

Affect and Sexual Behavior in Adolescents: A Review of the Literature and Comparison of Momentary Sampling With Diary and Retrospective Self-Report Methods of Measurement

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ABSTRACT. *Objective.* Assessment of mental health is important in understanding sexual risk behavior in adolescents, yet few studies have examined how affect is directly related to sexual behavior. Momentary sampling (MS) methods permit real-time assessment of affect in relation to specific events and embed the collected data in the context of the respondent's moment-to-moment life. The objectives of this study were to review the literature on affect and sexual behavior and to compare the feasibility and acceptability of MS with diaries and retrospective self-report as a means of collecting temporally relevant data on affect and sexual behavior in adolescents.

Methods. Sexually active, nondepressed adolescent outpatients who were aged 15 to 18 years were randomly assigned to a schedule of the 3 methods of data collection for 2 weeks each. All participants completed a retrospective self-report by interview at the end of each 2-week period. In the diary arm, participants completed twice-daily paper-and-pencil diary cards, which were returned by mail. In the MS arm, participants used 2-way pagers to respond to several random pages per day. Primary outcomes included rates of completion (diaries vs MS reports) and the participants' tolerance of and preferences for the methods. A secondary outcome was the agreement in means for positive and negative affect and in report of days on which substance use and sexual activity occurred. Associations of affect with contextual factors and with sexual activity were also explored in the MS arm.

Results. Ten youths completed 30 of 30 retrospective self-reports (100%, 3 per participant, by design), 254 of 280 diaries (91%; mean: 25.4 per participant), and 442 of 600 MS reports (74%; mean: 44.2 per participant). Most participants preferred the MS method to the diaries or retrospective self-report. Affect scores and reports of sexual activity and substance use were correlated among the methods. Measured with MS, affect was found to differ by location, companionship, and thoughts when paged; notably, positive affect was highest when participants reported thoughts about sex. There was no difference in affect before versus after coitus.

Conclusions. The results of this study suggest that MS in adolescents is feasible and preferred and provides contextual, temporally relevant, event-level data on affect and sexual activity that are not readily measured with traditional methods. Future research using MS methods will be important in increasing our understanding of the link between affect and sexual behavior and inform the development of improved risk reduction interventions for adolescents. *Pediatrics* 2005;115:e573–e581. URL: www.pediatrics.org/cgi/doi/10.1542/peds.2004-2073; *affect, sexual behavior, substance use, momentary sampling, diary, retrospective self-report.*

ABBREVIATIONS. STI, sexually transmitted infection; MS, momentary sampling; BDI, Beck Depression Inventory; NA negative affect; PA, positive affect; ESM, Experience-Sampling Method; EMA, Ecological Momentary Assessment; PANAS, Positive Affect–Negative Affect Schedule.

Preventive interventions for sexually active youths have had only modest success in reducing their high risk for HIV/sexually transmitted infection (STI) and unintended pregnancy,^{1–3} suggesting that new approaches to sexual risk reduction must be considered. Interventions that target specific groups of at-risk youths may be particularly promising. Although affect, depression, and other measures of mental health have been shown to affect sexual behavior,^{4–8} the nature of the associations has not been fully explored and few interventions have been directed toward depressed youths. In particular, few studies have attempted to capture affect, a highly variable measure of mental state, or to establish the temporal and causal associations of affective states and sexual behaviors. The measurement of affect and sexual behavior presents several methodologic challenges. In this article, we present a review of the research and theories supporting the link between affect and sexual behavior and the methods that have been used to measure these constructs, including retrospective self-report, diaries, and momentary sampling (MS) methods. We then present the results of a feasibility study that directly compares MS with the other 2 methods in a sample of sexually active adolescents.

LINK BETWEEN AFFECT AND SEXUAL RISK BEHAVIOR: REVIEW OF THE LITERATURE

Terminology

The literature is varied in the use of the terms “mood,” “affect,” and “emotion.” Affect and mood

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both refer to subjectively experienced feeling states (emotions).⁹ Affect is a momentary emotion that is a variable, fluctuating phenomenon, in contrast to the more pervasive, sustained condition of mood. However, in the review of the literature below, the terms used are those preferred by the investigators for the research cited. Affect and mood are clearly related, and the data from research on mood can inform the study of affect and sexual risk.

