matched to partners in diaries based on first name and last initial. The same process for reconciling misspelled names or incomplete full first name and last initial that we used to match partners across diary entries was used to match H-RASP data to diary data.

Statistical Analyses

Overall, we tested the validity of the H-RASP by comparing it to prospective diary data on measures of total number of sex partners and total number of sex acts with specific partners over the two month period. We used two methods for determining the validity: 1) calculating intraclass correlations (ICCs) between the two measures in order to determine similarity, and 2) testing for significant differences between the data participants reported using each method. We used GPower to calculate power given our sample size and found that power was .49 for detecting a small effect and .99 for detecting a medium-sized effect. The results suggest that we may have been underpowered to detect small differences between participants' reports on the diaries and the H-RASP.

ICCs using absolute agreement were conducted in SPSS 23 for H-RASP variables and their diary counterparts. We report the ICC values for both the raw data and the data after a logistic transformation had been used to correct for extreme values. With the raw data, we also report ICCs separately for participants in the daily and weekly diary conditions. Negative binomial regression models were used to test for differences between the H-RASP and the diaries in participant reports of their number of sexual partners in the previous two months. The negative binomial distribution was estimated in order to correct for the non-normality of count data. Method of data collection was coded as a dichotomous predictor (0 = Diary, 1 = H-RASP). The same method was used for comparing the number of anal sex partners and the number of condomless anal sex partners in the H-RASP and diary surveys.

In the H-RASP, participants were asked to report on their sexual behaviors with their three most recent partners in the previous two months. In order to use data for multiple partners reported by the same participant, multilevel repeated measures models were used to compare number of condomless sex acts reported in the H-RASP and number of days that condomless sex acts occurred with a partner in the diaries. As has been done in previous reports using the H-RASP (Greene, Madkins, Andrews, Dispenza, & Mustanski, 2016; Mustanski, Byck, et al., 2013; Newcomb et al., 2014), the condomless sex variables were winsorized at two standard deviations to correct for extreme values reported by participants. The benefit of multilevel models is that they can account for the similarity in the responses of the same participant reporting on experiences with multiple partners in the previous two months (Gelman & Hill, 2006).

In the final set of analyses, we tested for the possible effects of missingness on our results. All participants included in the present study provided complete data on the H-RASP. Sum scores were created for number of partners and number of acts from the diary data despite the presence of missingness for some participants. Multiple imputation was ruled out as a possible solution to address missingness because imputed values could not be assigned to

specific partners. Average diary completion was above 90% in the sample. We tested whether diary completion rates were associated with demographic factors (age, sexual orientation, relationship status, and race/ethnicity), diary condition, or number of condomless partners or acts reported on either the H-RASP or diaries using independent samples t-tests and negative binomial models. We also calculated difference scores between the H-RASP and diary data for the sexual partner and CAS acts within partnerships outcomes. We tested whether differences in percentage of completed diaries were predictive of differences between the H-RASP and diaries in order to determine if the differences between the two measures were the result of incomplete diary data.

RESULTS

Demographics

The mean age of the analytic sample was 23.51 ($SD = 3.30$). Participants in a serious relationship at the start of the diaries made up 38.9% of the sample. Most participants identified as gay (87.2%) with a smaller number identifying as bisexual (12.8%). The racial breakdown was majority White (56.4%), followed in size by Hispanic/Latino (26.6%), Black/African American (9.6%), multiracial (5.3%), Asian/Pacific Islander (1.1%), and participants who identified their race/ethnicity as “other” (1.1%). Participants were randomized to receive diaries on either a daily or weekly basis, and just over half of the participants in the analytic sample were in the weekly condition (56.9%). Participants in the weekly condition were asked to complete diaries for each of the previous seven days at the end of the week, whereas daily participants were asked to complete diaries for the previous day.

