Published in final edited form as:

J Sex Res. 2010 July ; 47(4): 279–284. doi:10.1080/00224490903050584.

Comparison of daily and retrospective reports of vaginal sex in heterosexual men and women

Mary Rogers Gillmore^a, Barbara C. Leigh^b, Marilyn J. Hoppe^c, and Diane M. Morrison^c

^a School of Social Work, Arizona State University

^b Alcohol and Drug Abuse Institute, University of Washington

^c School of Social Work, University of Washington

Abstract

This study examines the agreement between daily and retrospective reports of vaginal sex over a two-month period in a sample of 376 heterosexually active men and women. We also examined whether gender, age, or method of daily data collection (self-administered vs. interviewer administered) were related to agreement between daily and retrospective reports. Both counts and categorical measures of frequency of the behaviors were examined. There were no gender, age or data collection method effects. When measured as a count, participants reported more instances of vaginal intercourse in the retrospective reports than on the daily reports. In contrast, comparison of retrospective categorical measures of frequency to daily reports showed considerable variability. Possible reasons for the over-reporting of counts of vaginal sex in retrospective reports are explored.

Questions about sexual behaviors are critical to the study of reproduction, contraceptive use, and sexually transmitted infections. The answers to such questions rely largely on self-reports in which people recall their behavior over some specified period of time. This complex task requires that people understand the question, retrieve occurrences of the behavior from memory, determine whether the behaviors happened during the specified time frame, infer an answer based on the instances of the behavior, and accurately report the answer (Schwarz, 2007; Tourangeau, Rips, & Rasinski, 2000).

Inaccuracies are introduced when study participants forget exactly how often or how many times a behavior occurred. Recall over longer periods of time, or for behaviors that occur at very high or very low rates, may be especially subject to forgetfulness or over-reliance on heuristics. Retrospective reports are also more influenced by recent events than events that occurred in the more distant past, and people may use a different heuristic for recalling recent as opposed to longer-term behaviors, both of which can produce bias in recall (Jaccard & Wan, 1995; Bogart et al, 2007; Burton & Blair, 1991). Retrospective reports are also subject to “telescoping,” that is, including events that occurred before or after the specified time for recalling behaviors (Graham, Catania, Brand, Duong, & Canchola, 2003). Moreover, people may intentionally under- or over-report a behavior, and this may be more likely to occur when reporting sensitive behaviors such as sexual activities. Misreporting may differ by gender or other characteristics, as Wiederman (1997) points out when discussing research demonstrating that men report more sexual partners than women. Such differences may be due to errors of recall or estimation, with men more likely to “round up” their estimated number of lifetime

partners. Other research suggests that women, older persons, and those with less education tend to under-report sexual experiences (Wiederman, 1993).

In the absence of a valid criterion for measuring sexual behavior, daily reports have been assumed to produce more accurate reports of sexual behaviors than retrospective reports because many of the problems of recall are reduced (Graham et al., 2003; Leigh, Gillmore, & Morrison, 1998; Minnis & Padian, 2001), and events are recorded in their natural settings (Bolger, Davis, & Rafaeli, 2003). A recent review (Schroder, Carey, & Vanable, 2003b) concluded that existing studies show no clear trend toward under- or over-reporting of sexual behavior on questionnaires, relative to diaries, and that variations in item content and the samples studied (adolescents, sex workers, college students, men who have sex with men) might affect general tendencies to over-report or under-report. Some studies asked for counts of behaviors in retrospective reports, while others used categorical measures of frequency (for example, every day, twice a week, etc.; see Schroder, Carey, & Vanable, 2003a, for a comparison of these methods of assessing sexual behaviors). Recent studies have highlighted the role of question format, data collection mode (computer-assisted self-interviewing, self-administered questionnaires), and time of retrospection (McAuliffe, DiFranceisco, & Reed, 2007; Morrison-Beedy, Carey, & Tu, 2006; Schroder, Johnson, & Wiebe, 2007).