Clinical Research on Affect, Mood, and Sexual Behavior

Data from clinical studies support a link between affect and sexual behavior. Depressive symptoms^{10,11} and mood disorders^{12,13} are prevalent in adolescents, particularly among those who are at risk for HIV/STI.^{14–18} In a study of 674 high-risk adolescents and young adults, 11% of young women and 7% of young men reported frequent, severe depressive symptoms (Beck Depression Inventory [BDI] score >20).¹⁴ Among 125 clients who attended an STI clinic, 39.2% reported symptoms consistent with probable depression on the General Health Questionnaire.¹⁹ Compared with mentally healthy youths, young people with severe mental illness engage in increased sexual risk behavior, including early onset of sexual activity, more sexual partners, and less condom use.^{15–18} Adolescents with mental illness may engage in high-risk sexual behaviors as a result of poor impulse control, impaired judgment and perception of reality, decreased motivation for self-care,²⁰ poor decision making, lack of knowledge or understanding of the risks, and dysfunctional social interactions.^{16,17,21} Self-regulatory processes to repair negative affect (NA) may be disrupted²² or self-gratifying in unhealthy ways (eg, substance use, unprotected sexual intercourse).²³ Psychiatric distress is also associated with substance use,^{24–26} which is correlated with increased sexual risk behavior and STIs.^{6,27–30} Depressive symptoms have been associated with STI in many studies^{14,15,31,32} but not all.¹⁹

Prolonged depressed mood is the hallmark of depression; 90% to 95% of adolescents and young adults with major depressive disorder report depressed mood for at least 2 weeks (the rest meet the *Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition*)⁹ criteria for major depressive disorder with the symptom of anhedonia).³³ However, little is known about the role of mood and affect in sexual risk behavior among depressed adolescents. Among adult men with a propensity for depression, depressed mood was associated with increased sexual interest or response.³⁴ In-depth interviews of gay and heterosexual men revealed that men who experienced increased sexual interest or activity when depressed reported wishing to use sex for mood regulation, to connect with someone and feel validated and/or to directly improve one's mood.^{34,35} A minority of gay men reported that they were more likely to take sexual risks when depressed because they did not care about the consequences.³⁵

In a few clinical studies, moods in normal adolescents have been associated with sexual behaviors.^{36,37} Positive mood has been correlated with sex-

ual interest³⁷ and the occurrence of coitus.³⁷ Negative mood has also been associated with sexual interest but, in contrast to positive mood, was correlated with a decreased likelihood of coitus.³⁷ In addition, condom use has been associated with both less positive mood³⁶ and lower levels of negative mood.³⁷ These findings suggest that methods of HIV/STI prevention may conflict with thoughts and behaviors that produce desirable mood. To inform HIV/STI prevention intervention research, it will be important to establish whether antecedent mood and affect influence the occurrence of sexual behavior and the use of measures to prevent HIV/STIs.

Affective changes may follow as well as precede sexual behavior. Sexual intercourse has affect-improving effects. However, little is known about these effects in adolescents and in depressed individuals. As seen in research on the effects of substance use on affect,³⁸ sexual intercourse may be used for both NA reduction and positive affect (PA) enhancement. Depressed individuals who engage in sexual behavior may experience greater increases in PA because they are starting at lower levels of PA than their nondepressed peers. Conversely, the emotional dysregulation seen in depression may inhibit mood elevation after sexual activity or result in a negative affective experience.

Potential Mechanisms for the Association Between Affect and Sexual Behavior

There is no single theory or model of affect and behavior that has been applied specifically to the study of sexual risk behavior. However, research on behavior in general suggests that affect may be associated with sexual behavior through cognitive, personality, behavioral, and interpersonal mechanisms. Several studies have demonstrated that affect is linked to cognition. PA facilitates cognitive flexibility, innovation, and problem solving.³⁹ In safe situations, PA results in exploration and trying new things (risk-prone behavior), but in risky situations, PA is associated with self-protection (risk aversion).^{39–41} Other research suggests that PA signals that the situation is safe; thus, PA is associated with less forethought, planning, and consideration of risk.⁴² Whether PA produces more exploration and innovation or heuristic processing, the end result may be increased sexual risk behavior. Affect has also been linked to cognitive distortions,⁴³ which may impair an individual's ability to make safer sex decisions. Personality factors, such as self-esteem⁴⁴ and impulsiveness,⁴⁴ may moderate affective influences on cognition and behavior.⁴⁵