Total Number of Sexual Partners

Participants were asked in the H-RASP to report the total number of sexual partners they had in the previous two months. This was compared to the number of partners that appeared in the participants’ diaries during the same period. A negative binomial regression model found no significant difference between the number of partners reported in the diaries and the number retrospectively reported on the H-RASP ($M = 3.22$ $SD = 3.50$ vs. $M = 3.20$ $SD = 3.52$, $p = .97$; see Table 1). When the analysis was limited to anal sex partners, there was still no significant difference between the diaries and the H-RASP ($M = 2.18$ $SD = 2.46$ vs. $M = 2.61$ $SD = 2.81$, $p = .26$). When limited to CAS partners, participants reported significantly fewer partners in the diary compared to the H-RASP ($M = .96$ $SD = 1.12$ vs. $M = 1.58$ $SD = 2.74$, $p < .05$).

ICCs were above .40 for all outcomes related to number of sexual partners reported in both the H-RASP and diaries (see Table 2). The ICC for number of sexual partners indicated that 77% of the variance in number of sexual partners in the H-RASP and diaries was shared variance. Likewise, 62% of the variance in anal sex partners and 41% in CAS partners was shared. The ICCs indicated more similarity between the diaries and H-RASP after a logistic transformation was performed. Shared variance for total sexual partners was 86%, for anal sex partners it was 77%, and for CAS partners it was 65%.

The ICC values were higher for participants in the daily condition compared to the weekly condition on number of sexual partners (83% vs. 66%) and number of anal sex partners (74% vs. 50%). However, variance was lower for the daily condition compared to the weekly on number of CAS partners (40% vs. 44%).

Total Number of Condomless Anal Sex Acts within Partnerships

Over the course of the diaries, participants reported an average of 3.19 ($SD = 3.50$) unique partnerships. For the full sample, there were 303 total unique partnerships reported in the diaries and 139 were matched to the maximum of three reported partnerships in the H-RASP. Participants reported an average of 1.99 ($SD = .97$) specific partnerships on the H-RASP. In total, 189 partnerships were reported on the H-RASP across the 95 participants. There were 30 participants (32% of the sample) that reported more than three partners in the two month period and thus had partnerships that were not reported on in the H-RASP. Of 189 partnerships reported in the H-RASP, 74% ($N = 139$) were matched to partnerships reported in the diaries. The match rate was higher for participants who reported a single partner in the previous two months (87%) compared to participants who reported multiple partners (64%). Of the 139 matched partners, 79% were present in the second month of the diary study and 66% were present in the first month of the diary study (note: 45% of matched partners appeared in both months). Unmatched H-RASP partners fell into two categories: partners where the participant provided a nickname instead of a first name and last initial (e.g., “sauna guy,” “guy from party,” etc.) that was unable to be matched to a similar description in the diaries (30%) and partners where the reported first name and last initial did not appear in the diaries (70%). Out of the 139 matched partnerships, 52 (33%) reportedly included anal intercourse.

The ICCs for CAS acts are presented in Table 2. The H-RASP and diaries shared 45% of the variance in CAS acts. The common variance was 34% for CAS acts in serious partnerships and 38% for CAS acts in casual partnerships. ICC values were higher after a logistic transformation. Common variance for total CAS acts was 78%, for CAS acts with serious partners it was 73%, and for CAS acts with casual partners it was 67%. When the ICC was broken down by diary condition, daily participants had higher common variance (50%) compared to weekly participants (39%).

Multilevel mixed-effects models were run to compare reports of CAS acts in the H-RASP and the number of days the participant reported having CAS with that same partner in the diaries (see Table 3). CAS acts were significantly lower in the diaries compared to the H-RASP ($M = 2.08$ $SD = 3.21$ vs. $M = 5.94$ $SD = 10.01$, $p < .01$). This was also true for condomless sex acts with serious partners ($M = 4.40$ $SD = 4.19$ vs. $M = 12.90$ $SD = 13.27$, $p < .01$) and with casual partners ($M = 0.63$ $SD = 0.75$ vs. $M = 1.59$ $SD = 2.46$, $p < .01$).