In the current study, participants reported on their sexual and other behaviors daily for 8 weeks and then completed a retrospective questionnaire about their activities over the reporting period. The sample included both male and female adolescents and adults. We included both counts of behaviors and categorical frequency measures in the retrospective questionnaire, and assessed both agreement and bias in our comparisons of daily vs. retrospective measures. In addition, we examined whether gender, method of daily reporting (self-administered vs. telephone administered), age (adolescent or adult), and length of retrospection (1 week, 1 month, 2 months) were related to discrepancies between the diaries and the retrospective questionnaires. Based on the literature review, we expected that diaries would produce higher rates of vaginal sex than retrospective reports and longer periods of retrospection would produce greater discrepancies between diary and retrospective reports.

Method

Sample selection and description

The data come from a larger study of the associations between substance use and risky sex and include three sub-samples. Adolescents ($n = 137$) were recruited through flyers posted in locations frequented by teenagers (e.g., recreation centers) and distributed by clinicians in adolescent health clinics. A sample of adults ($n = 198$) was recruited through flyers placed in the restrooms and waiting rooms of several public health clinics specializing in reproductive health and sexually transmitted infections (STIs). To supplement this passive procedure in the largest STI clinic, a research staff member also recruited adult participants on site. A random sample of university undergraduates ($n = 178$) was recruited via invitational letters sent to their residences. All procedures were approved by the university's IRB. A trained interviewer screened all interested persons by telephone for eligibility. Eligible persons were unmarried, engaged in heterosexual sex no fewer than four times in the prior 2 months, were not in a current monogamous relationship of more than 6 months duration, used condoms at least once in the last year, and drank alcohol at least 4 times in the last 2 months (these requirements were necessary for the purposes of the larger study which focused on the relationship between substance use and risky sexual behaviors). Although men who have sex with men were included in the larger study, they are not included here because they had very low rates of vaginal sex and, conversely, those who engaged primarily or exclusively in heterosexual sex had very few instances of anal intercourse. Therefore, the analyses reported here focus on vaginal sex. Participants who were age 18 and older were required to provide written consent. Minors were

required to provide written assent and parental consent unless they were emancipated; if the latter, minors provided their own consent. Table 1 presents the sociodemographic characteristics of each sub-sample.

Procedure

The study was described as a “health habits” study examining daily patterns of various health-related behaviors. Consenting participants were randomly assigned to complete written daily diaries or to participate in daily telephone interviews, and were then mailed an initial questionnaire to obtain background information. Daily data collection began when the initial questionnaire was returned.

Participants in the self-administered diary condition were sent packets each week for eight weeks. Each packet contained instructions, seven daily diary forms, and seven pre-addressed, stamped envelopes in which to mail back the diary each day. In the telephone condition, participants responded to a daily telephone interview. At the conclusion of each interview, an appointment was made for the next day’s interview. The daily report (identical in the telephone and self-administered conditions) included questions about smoking, diet, dental care, exercise, seatbelt use, sleeping patterns, drug and alcohol use, and sexual behaviors. On the first day of daily data collection, participants reported on their activities in the past 24 hours. Each day thereafter, participants were asked “Since you filled out this form [talked with us] yesterday, did you ...”

Following the 8 weeks of daily data collection, participants were mailed retrospective questionnaires that asked about several of the behaviors listed on the diaries. They were randomly assigned to recall their behavior either over the past week, past month, or past two months.

Measures

Up to three occasions of sexual intercourse could be recorded on each day’s report (few participants reported more than one instance of sexual intercourse in a day). For each instance of sexual intercourse, participants were asked a series of questions including whether intercourse was vaginal, anal, or oral. The self-administered retrospective questionnaires contained two kinds of questions about sexual activity. One question (“in the past [week/month/2 months] how many times did you have vaginal sex?”) required an open-ended numerical answer (for example “5 times”). The other question (“In the past [week/month/2 months] about how often did you have vaginal sex (penis in the vagina)?”) was followed by a categorical response set with options ranging from *never* to *every day*.