According to several theories, the desire to regulate affect drives much of the behavioral response to affect.^{46–48} Research in mood repair found that individuals who were induced to feel a sad mood initially recalled a negative memory but then deliberately recruited a positive memory to counteract the negative mood.⁴⁹ In addition, substance use may be used for self-regulation of affect and can substantially impair risk assessment.^{39–41}

Affect is also correlated with key concepts in psychosocial theories of health behavior. NA is related

to decreased self-efficacy to perform health-promoting and illness-alleviating behaviors.⁵⁰ Thus, individuals with high NA are likely to demonstrate reduced condom use self-efficacy and subsequently be less likely to use condoms.⁵⁰ PA is associated with lower perceived vulnerability to adverse behavioral outcomes (“optimistic bias”).⁵⁰ Thus, individuals with high PA may perceive low risk of HIV and other STIs and engage in more sexual activity and use condoms less often. This research suggests that both high PA and high NA put individuals at risk for unsafe sexual behavior.

The extent to which affect is associated with behavior may also depend a great deal on the social situation in which the behavior occurs.⁵¹ Furthermore, interpersonal processes deriving from social persuasion⁵² or the relationship with the individuals with whom one is interacting⁵³ or chronic feelings about them⁵⁴ may influence the effects of mood on social judgments and behaviors. Mood also seems to motivate selective partner choices, with sad individuals preferring social partners with high interpersonal qualities,⁴⁴ which may be associated with increased sexual behavior.

In a meta-analysis of 34 studies, Crepaz and Marks²⁰ found limited evidence to support an association between negative affective states and HIV sexual risk behaviors. However, in their discussion of the analysis and in the accompanying editorial comment,⁵⁵ important limitations were raised and directions for future research were suggested. Most studies have had cross-sectional designs and could not determine the temporal nature of the associations. In addition, global measures of affect have been used; thus, NA immediately before sexual thoughts and behaviors as well as indirect effects of NA (eg, through substance use) could not be assessed. In their comment, Kalichman and Weinhardt⁵⁵ urged the study of NA and sexual behavior at the event level, using methods such as momentary assessments.

MEASURING AFFECT AND SEXUAL BEHAVIOR

The optimal method of measuring the temporal associations of affect and sexual behavior^{56–58} has not been determined, particularly for adolescent populations. Most studies of mental health and sexual behavior have relied on retrospective self-report using aggregate, cumulative, or composite measures, such as frequency of depressive symptoms over 2 weeks and frequency of condom use in general. This method is simple to administer, but the accuracy of retrospective self-report is not known; it is subject to “recollective interpretation,”⁵⁹ the process of reconstituting experience in the broader context afforded by reflection, new perspectives, and the accumulation of other experiences, including consequences of the original experience. This recall bias may result in distorted estimates of certain behaviors and a reorganization of the experienced affect.⁵⁹ Frequency self-reports also may be subject to under- or overreporting to provide socially desirable responses. Finally, retrospective reports have limited utility in

relating specific feelings and thoughts to specific behavioral events.

Daily diaries have also been used to collect data about specific events, such as coitus,^{60,61} and there is some support for the validity of event-specific diaries with regard to certain sexual risk behaviors.⁶² This unobtrusive method reduces the time between the occurrence of an event and its recording, thereby limiting recall bias. Diaries also may be more accurate than retrospective methods for reports of event-specific feelings and behaviors. However, because the diaries tend to be completed at the same times each day, respondents may become habituated to the instruments, develop patterned responses, or otherwise fatigue from the repetitive nature of the task. Some individuals may have difficulty in consistently recording complete data over a period of time or hoard their responses, threatening the reliability of the data. Daily diaries have been used to collect data on mood and substance use in young women⁶³ and on sexual behavior and substance use in adolescents⁶⁰ and adults.^{57,63} In 1 study of mood states and substance use, young women completed 90% of daily diary questionnaires over 3 menstrual cycles.⁶³

MS methods, such as the Experience-Sampling Method (ESM) and Ecological Momentary Assessment (EMA), were developed to add ecological validity to the study of the feelings, thoughts, and behaviors of daily life.^{64–66} With ESM, individuals are asked to log self-reports in response to random signals (sent via wristwatch, beeper, or handheld computer) during the waking hours of a normal week. Completed in “real time,” these random reports are not affected by recall bias. EMA extends ESM by including self-monitoring as well as random reports^{67,68}; in addition to responding to random signals, participants record a response as soon as possible after they identify a target behavior. Self-monitoring enriches the random data of ESM by adding more detailed information about events of interest.