Diary Completion Rates on H-RASP and Diary Data

The average percentage of completion for the diaries was 93.4% ($SD = 8.2\%$) in the analytic sample. There were no differences in rate of diary completion based on age ($t = -0.68$, $p = .50$), relationship status ($t = 0.58$, $p = .57$) sexual orientation ($t = -0.24$, $p = .81$), race/ethnicity ($F = 0.58$, $p = .63$), or diary condition ($t = -0.54$, $p = .59$). Negative binomial

models were run to test if the rate of diary completion was related to sexual risk taking as reported in the diaries and the H-RASP. Diary completion rates were not significantly associated with the number of CAS partners in either the diary (Beta = 1.28, $p = .37$) or the H-RASP (Beta = 0.06, $p = .97$). Diary completion was also not significantly associated with number of CAS acts reported in the diaries (Beta = 0.15, $p = .95$) or in the H-RASP (Beta = 0.71, $p = .74$).

In order to determine if differences between the diary and the H-RASP were partially explained by the percentage of diaries participants completed in the two month period, linear and multilevel regressions were run to see if diary completion percentage was predictive of the differences (see Table 4). The percentage of diary completion was not significantly associated with observed differences between methodologies in the total sexual partner measures or the differences in CAS acts within partnerships.

DISCUSSION

The purpose of the current study was to validate the H-RASP, a retrospective measure of participants' sexual relationships with up to three partners in the previous two months, by comparing the measure to prospective diary data collected over the same period. We found that there was greater convergence between the H-RASP and diary data when measuring participants' total number of sexual partners and total number of anal sex partners. However, the two methods were significantly different in measurement of total number of CAS partners and number of CAS acts within partnerships, such that participants reported on average a greater number of CAS partners and acts in the H-RASP. The two measures shared 40.8% of variance on measurement of CAS partners and 44.6% of variance on CAS acts within partnerships. These results suggest that even though the H-RASP is not a perfect replication of prospective diary data, it captures a moderate proportion of the same variance, and, in the case of CAS acts attributable to specific partnerships, a proportion of the variance that likely would not be measured by global reports. Overall, our findings suggest that the H-RASP may not always be a replacement for diary and TLFB approaches, but within specific contexts, it can be a less burdensome tool with clear advantages over global measurements.

Measurement of the total number of partners a participant had in the previous two months is most similar to global measurements of sexual risk where a single question is asked that collapses across events and the specific context of those events. The H-RASP had the best convergence with diary data for these partner measures. For total sexual partners, 76.8% of the variance in measurement was shared between the H-RASP and diaries and the difference between the two measurements was statistically indistinguishable. It was a similar pattern for number of anal sex partners, where 62.1% of variance was shared. Based on participants' accuracy at remembering who they had sex with and whether or not they had anal sex with those partners, if total number of sexual partners is the outcome of interest, daily measurement of sexual risk may not be necessary to accurately measure that outcome.

The shared variance was lower for the total number of CAS partners at 40.8% and, in the paired samples t-test, participants reported a significantly higher number of CAS partners on the H-RASP compared to the diaries. The similarity between the measures decreased as the

measures became more specific (i.e., the ICC for total anal sex partners was lower than the ICC for total sexual partners). This pattern suggests that there may be a recall bias on the part of participants such that they are very accurate at remembering the number of sexual partners they had over the previous two months but are less accurate at remembering whether sex was condomless. It is also possible that the H-RASP is more vulnerable to overestimation of sexual risk behavior than diary studies because it asks participants to estimate total numbers of behaviors or partners over a specified recall period (as opposed to summing daily reports). Indeed, some prior evidence suggests that some MSM overestimate their engagement in sexual risk behaviors in retrospective global assessments compared to diary reports (Horvath, Beadnell, & Bowen, 2007), particularly those with substantial variability in risk behavior engagement over time (Hoppe et al., 2008).

