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Original article

Factors associated with time of day of sexual activity among adolescent women

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Background: Our objective was to describe familial, intrapersonal, and partner-related factors associated with time of day of sexual activity among adolescent women.

Methods: Annual questionnaires and daily diaries were collected from 106 adolescents. Participants contributed up to 3 questionnaires and 5 12-week diary periods over 27 months. Predictor variables included type of day (weekend, school day, vacation day); partner variables (argument with partner, partner emotional support, time spent with partner); parent/family variables such as supervision, monitoring, and attitudes about adolescent sexual behavior; and mood and behavior variables such as negative mood, positive mood, and sexual interest. The outcome variable for each diary day was no coitus, coitus between noon and 6 PM, or coitus after 6 PM.

Results: Coitus occurred on 12.0% of the diary days. Coital events were more than twice as likely to occur after 6 PM (8.5% of days) than in the afternoon (3.5% of days). Afternoon sex was least likely to occur on school days whereas evening sex occurred most often on weekends. An argument with a partner, partner emotional support, time spent with partner, sexual interest, and coital frequency were associated with increased likelihood of afternoon sex, whereas parental supervision and negative mood were associated with decreased likelihood of afternoon sex. For school days, skipping school was associated with increased likelihood of afternoon sex. Evening/night sexual activity was not associated with any parent/family variables.

Conclusion: Afternoon sex on school days is relatively uncommon. Direct parental supervision may decrease afternoon sexual activity but relationship and intrapersonal factors also are important factors in the timing of sexual activity on any given day.

Key words: Sexuality; Parents; Sexual behavior

The after-school period is thought to represent an important opportunity for health risk behaviors among unsupervised adolescents [1]. Because of the association of risk for sexual activity and lack of parental monitoring/supervision, some have advocated increased adult supervision during after-school periods as a way to decrease adolescent sexual activity [2,3]. A recent study noted that increased levels of parental supervision were associated with decreased risks for gonorrhea or chlamydia infection among adolescent women [4].

However, the extent to which adolescent sexual activity actually occurs during after-school periods (when adolescents with working parents may be unsupervised for several hours) is not well documented. Retrospective cross-sectional studies indicate that 15% to 17% of the first or most

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recent coital events, respectively, appear to occur between 3 PM and 6 PM [2,5].

Other limitations of existing data include lack of attention to factors that could explain apparent associations between time of day and sexual activity. Distinction of school days from weekend days and vacation days is important [6]. Some studies have not appropriately distinguished parental monitoring from parental supervision [7]. Self-reported supervision, a commonly used measure, could be a surrogate for other parental characteristics such as closeness or communication [8,9]. Because homes of partners are among the most common locations of adolescent sexual activity [5], reported supervision also could be simply a function of membership in more populous households with fewer private opportunities for sex. The qualities of the adolescents' interpersonal relationship with partners may be important because supervision of such relationships is likely to change as partners become known and trusted by family members [10]. During the course of a school day, teenagers report mood changes, most often positive during after-school hours [11]. Purposeful behaviors to avoid supervision, such as skipping school, likely are associated with a larger constellation of behaviors that include sexual activity [12].

The purpose of this study was to examine the occurrence of adolescents' sexual activities during various periods of the day, and to identify factors associated with coital activity during those time periods. To address limitations of previous research, daily diaries were used to measure phenomena that are subject to day-to-day variation in association with the likelihood of sexual activity, and to capture variations associated with school weekdays, weekends, school holidays, and summer vacation. In addition, measures related to sexuality, mood, partners, and family were included to assess a potentially complex array of predictors associated with timing of sexual activity within a given day.