MS methods offer several unique features to collecting data on affect and sexual behavior. First, MS involves assessment of a random sample of momentary states that permits examination and description of the topology of daily experience. With MS data, one can construct composite measures, such as average affect, without losing the value associated with understanding the variance and extremes of affect. These data may be used to create measures of affect variability and affect reactivity both within and across participants. Second, MS samples a large number of repeated observations to create a very rich and detailed database. Third, MS collects data on environmental factors, such as location and companionship, that provide a context for the momentary states. Fourth, the electronic technology used in MS data collection uses the same device for recording both responses to random signals and reports prompted by a target event. Fifth, data may be downloaded directly from the electronic devices, eliminating errors acquired during data entry. Sixth, MS overcomes many of the problems associated with other self-report methods, including errors associ-

ated with retrieval, telescoping, inference, recency, and salience.⁶⁸ Extensive experience with MS has minimized many of the methods' disadvantages, including participant burden, retention, and adherence.^{68,69} Other limitations include small sample size, device expense, reliance on self-report, the potential for self-selection bias, and the possibility that the method influences the phenomena being measured.^{65,66} MS methods have been used to describe daily mood in children and adolescents,^{59,70,71} adolescent substance use and mood states,⁷² and adolescent moods and smoking behavior.^{69,73,74} Adolescents who have participated in studies that used MS methods have responded to 69% to 90% of signals.^{63,69,70,73-75}

In the following study, we compared 3 methods of collecting timed data on affect, substance use, and sexual behavior in male and female adolescents: a retrospective interview and questionnaire, twice-daily diaries, and MS using a 2-way pager.

FEASIBILITY STUDY

Methods

Patients of a children's hospital-based adolescent clinic who were aged 15 to 18 years and currently sexually active (defined as sexual intercourse, on average, at least once every 2 weeks) were eligible for this study. Patients with a current mood disorder, suicidality, or mental/emotional crisis were excluded. As this was a feasibility study and includes qualitative assessment elicited from participants, it was important that participants were able to provide complete data and participate actively in discussions around the methods of data collection. To this end, we asked clinic providers to suggest motivated, interested patients. Providers invited interested adolescents to meet with a research assistant to discuss the study protocol and provide informed consent.

In a private room in the clinic, each participant was asked to complete a baseline assessment battery using audio computer-assisted self-interview that included demographic information, sexual history, substance use history, history of mood disorder, the Positive Affect–Negative Affect Schedule (PANAS),⁷⁶ and the BDI.⁷⁷ The PANAS is based on a 2-factor model of affect, which posits that PA and NA are independent dimensions. Respondents were asked to rate on a 5-point Likert-type scale the extent to which they feel each of 10 positive and 10 negative affective states. Responses are summed separately for PA and NA, each with a

possible score of 10 to 50. The PANAS has been shown to be valid and reliable in adolescent samples.^{76,78} Furthermore, the time frame can be varied, so in the baseline assessment and recall interviews, affect was measured over the previous 2 weeks. For the diary and MS reports, affect was measured for "right now."

On completion of the baseline assessment battery, the research assistant scored the BDI by the summing of the responses. Participants with scores of 16 or more (out of a possible 63) were considered to have a high level of depressive symptoms^{79,80} and excluded from the study. (A BDI score of 16 or greater has been shown to have a sensitivity of 100% and a specificity of 93.2% for major depressive episode in adolescents.⁸¹) Any participant who responded other than, "0, I don't have any thoughts of killing myself," to question 9 on suicidal ideation were also excluded from study participation.

Using a random-numbers list stratified by gender, each participant was randomly assigned to 1 of the 6 possible orders of the 3 data collection methods. The methods, described in detail below, included a retrospective questionnaire and interview, twice-daily diary, and MS using a 2-way pager. Items and scales included in each method are presented in Table 1. Each arm of the study took 2 weeks to complete, with at least 1 week of no data collection between each arm. Total time of study involvement therefore was a minimum of 8 weeks.