Measurement of sexual risk behaviors within multiple partnerships is the primary innovation of the H-RASP. As such, the comparison of H-RASP measurements of CAS acts within partnerships to diary data from the same partnerships was the most relevant to assessing the reliability of that innovation. We found that for CAS acts within partnerships, 44.6% of variance was shared between the H-RASP and the diaries. We also found that participants reported significantly more CAS acts within partnerships in the H-RASP in comparison to the diary data, and this was true for CAS acts in both serious and casual partnerships. If indeed this difference reflects over-reporting of CAS acts in the H-RASP, then the H-RASP is not a complete replacement for diary measurement. When used as a tool for studying effects of partner and relationship characteristics (e.g., partner age and relationship status), the potential over-reporting of CAS in the H-RASP would have minimal effects on estimated within-person effects because the over-reporting bias essentially represents a linear transformation of the dependent variable. This interpretation is supported by the higher ICCs for each outcome after a log transformation. After being transformed, common variance was above 65% for all measures.

The significantly higher numbers of reported CAS partners and CAS acts in the H-RASP was in line with previous research that has found that global reports over- or underestimate sexual behaviors (Coxon, 1999; Downey et al., 1995; Jaccard et al., 2002; Ramjee et al., 1999). One possible explanation in the current study was that differences in diary completion rates might partially explain the discrepancies between the diaries and H-RASP on some measures. Diary completion was high in the current sample ($M = 93.4\%$, $SD = 8.2\%$), and the percentage of diary completion was not predictive of any of the differences between the diaries and the H-RASP. There was also evidence in the ICC values that diary and H-RASP data was more similar for participants in the daily diary condition compared to the weekly diary condition, but there was no significant difference between the two groups on percentage of completed diaries. Participants in the weekly diary condition were asked to complete a week's worth of diaries in a single sitting, it is possible that this led to fatigue and less accurate reporting compared to participants in the daily condition who were asked to respond to shorter surveys more frequently. The possibility of underreporting in the diaries would be in line with previous research that has found systematic changes in how participants respond to diaries over time (Newcomb et al., 2016; Schroder et al., 2003).

Based on these findings, it appears that the H-RASP may be susceptible to some of the same recall biases that effect global measurements. However, the ICC for CAS acts within partnerships was slightly higher than the ICC for number of CAS partners (47.5% vs. 42.4%), which suggests that retrospective measurement of acts within partnerships is at least comparable to retrospective global measurements in terms of shared variance with diary data. If measurement of total number of CAS partners is the most analogous to global reports, then the similarity in ICCs may indicate that accuracy is not lower in a partnership-based measurement model and that both approaches have similar strengths and weaknesses in comparison to diary reports.

We acknowledge that the completion of diaries for two months prior to completing the H-RASP at follow-up may have primed participants to be thinking more thoroughly about their sexual behavior, thus influencing their ability to recall their behavior more accurately when completing the H-RASP. While this was unavoidable in the current design (and in many other approaches to assessing validity), the current analyses contribute to a body of converging evidence for the validity of the H-RASP. The H-RASP has already been found to be equivalent to interviewer administered questions about sexual partners and sexual behaviors within specific partnerships delivered through *netCanvas*, a digital tool for collecting social and sexual network data (Hogan et al., 2016). Additionally, condomless receptive anal sex acts as measured by the H-RASP has also been found to be associated with higher rates of rectal chlamydia and gonorrhea in YMSM (Mustanski, Feinstein, Madkins, Sullivan, & Swann, 2017), which provides evidence of predictive validity of the measure. Taken together with the findings from the present study, our research supports the H-RASP as a valid measure for sexual risk-taking, albeit one that is most appropriate in specific contexts, which has associations with biomedical outcome data such as STIs.