Methods

Study design and procedures

Data were collected as part of a larger longitudinal study of risk and protective factors associated with sexually transmitted infections among girls in middle adolescence. Briefly, the larger study consisted of up to 3 annual questionnaires, interviews at 3-month intervals, and up to five 84-day diary collection periods over a 27-month period. Each 84-day diary collection period was followed by a rest period of similar length in which no diary information was collected. Each annual questionnaire was conducted in conjunction with a clinic visit for collection of additional interview and physical examination data related to the larger project. Other clinic visits occurred at 3-month intervals for the duration of the project. These visits were at the beginning and end of each diary collection period, allowing research personnel to reinforce diary collection procedures and maintain current contact information. Informed consent was obtained from each participant and written permission was obtained from a parent or legal guardian. This research was approved by the institutional review board of Indiana University/Purdue University at Indianapolis–Clarian.

The annual questionnaire consisted of multiple items assessing personal attitudes and behaviors as well as perceived parental attitudes and behaviors. The diary instrument consisted of a single bar-coded, scannable sheet containing probes and response options. Each diary sheet comprised 2 sections: partner-specific behaviors occurring on the specified day and non–partner-specific items related to substance use, sexual interest, and mood. Partner-specific items were identified by partner initials or first names, and the items assessed partner interactions as well as coital activity. Items assessing marijuana use and mood are described in detail later.

At the time of enrollment, participants received detailed instructions regarding diary completion as well as a packet of blank diary sheets. Participants were asked to complete a single diary sheet at the end of each day, before going to bed. If an entry was forgotten, participants were asked to complete the form as soon as it was remembered. An appointment time for diary pick-up was arranged for the subsequent week. At weekly intervals, trained field personnel visited each participant (typically at their homes) to collect completed diaries and leave blank diary forms. Field personnel reviewed diaries for ambiguous or missing data but did not retrospectively complete missing entries. Participants received $2.00 for each completed diary as well as a bonus for completion of 80% of scheduled diaries.

Participants

Participants were English-speaking adolescent women receiving health care in 1 of 3 primary health clinics in Indianapolis. These clinics serve primarily lower-class and middle-income residents of areas with high rates of teenage pregnancy and sexually transmitted diseases. Most participants (87%) reported their race as African-American, and 2% reported Hispanic ethnicity.

Clinic patients were eligible if they were between 14 and 17 years of age at enrollment, spoke English, and were not pregnant at the time of enrollment. However, participants who became pregnant were continued in the study. Prior sexual experience was not a requirement for participation.

Measures

Measures were obtained from both the annual questionnaire and the daily diaries. Age was calculated as the age on each given diary day.

Questionnaire measures included items and multi-item

scales assessing family and individual issues. Family measures included supervised time, parental monitoring, number of family members in the same household, parental attitudes about teenage sex, and parental disapproval of teenage sex. Supervised time was a single item assessing the amount of time (on an average day) spent in the company of an adult family member. The number of household members reflected a sum of parents, grandparents, uncles/aunts, brothers/sisters, and cousins sharing the same household. Parental monitoring (4 items; $\alpha = .78$) assessed the frequency of parental inquiry about peers and activities. Parental attitude about teenage sex (3 items; $\alpha = .81$) addressed the degree to which parents felt that adolescent sexual activity was wrong, dangerous, or reflected immaturity. Parental disapproval of teenage sex (2 items; $\alpha = .90$) reflected the degree to which parents would reject conditional reasons for adolescent sexual activity, for example, because of love. An additional item assessed whether the participant's partner was living in the same household.

Other questionnaire measures were chosen to reflect dispositional differences in sexuality. These were multiple-item scales for sexual arousability and sexual body image. Sexual arousability (4 items; $\alpha = .80$) assessed the degree to which the participant reported sexual interest and comfort with sexual experimentation. Sexual body image (5 items; $\alpha = .55$) assessed the participant's perception of herself as a sexual person.