Results

Three hundred seventy-six participants (208 female, 168 male) completed the diary and follow-up procedures; a total of 4556 sexual events were reported on the diaries. The number of occasions of sexual intercourse reported for the eight weeks ranged from 0 to 85 per participant ($M = 11.9$, $SD = 12.5$, $Mdn = 9$).

Because most participants had at least one missing day of data ($M = 3.31$, $SD = 5.68$), we adjusted the daily data for missing days by 1) computing the average daily number of intercourse occasions for the days that were reported, and 2) multiplying by the number of missing days in the diary period, and 3) adding that number to the total reported occasions.¹ We also removed six outliers with extreme discrepancies that suggested a misunderstanding of the instructions (for example, 11 sexual encounters reported by diary and 60 reported retrospectively). Removal of outliers did not substantially affect the results. Analyses of

variance revealed no significant differences in the retrospective vs. diary reports of vaginal sex as a function of method of daily data collection (self-administered diary vs. telephone interview), or age (adolescent vs. adult) (all $F_s < 1.0$), so these data were combined for the following analyses.

Comparing daily counts of vaginal sex to retrospective counts

More instances of vaginal sex were reported by retrospective questionnaire than by daily reports, with discrepancies from 13% to 32% for the different recall intervals (see Table 2). Although these discrepancies appeared greater for women than for men, gender differences were not statistically significant in any of the recall conditions ($F_s < 1.0$). The retrospective and daily reports were strongly correlated (see Table 2).

Comparing daily counts of vaginal sex to retrospective categories

The number of vaginal sex occasions reported on the daily reports for the respective recall condition (adjusted for missing days as described above), plotted against the frequency category chosen on the retrospective questionnaire, is displayed in Figures 1, 2, and 3 for each recall condition. The figures also show the mean number of diary encounters for each frequency category and the expected range of counts for each category—for example, “two or three times a week” for an 8-week period should represent between 16 and 24 sexual encounters. The figures show a great deal of variability in agreement, both overestimation and underestimation; for example, among participants in the one-month recall condition who stated retrospectively that they had sex once a week (about 4 times in the month), the number of sexual encounters reported on the daily reports ranged from 3 to 13. Inspection of the figure suggests that while the retrospective categories underestimated the diary numbers for participants with few sexual encounters, the reverse was true for participants with more encounters; however, the number of participants at these higher levels is sparse.

In summary, we found no significant differences in diary vs. retrospective reports of vaginal sex by gender, age, or method of data collection (telephone interview vs. self-administered questionnaire). When measured as a *count* variable, we found that retrospective reports produced significantly higher counts of vaginal sex than daily diaries, contrary to our expectation. However, when measured as a *categorical* variable rather than a count, there appears to be no consistent pattern of differences. For example, retrospective recall tended to underestimate the diary numbers when the number of vaginal sex occasions was small, but overestimated the diary numbers when vaginal sex occurred frequently, although the number of events at these ends of the distribution was small, so this finding must be interpreted with caution.

Discussion

We assessed the agreement between daily and retrospective reports of instances of vaginal sex over a two-month period among male and female adolescents and adults, examining both counts and categorical frequencies of sex. Contrary to our expectations, retrospective reports produced higher counts of vaginal sex than the daily reports, regardless of the length of retrospection.