The current analyses have several important implications for selection of sexual behavior measurement methodology. We observed high correspondence between the diary data and H-RASP items assessing total number of sexual partner and anal sex partners. These simple global retrospective items are likely sufficient for cases in which the independent variable and dependent sexual behavior variable are not hypothesized to vary substantially within persons over time (e.g., “does an intervention X reduce the total number of sexual partners post-intervention?”). However, for cases in which there is substantial variation within persons over time in independent and dependent variables, or the independent variable must be mapped directly onto the occurrence of the dependent variable (i.e., “are participants more likely to have condomless sex with older partners compared to younger partners?”), then a within-persons approach like the H-RASP is preferable. For such cases in which a within-persons approach is needed, the H-RASP is an attractive alternative to diary and TLFb methods because it is self-report and administered in a single setting. If indeed participants are somewhat more likely to overestimate their sexual behavior in the H-RASP, this would have less of an influence on within-persons analyses given that each individual serves as their own control in this analytic approach. A diary or TLFb approach, on the other hand, should be used when the research question involves assessment of correlates or predictors of sexual behavior at the level of the sexual encounter (as opposed to the partnership-level). For example, a diary or TLFb approach would be needed to understand

whether individuals are more likely to have condomless sex on days on which they drank alcohol.

We also note that the items in the H-RASP may be adapted depending on the research question. For example, some analyses may necessitate separating sexual behaviors with male and female partners. The global retrospective items in the H-RASP may be administered separately for male and female partners, and the partnership level items already assess birth sex of sexual partners. Furthermore, the HIV prevention landscape has evolved substantially in recent years with the uptake of biomedical treatment as prevention (TasP), including pre-exposure prophylaxis (PrEP) use among HIV-negative persons and viral suppression among HIV-positive persons as highly efficacious prevention strategies, even in the absence of consistent condom use (Cohen, McCauley, & Gamble, 2012; Grant et al., 2010). The current analyses focus on reliability of the H-RASP to produce accurate reports of number of sex partners and condomless sex acts in the absence of biomedical prevention because these data were collected prior to the more widespread use of biomedical prevention. However, the novel partnership-level approach of the H-RASP is ideal for capturing sexual behavior in the context of both participant and partner biomedical prevention use. For example, by comparing behavior across multiple partnerships within-persons, this approach can estimate which partner and relationship factors are associated with combination biomedical and condom use. Furthermore, the partnership-level approach can assess each partner's perceived viral suppression or PrEP use in order to examine how individuals make decisions about condom use when partners are using biomedical prevention strategies. Future analyses should seek to validate the H-RASP as a tool for assessing sexual risk in the context of biomedical prevention use.

This study is not without limitations. First, these analyses examined the validity of H-RASP data in a two month retrospective reporting window because we utilized a sample enrolled in a two month prospective diary study for the validation. It is unclear how these findings would generalize to the use of the H-RASP to assess larger reporting windows (e.g., six months). Second, this study did not administer global retrospective reports of sexual risk behavior during the two month reporting period, so we were not able to assess differences between global reports, the H-RASP partnership-level approach, and diaries. Third, even acknowledging the high rate of diary completion, incomplete diary data remains an important limitation. Approaches for imputing missing data might have been successful at generating estimated values on days or weeks when diaries were not completed, but we could not have estimated the identity of partners that would be necessary to match that data with participants' H-RASP values. Relatedly, a quarter of partnerships identified in the H-RASP could not be matched to diary counterparts. Of that quarter, 30% were not matched because the participant reported a nickname in the H-RASP instead of an actual name, and that nickname could not be matched to a diary partner with confidence. The potential causes for the other 70% of unmatched partners could include missing data in the diaries. It could also be that completing diaries for a two month period became burdensome for some participants and led them to under-report partners in order to reduce the time spent on surveys. Finally, there are certain limitations related to our sample of adolescent and young adult MSM. Our sample included 95 YMSM who were recruited online through a single social media platform and we may have been underpowered to detect small differences

between participant reports on the diaries and the H-RASP. In addition, while the sample was relatively diverse in terms of race/ethnicity, it is unclear the extent to which these data generalize to other populations.