Partner-specific diary measures assessed on each diary day included argument with a partner (no/yes), partner emotional support (4 items; $\alpha = .94$), and time spent with partner (in hours). Intrapersonal, within-day measures included positive mood (3 items; $\alpha = .84$), negative mood (3 items; $\alpha = .81$), sexual interest (1 item), and skipped school (1 item; no/yes). For the mood and sexual interest items, participants were asked to indicate the proportion (not at all, some, about half, most, all) of the day they felt the following: happy, friendly, or cheerful (positive mood); unhappy, angry, or irritable (negative mood); and sexual (sexual interest). These items were modified from the Positive and Negative Mood Scale, and from our earlier research [13]. Finally, to assess potential effects of usual behavior, the number of coital events reported for the preceding week was assessed. Values for this variable ranged from 0 to 7.

The "skipped school" measure was included to assess intentional missing of school as an opportunity for sexual activity; this measure was included only in statistical models with the sample limited to school days.

For each diary day, participants recorded the occurrence of coitus (no/yes). If coitus occurred on any given day, time of day of coitus was assessed by 4 choices: midnight to noon, noon to 3 PM, 3 PM to 6 PM, and 6 PM to midnight. These time groupings were chosen to represent periods of relevance to adolescents in terms of a diurnal cycle of school and home and are consistent with time periods used in other research [2]. Because school dismissal times may vary substantially and to highlight sexual activity during potentially unsupervised times, time of day was aggregated to afternoons (noon to 6 PM) and evenings/night (6 PM to noon). If multiple events with the same partner were recorded that occurred during different time periods then the afternoon event was chosen. However, only a small proportion of coital events (less than 5%) represented same-day events. No participant reported coitus with more than one partner on the same day.

Because each diary record is date-specific, both month and day of week are data available for a given diary record. The date was used to construct 3 additional time-related measures: weekend (no/yes), school day (no/yes), and vacation weekday (no/yes). Weekends were defined arbitrarily as Saturday from 12 AM to Sunday at 12 PM. We chose this definition of a weekend (although some may consider weekends to begin on Friday evenings and end on Sunday evenings) because patterns of adult supervision, especially for afternoons, are likely to follow a traditional weekday/weekend pattern. School day and vacation weekday were constructed around school session and vacation schedules of the Indianapolis Public Schools. Thus, weekdays from August 20 to December 20 and from January 5 to May 31 were classified as school days. All other weekdays were classified as vacation days. These measures do not capture some school-to-school seasonal variability in late-summer school start, autumn break, Christmas vacation, spring break, and spring school completion dates. However, these locally vary by no more than 1 or 2 weeks. None of the schools attended by participants are year-round schools. These measures allow a more accurate representation of the annual cycle of school, holiday, and vacation that may be important in adolescent sexual behavior [14].

Statistical analysis

Analyses were performed in SAS version 8 (Cary, NC). The null hypothesis was that predictors derived from the questionnaires and diaries were not associated with any of the 3 possible daily outcomes: no coital event, afternoon coitus, and evening/night coitus.

There are multiple observations from each subject based on first-quarter diary data after enrollment and the first quarter of each subject's second study year. Questionnaire data are from enrollment and from the questionnaire at the beginning of the second year. Each diary date may have multiple observations for up to 5 partners reported (whether or not coitus was reported with partner). Only data from subjects who reported sexual activity in the diary quarter were included. The variable for skipping school was included only for subjects who had skipped at least 1 day of school (total observations = 1,465). Multiple-item variables used imputation of missing values based on the average of present values if at least 60% of items were present.

Ordinal and continuous predictors were standardized to a

Table 1
Coital events by time of day and type of day

Time of coitus	Weekend N (%)	School day N (%)	Vacation day N (%)	Total N (%)
No	2,990 (86.1)	5,894 (89.0)	1,826 (88.1)	10,710 (88.0)
Afternoon	131 (3.8)	204 (3.1)	87 (4.2)	422 (3.5)
Evening	353 (10.2)	523 (7.9)	160 (7.7)	1,036 (8.5)

Note: Time of day was defined as no coitus, afternoon coitus (noon to 6 PM), and evening/night coitus (6 PM to noon).
Type of day was defined as weekend (Saturday 12 AM to Sunday 12 PM), school day (Monday through Friday, excluding vacation days (December 20–January 5 and June 1–August 20).