Twice-Daily Diary

Each participant was given 14 stamped, addressed diary cards that could be folded over, sealed, and mailed to the principal investigator each day of the 2-week study period. Each card included the PANAS affect scale, to be completed on awakening and before going to bed each day. The card included a space for logging episodes of sexual intercourse, including the time that the sexual activity began, the relationship with the sexual partner (new, occasional, regular, main), and whether a condom was used. The card also included a space for logging alcohol, marijuana, and other substance use, including the time each episode of use began and ended and the type and quantity of substance(s) used. To protect the participant's confidentiality, the diaries did not include the participant's name, and the responses were coded such that their meaning would not be obvious if someone other than the participant or study personnel read the diary card. Each participant was provided with a "cheat sheet," a small card that could be kept in the participant's wallet, explaining the code for the diaries. Completion of the diaries took no more than 10 minutes each day.

MS

Participants were provided with an electronic pager and paged each day for 2 weeks at random times within each of 4 blocks of time: 9:00 AM to 12:00 PM, 12:01 PM to 3:00 PM, 3:01 PM to 6:00 PM,

TABLE 1. Items and Scales Included in Each of 3 Methods Measuring Affect and Sexual Behavior

Item or Scale	Method		
	Retrospective Self-report	Twice-Daily Diaries	MS
Mood			
PANAS	Past 2 wk	"Right now"	"Right now"
Daily mood in general	Using TLFB calendar	—	—
Days with best and worst moods	Using TLFB calendar	—	—
Sexual behavior			
Occurrence of coitus	Using TLFB calendar	In previous 12 h	Since last report
Time of coitus	—	Exact	Since last report
Coital event-specific sexual partner type	Using TLFB calendar	In previous 12 h	Since last report
Coital event-specific condom use	Using TLFB calendar	In previous 12 h	Since last report
Substance use (separately for alcohol, marijuana, other drugs)			
Type and quantity	Using TLFB calendar	In previous 12 h	Since last report
Time of use	—	Exact	Since last report
Contextual questions	—	—	When paged
Main thought	—	—	When paged
Location	—	—	When paged
Companionship	—	—	When paged
Main activity	—	—	When paged
Reason for doing main activity	—	—	When paged

TLFB indicates timeline followback.

and 6:01 PM to 9:00 PM, with a fifth signal between 9:01 PM and 12:00 AM on Friday and Saturday nights. Paging was suspended from 9:00 PM on weekday nights, 12:00 AM on weekend nights, until 9:00 AM the following morning to avoid sending signals during hours when participants would be most likely to be asleep. At the signal, the participant recorded his or her responses to the PANAS scale and to contextual questions on thoughts, location, companionship, and activity (Table 1). A card on the back of the pager contained the questions, which were the same as for the diary except that the interval for reporting the risk behaviors was "since last page" (Appendix). Participants were instructed to respond immediately to a page but could ignore the page if it occurred during an incompatible activity (eg, taking a test). To protect their own confidentiality, the adolescents controlled whether they carried the pager and whether and when they responded to the signals. They were provided with a business card with the research assistant's contact information, which they could present to curious adults who may be concerned about the adolescents' carrying a pager. Completion of this method took ~22 min/day.

Retrospective Report

Participants were asked to recollect their affect, substance use, and sexual behavior for a 2-week period using a timeline follow-back calendar recall method. This reliable method has been used extensively in substance use research⁸² and specifically with adolescents for recall of both substance use⁸³ and sexual behavior.^{83,84} The timeline followback calendar uses recall-enhancing techniques to provide a detailed assessment of substance use and coitus at the event level.

Because it would have been difficult to recall the specifics of affect on any given day, participants were asked to give a general impression of their affect for each of the 14 days, noting in particular days with the best and the worst affective states. The interview took ~30 minutes (more or less, depending on the frequency of substance use and sexual behavior). Participants were also asked to complete a brief questionnaire with general frequency measures for affect, substance use, and sexual behavior for the previous 2 weeks. The questionnaire took ~10 minutes to complete. Participants completed the retrospective interview and questionnaire at the end of each of the three 2-week periods.