In sum, the H-RASP is an innovative tool that bridges the gap between global retrospective reports of sexual behavior and intensive prospective sexual behavior diary methods in order to capture data on sexual behavior across multiple partnerships within-persons, as well as the context in which these behaviors occurred. Furthermore, the current analyses found supporting evidence for the validity of the H-RASP in a sample of YMSM in that it shared a moderate amount of variance with sexual behavior diary reports and shared variance was high after a logistic transformation of variables. Results support the use of the H-RASP in contexts where more intensive or burdensome measurement is not possible (e.g., diary or TLFB approaches). Future research should examine the validity of the H-RASP in other populations, including sexual minority women, transgender individuals, and heterosexuals. In order to fully understand sexual risk behavior, it is critical that we examine how behaviors change within persons over time. The H-RASP provides a low-burden and easy to administer approach for capturing this vital contextual data.

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Table 1
 Negative Binomial Model for Reporting Method on Number of Sexual Partners Reported

	N	Diary		HRASP		<i>p-value</i>	Exp (B)	95% CI	
		M (SD)	M (SD)	Lower	Upper				
Total Sexual Partners	95	3.22 (3.50)	3.20 (3.52)	0.967	1.01	0.74	1.37		
Total Anal Sex Partners	95	2.18 (2.46)	2.61 (2.81)	0.256	0.84	0.61	1.14		
Total CAS Partners	95	.96 (1.12)	1.58 (2.74)	0.019	0.61	0.40	0.92		

Note: CAS = Condomless Anal Sex. CI = Confidence Interval.

Table 2

Intraclass Correlations

	ICC Coefficient	ICC Coefficient – Daily Condition	ICC Coefficient – Weekly Condition	ICC Coefficient (after logistic transformation)
Total Sexual Partners	0.768	0.831	0.662	0.858
Total Anal Sex Partners	0.621	0.739	0.496	0.770
Total CAS Partners	0.408	0.396	0.440	0.653
CAS Acts	0.446	0.504	0.390	0.783
CAS Acts - Serious Partners	0.341	-	-	0.725
CAS Acts - Casual Partners	0.383	-	-	0.673

Note: CAS = Condomless Anal Sex, ICC = Intraclass Correlation

Table 3

Multilevel Repeated Measures Comparison of Sex Acts with Last 3 Partners

	Diary			HRASP		
	N	M (SD)	M (SD)	t	p-value	
CAS Acts	52	2.08 (3.21)	5.94 (10.01)	-3.65	0.001	
CAS Acts w/ Serious Partners	20	4.40 (4.19)	12.90 (13.27)	-3.72	0.001	
CAS Acts w/ Casual Partners	32	0.63 (0.75)	1.59 (2.46)	-2.82	0.008	

Note: HRASP data has been winsorized at 2 SD, CAS = Condomless Anal Sex

Table 4

Percentage of Diary Completion on Diary and H-RASP Difference Scores

	N	Beta	t	p-value
Diary % on Difference in Total Sexual Partners ¹	95	-2.32	-0.76	0.447
Diary % on Difference in Total Anal Sex Partners ¹	95	-0.77	-0.27	0.790
Diary % on Difference in Total Unprotected Anal Sex Partners ¹	95	1.08	0.38	0.705
Diary % on Difference in CAS Acts ²	52	30.58	1.65	0.107
Diary % on Difference in CAS Acts w/ Serious Partners ²	20	28.50	1.00	0.333
Diary % on Difference in CAS Acts w/ Casual Partners ²	32	1.35	0.18	0.858

Note: difference scores were calculated by subtracting HRASP scores from diary scores.

¹Linear Regression

²Multilevel Regression