It has long been assumed that higher reports of sensitive behaviors suggest greater accuracy (Armstrong, White, & Saracci, 1992; Verbrugge, 1980). This assumption is based on the

¹This adjustment assumes that the probability of sexual behavior is equal on missing and non-missing days. If not, the difference between diary and retrospective measures is incorrect. That is, if someone was more likely to have sex missing days than non-missing days, the daily measure is biased downward while the retrospective measure is not; the discrepancy between diary and retrospective measures is then an artifact of missing days.

common-sense notion that reporting sensitive behaviors may cause embarrassment or discomfort and therefore be under-reported. Although under-reporting of sexual behaviors has been reported (Blair, Sudman, Bradburn, & Stocking, 1977; Catania, Gibson, Chitwood, & Coates, 1990), over-reporting might also occur due to bragging or social desirability (Catania et al., 1990; Miller, Turner, & Moses, 1990), or the tendency to “round up” (Wiederman, 1997). Moreover, more deviant behaviors might be underreported, while more normative behaviors may be over-reported by people who wish to appear to conform to societal norms (Tourangeau & Yan, 2007).

If we assume that daily reports produce more accurate data, retrospective reports in this study resulted in over-reporting of vaginal sex for both men and women. Over-reporting in retrospective reports may occur among people who have a regular behavioral pattern and use it to determine their responses to retrospective questions, disregarding interruptions in that pattern (Hornsby & Wilcox, 1989). Discrepancies can also result from the cognitive complexity of the task (Jaccard & Wan, 1995); if so, methods that improve recall may reduce errors. For example, McAuliffe et al. (2007) found that greater consistency between diary and retrospective reports was achieved when the retrospective report used a partner-by-partner questioning format, in which sexual activity was described separately for each partner.

When we compared the daily counts to retrospective frequency categories, we found that although the frequency categories bore a general ordinal relationship to the frequencies calculated from the daily reports, there was much variability in this agreement (see also Hoppe et al., 2008). Frequency categories are often used in the literature on sexual behavior (Schroder et al., 2003a); however, the variability that results as people try to fit their behavior into categories can affect the psychometric properties of the measures (Jaccard, Wan, Dittus, & Quinlan, 2002). Furthermore, biases in these measures can affect estimates of the association of behaviors to outcomes.

Examination of the figures demonstrates another problem with commonly-used frequency categories: they are not exhaustive, although they appear so in the categories constructed. Consider a person who has sex 3 times a week for 4 weeks and 4 times a week for the other 4 weeks. This individual has had sex 28 times, or an average of 3.5 times a week over the 8 weeks. He or she can report having had sex on 28 daily reports, but must choose between “2 or 3 times a week” or “4 to 6 times a week” on the retrospective questionnaire. Either choice will be inaccurate. This point is illustrated by the gaps in the ranges of correct responses shown in the third graph in Figure 3. The top of the “correct range” box for 2–3 times a week is 24, and the bottom of the “correct range” box for 4–6 times a week is 32. There is no obvious solution to this problem. One could instead ask people to select from an exhaustive range of counts of sexual encounters (e.g., none, 1 – 10, 11 – 20, etc.). However, McAuliffe et al. (2007) found that reporting the exact number of acts retrospectively resulted in rates of discrepancies similar to those found in this study, suggesting that the gaps are not the primary cause of discrepancies. Jaccard and Wan (1995) suggest that when people are asked to retrieve information about the number of acts for a behavior they perform frequently (and for which they have internalized a “behavioral rule”), they may use semantic memory to estimate frequency for a longer period. They would recall the number of instances in a recent period (e.g., a week) and extrapolate from that rate to produce an estimate for the longer period. In that case, gaps in the range should not contribute to problems, since people are unlikely to have behavioral rules such as “3 1/2 times a week.”

The fact that no significant differences emerged as a function of the length of recall (1 week, one month, two months) suggests that recall of instances of vaginal sex may be fairly accurate over a relatively short period of time. However, if the behavior under question occurs at very high rates or is very rare, inaccuracies may occur even with relatively short periods of recall.

Therefore, it is important to think about the amount of behavior expected when determining the length of recall to be used in studies. Clearly more research on length of recall would be useful.