Exit Interview and Study Termination

On completion of all 3 methods, participants were invited to share their impressions about the methods and suggest which method(s) they believed best represented their actual experience and how they felt about the time commitment and tasks involved, issues of confidentiality, and other aspects of the research experience that they wished to share with the investigators. Because we were interested in comparing the 3 methods for each participant, we discontinued an adolescent's participation if he or she was unable to complete all 3 retrospective self-reports and at least 50% of both the diaries and the MS reports. We offered participants remuneration commensurate with the number of reports, diaries, and interviews that they completed, up to a maximum of \$61.50 for 6 weeks of active study participation. The hospital institutional review board approved the study protocol.

Data Analysis

Data were dually entered into a Microsoft Excel database, and the analyses were conducted using SAS version 9.0. The outcomes of interest were the rates of completion of the study instruments, adherence to each method's protocol, the adolescent participants' tolerance of and preferences for the methods, and agreement among the methods in mean scores for PA and NA and in the report of days on which substance use and sexual activity occurred. To understand better the advantages of MS, we also explored associations between affect and contextual questions, including location, companionship, and thoughts. For these analyses, we used linear mixed-effects models to account for potential correlations between repeated measurements taken on the same participant. Pairwise comparisons then were conducted to explore patterns of differences. Because these analyses were exploratory, we did not adjust for multiple comparisons. We also evaluated whether and how affect changed from before to after coital events, again by linear mixed-effects models. Because sub-

stance use was infrequent in our sample (overall, only 3 participants reported 2 marijuana and 4 alcohol use events), no analyses were performed to evaluate the associations between affect and substance use.

Results

Sample Characteristics

Six girls and 4 boys completed the study protocol. Mean (\pm SD) age was 16.9 (\pm 1.0) years, and 70% of the sample self-identified as black race. Mean (\pm SD) age at first sexual intercourse was 14.4 (\pm 1.8) years. Participants reported a median (range) of 3.5 (1–16) sexual partners in their lifetime and 1 (1–3) sexual partner in the previous 3 months. The adolescents estimated that they had sexual intercourse a median (range) of 3 (1–10) times in the previous 2 weeks. Only 4 youths reported any alcohol or marijuana use, and none reported smoking cigarettes in the previous 30 days. Three participants reported feeling sad or hopeless for at least 2 weeks in the previous 12 months. Median (range) BDI score was 5 (1–13).

Completion Rates

Nineteen adolescents were initially enrolled, with 6 of the nine dropouts occurring during the MS arm. Noncompleters were significantly more likely than completers to report on baseline marijuana use in the previous 30 days. By study design, 30 of 30 of the retrospective interviews were completed (100%, 3 per participant). Of the 280 diaries expected, 254 were returned and complete (91%; mean: 25.4 per participants) and three fourths (74%) of the MS reports were completed (442 of 600; mean: 44.2 per participant; completion rate for diaries vs MS, $P = .065$). The median time to respond to an MS signal was 28 minutes (range: 0–288 minutes).

Tolerance of and Preferences for the Methods

Most adolescents (6 of 10) preferred the MS method because they were asked to "react to a specific moment" and "being paged is fun" and "cool," with the remaining stating a preference for the diaries because they "capture the whole day instead of a specific moment," were "easy," and "didn't interfere with daily activities." Three participants preferred diaries the least, citing that they were "boring," "a pain to mail," and "got in the way of school," and 2 did not like MS, finding it "annoying" to get paged, especially "at awkward times," and that they had to respond to "too many questions." One participant noted, "The pager going off can affect your mood because it might agitate you." Girls (5 of 6) tended to prefer MS, whereas boys (3 of 4) tended to prefer the diaries.

Correlations Among the Methods Between Average Daily Affect Scores and Reports of Substance Use and Sexual Activity

Mean daily PA and NA scores that were measured using twice-daily diaries or MS were moderately to highly correlated with scores that were obtained using retrospective report (Table 2). Mean affect scores were consistently higher on retrospective report than with the other 2 methods. There was 100% agree-

TABLE 2. Correlations of Positive Affect and Negative Affect PANAS Scores on Twice-Daily Diaries or MS Versus Retrospective Self-report

Method	PA Score		NA Score	
	Mean (SD)	Spearman ρ	Mean (SD)	Spearman ρ
Twice-daily diaries	24.4 (5.9)	.83	15.6 (4.4)	.94
Retrospective self-report	30.3 (5.9)		21.6 (4.6)	
MS	23.2 (5.6)	.87	14.9 (4.0)	.90
Retrospective self-report	31.6 (7.3)		19.1 (6.2)	

ment on report of sexual activity between diary or MS and recall and on report of substance use between MS and recall. One adolescent did not recall 1 episode of substance use that was reported by MS.

Correlations of Momentary Affect With Contextual Variables and With Coitus

Participants were most often in nonschool public places when paged (42% of signals), followed by home (34%) then school (24%; Table 3). PA and NA both differed significantly by location when paged ($P = .006$ and 0.01 , respectively). Pairwise comparisons revealed that PA when in public was higher than PA when at home or in school ($P = .014$) and NA when in school was higher than NA when in public or at home. Participants were most often with other people when paged (65% of reports). NA differed by companionship ($P = .03$); pairwise comparisons showed that NA in class was higher than NA with friends. There were no differences in PA according to companionship ($P = .72$). PA differed by thoughts at the time of the signal ($P = .03$). Although the adolescents reported thinking about sex on only 5% of reports, their PA scores were highest at those times compared with times when they were thinking about anything else (pairwise comparison $P = .047$). Eight participants reported 20 coital events (mean: 2.5 coital events per participant; range: 1–6 events). Partic-

ipants provided data on partner type and condom use for 18 and 16 coital events, respectively; 94% of the coital events (17 of 18) occurred with a main sexual partner, and only 38% (6 of 16) were condom protected. From before to after coitus, PA increased and NA decreased, but the differences were not significant (change in PA: ± 2.87 [SE: 1.96; $P = .19$]; change in NA: -0.39 [SE 1.39; $P = .78$]).

CONCLUSIONS

A substantial body of theoretical and experimental literature supports the notion that affect or mood is related to risk behavior; far fewer empirical studies have been conducted to examine directly the associations, particularly in adolescents. What studies have been done suggest that both positive and negative mood are correlated with sexual interest,^{36,37} the occurrence of coitus,^{36,37} safer sex behaviors such as condom use,^{36,37} and degree of substance use.^{38,63}

For addressing the large gap between theory and research in affect and risk behavior, methods to measure these constructs need to be refined. MS methods offer several advantages over traditional retrospective self-report and diary methods, including the ability to assess the variability in affect in daily life and to relate affect to contextual factors and specific behavioral and environmental events while avoiding many of the biases of other methods.

In a small feasibility study of methods to measure affect and sexual behavior in adolescents, we found that retrospective self-report, twice-daily diary, and MS methods were comparable for collecting data on the occurrence of coitus and on summary affective states, although data on affect from retrospective self-report may be biased toward the extremes. In contrast to the other 2 methods, MS was better able to detect within-day fluctuations in affect as well as situational factors that may influence affect. Importantly, adolescents in this study preferred MS to diaries and retrospective self-report. Findings from the MS data demonstrate that affect differs by contextual factors such as location, companionship, and

TABLE 3. Contextual Data From MS Reports: Frequencies and Correlations With PA and NA PANAS Scores

Contextual Variable	% of Reports	PA Score		NA Score	
		Mean (SE)	P	Mean (SE)	P
Location ($n = 439$)			.006		.01
Public	33	24.6 (1.8)		14.2 (1.3)	
Home	43	22.0 (1.8)		14.8 (1.3)	
School	24	23.0 (1.8)		16.3 (1.3)	
Companionship ($n = 431$)			.72		.03
Alone	35	22.7 (1.8)		15.3 (1.3)	
Friends	29	23.6 (1.9)		13.9 (1.3)	
In class	16	23.4 (1.9)		16.2 (1.4)	
Relatives	17	22.6 (1.9)		14.3 (1.4)	
Strangers	3	23.4 (2.4)		16.5 (1.8)	
Thoughts ($n = 434$)			.03		.48
Friends	12	23.2 (0.9)		15.6 (1.1)	
Self	11	23.0 (1.1)		15.3 (0.7)	
School	11	23.1 (0.9)		15.8 (0.8)	
Family	5	23.2 (1.6)		16.3 (1.4)	
Sex	5	27.9 (1.6)		19.1 (1.2)	
Other	56	22.7 (0.6)		14.5 (0.4)	

thoughts. By collecting temporal and contextual data, MS permits exploration of possible causal mechanisms for the associations among affect and sexual activity in adolescents. The finding that adolescents experience their most PA when thinking about sex suggests that further research into the association between affect and sexual behavior is warranted, particularly with regard to sexual intercourse for the purposes of affect management.