As with similar studies of sexual behaviors, this study had limitations that bear mentioning. The data are based on self-reports and there is no way to determine with certainty which method yields the more accurate results. Although this study had a sample size larger than many studies that collected daily reports, we still found small subgroup sizes -- for example, it was difficult to test whether under- or over-reporting differed by usual frequency of sex, since there were few people in higher categories. The data in this report were obtained as part of a larger study that focused on persons who engage in risky sexual behaviors, including clients of public clinics specializing in treatment of STIs, and the extent to which these findings generalize to the more general population is unknown. Future studies that sample more general populations would add to our understanding of discrepancies between retrospective and daily reports of behaviors. Moreover, we know little about cultural factors that may influence reports of behaviors, especially sensitive behaviors like sexual activities; research on these factors would aid our understanding.

Understanding sources and types of error in recall of sexual experiences is crucial to accurately evaluating interventions for reducing sexual risk. The average effect size of interventions to reduce sexual risk taking is small (Albarracín, Gillette, Earl, Glasman, & Durantini, 2005), and errors or biases in recall may equal or even exceed the expected effect sizes of interventions (McAuliffe et al., 2007). In self-reports of sexual behavior, both under-reporting (McAuliffe et al., 2007) and over-reporting (Graham et al., 2003) can occur, and accuracy can be influenced by time of retrospection, method of data collection, and the use of counts vs. frequency categories (McAuliffe et al., 2007; Morrison-Beedy, et al., 2006; Schroder et al., 2007). Daily measures of behavior may capture more complete and accurate reports by reducing problems of recall, but studies that collect such data have been expensive and labor-intensive. Technologies for data collection such as handheld computers (Shrier, Shih, Hacker, & de Moor, 2007), automated telephone interviewing (Bailey, Gao, & Clark, 2006), and the World Wide Web (Horvath, Beadnell, & Bowen, 2007) have increased the feasibility of collecting data daily, or even multiple times a day. Using these technologies to undertake larger-scale studies with daily data is a promising avenue for studying self-reports of sexual activity and other behaviors.

Acknowledgments

Supported by grants from the National Institute on Alcohol Abuse and Alcoholism (R01AA013688, R01AA000183, K05AA015050).

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Figure 1.
One-week recall.

Figure 2.
One-month recall.

Figure 3.
Two-month recall.

Table 1

Sample characteristics

	College students	Adolescents	Adults
Gender			
Male	49%	28%	48%
Female	51%	72%	52%
Educational level			
< High school	0	54%	5%
High school grad.	100%	46%	95%
College graduate	5%	0	33%
Race/Ethnicity			
African American	2%	12%	11%
Asian American	13%	6%	4%
European American	74%	58%	72%
Latina/o	4%	9%	6%
Native American	1%	4%	0
Other	5%	12%	6%
Work status			
Employed full time	17%	19%	42%
Employed part time	54%	28%	27%
Not employed/other	29%	53%	31%
Mean age (SD)	20.54 (1.29)	17.04 (1.49)	26.52 (4.26)
Age range	18 – 23	14 – 19	19 – 35
Modal income	\$5,000–10,000	\$1,000–\$5,000	\$10,000–15,000

Table 2
Mean number of vaginal intercourse occasions from daily and retrospective counts

	n	Daily report mean (adjusted)	Retro- spective mean	Mean difference diary-retrospective	95% C.I. of mean difference	r of daily and retro-spective
56 days	117	12.43	15.28	-2.85	-4.35, -1.34	.89
Female	66	13.13	16.98	-3.85	-5.95, -1.76	
Male	51	11.52	13.08	-1.55	-3.72, .61	
28 days	128	5.82	7.65	-1.82	-2.66, -.99	.83
Female	71	6.78	8.96	-2.18	-3.42, -.94	
Male	57	4.63	6.02	-1.38	-2.47, -.29	
7 days	124	1.36	1.71	-.35	-.57, -.12	.84
Female	69	1.55	2.07	-.51	-.90, -.14	
Male	55	1.12	1.25	-.15	-.34, .05	