This study has several limitations. The number of adolescents who participated in this intensive protocol was small. The relatively infrequent nature of substance use and sexual events may limit the utility of MS methods in studies of these behaviors. Future studies will need to consider longer or repeated periods of data collection and include assessments prompted by the target event (as has been done in EMA studies^{67,68}). The MS method was associated with decreased compliance compared with diaries, although the completion rate was not significantly different and was similar to that reported in previous studies using MS.^{63,69,70,73–75} This problem may be remedied in future studies by shortening the MS report and considering use of other electronic devices, such as palm computers.^{69,74}

Despite its limitations, this study adds to the relatively sparse literature exploring the use of MS in adolescent samples and uniquely examines the feasibility of this method to collect data on sexual behavior. If the methodologic challenges can be addressed, then additional research with larger samples will help to determine how MS may complement existing methods of collecting affect, substance use, and sexual behavior data in adolescents. Specifically, these studies should examine how MS can increase our understanding of the role of contextual factors, offer a unique look at adolescents' affect and other salient experience before and after occurrence of the risk event, and permit examination of the influence of affect variability on adolescent risk behavior.

Findings from this line of research may influence HIV/STI prevention interventions in several ways, such as consideration of affect assessment and management before or as part of an intervention, affect self-assessment and increasing an individual's understanding of the relation of affect to risk behavior within an intervention, and identification of risk behavior as a method of affect self-management and the development of alternative response strategies as part of an intervention. Increasing our understanding of the associations of affect and sexual risk behavior among adolescents will be important to enhancing behavioral interventions for this at-risk population and may be particularly salient for interventions to reduce risk among depressed youths.

APPENDIX. Momentary Sampling Report for the Measurement of Affect and Sexual Behavior in Adolescents

As you were beeped . . .

1. What were you thinking about?
 - (a) Family (b) Food (c) Friends (d) School

- (e) Self (f) Sex (g) Society, Religion, Politics (h) Sports (i) Television (j) Time (k) Other
2. Where were you?
 - (a) At Home (b) In School (c) In Public—non-school
3. What was the MAIN thing you were doing?
4. WHY were you doing this particular activity?
 - (a) I had to (b) I wanted to (c) I had nothing else to do

Use the numbers to express how you feel right now:
 1 = Not at all 2 = A little 3 = Moderately 4 = Quite a bit 5 = Extremely

5. Interested
6. Distressed
7. Excited
8. Upset
9. Strong
10. Guilty
11. Scared
12. Hostile
13. Enthusiastic
14. Proud
15. Irritable
16. Alert
17. Ashamed
18. Inspired
19. Nervous
20. Determined
21. Attentive
22. Jittery
23. Active
24. Afraid
25. When you were beeped, whom were you with? (type all the lettered responses that apply.)
 - (a) Alone (b) Friends (after this letter, type how many female [F] and how many male [M]) (c) In class (d) Relative(s) (e) Strangers

Questions 26–30. Since you were last beeped . . . (Y for yes or N for no)

26. Has anything happened or have you done anything that could have affected the way you feel?
 - (a) If Yes, indicate what it was.
27. Have you had sexual intercourse?
 - (a) If Yes, indicate the type of sexual partner MP = Main Partner, OP = Other Partner, NP = New Partner (b) If Yes, did you use a condom (Y = Yes, N = No)?
28. Have you used alcohol?
 - (a) If Yes, what kind? B = Beer, W = Wine, L = Liquor (b) If Yes, how much (eg, 2 cans = "2cn")? cn = Can, btl = Bottle, gl = Glass, oz = Ounce/Shot
29. Have you used marijuana?
 - (a) If Yes, indicate the way you smoked and how many (eg, 2 cigarettes = "2c")? c = Cigarette, bl = Blunt, p = Pipe, bg = Bong
30. Have you used any other drugs?
 - (a) If Yes, name the drug.
31. Have you had your period? [Asked only of female participants]

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