normal distribution. The analysis using PROC NLMIXED was a generalized linear model with subject-specific intercepts for correlated data because of repeated observations on each subject across diary days and partners. Models all were categoric multinomial logistic regression with 3 outcomes for sexual activity: coitus during afternoon, coitus during evening/night, and no coitus. Only one observation per day was used in the analyses. For days with coitus, the partner with whom coitus occurred was used. When coitus occurred more than once, the afternoon event was chosen. For days with no coital events, one partner was chosen randomly if more than one partner was identified.

Model building

Initially, analyses were performed with 1 diary or questionnaire predictor and day category. Day categories were as follows: school day, weekend, and vacation day, which was the reference category. Predictor variables associated with afternoon coitus or evening/night coitus at a p value of less than .2 were selected for subsequent model building. Because multivariate mixed-effect logistic models are computationally intensive, a more efficient interim model-building strategy was used. Based on the results of initial associations among the predictors, we fit 5 interim models using partially overlapping subsets of the covariates. Potentially important covariates ($p < .2$) then were added to the largest subgroup model. Significant ($p < .05$) covariates were retained in the final model.

To examine the effect of skipping school, that variable was added to the final overall model but without the day category indicators because this behavior is relevant only on school days.

Results

There were 106 women who participated. The mean age at enrollment was 16.7 years, with a range of 14 to 18 years. The mean and median number of diary days contributed by each participant was 79.0 and 84, respectively (minimum of 14 and a maximum of 184 diary days). Coitus occurred on 12.0% (1,458 of 12,168) of the diary days overall (Table 1). The occurrence by type of day was 13.9% on weekends, 11.0% on school days, and 11.9% on vacation weekdays. Coitus was more than twice as likely to occur during the evening/night (8.5% of days) as during the afternoon (3.5% of days). Afternoon sex occurred less often on school days than on vacation days and evening/night sex occurred more often on weekends than on vacation days.

The results of the initial bivariate modeling adjusting for within-subject correlation are shown in Table 2. Eight of the diary or interview predictors increased the likelihood of coitus in both the afternoon and evening/night: argument with partner, increased partner support, greater positive mood, feeling sexual, more time with partner, increased parental monitoring, coital activity in the previous week, and older age. Of additional interest is that adjustment for time with partner, amount of recent sex, or sexual feelings eliminated the significant difference in afternoon coitus between school and vacation days. Increased negative mood and more family members in the household decreased the likelihood of sex in the afternoon and evening. Greater parental supervision inquiry was associated with more evening coitus and feelings of arousal were associated with less afternoon sex. Women who were living with their partner showed greater odds of evening/night sex but lower odds of afternoon sex.

Multivariable modeling

The final multivariable multinomial logistic regression model contained 8 factors besides the day categories (Table 3). Four variables (partner emotional support, sexual interest, time spent with partner, and more sex in the past week) were associated with increased likelihood of sex in both the afternoon and evening. For every standard deviation increase in time spent with a partner (about 1.7 h) the odds of sex with that partner on that day increased almost 5-fold in the afternoon and more than 6-fold in the evening/night. As the sexual interest scale increased about 1.3 points, the odds of sex increased almost 3-fold in both time periods. For increases of about 1.7 in the partner support scale, the increase in odds was 72% in the afternoon and 57% in the evening. Finally, for every additional 1.4 days with sex in the past week, the odds of sex increased 20% for the afternoon and 35% for the evening. Negative mood also was included in the final model and for each increase of 3.1 on

Table 2
Univariate associations with afternoon and evening sex

	Afternoon		Evening	
	Odds ratio	95% confidence interval	Odds ratio	95% confidence interval
Type of day				
Weekend*	.92	.69–1.24	1.35	1.09–1.68
School day*	.70	.53–.92	.97	.79–1.20
Partner variables				
Argument with partner†	2.09	1.66–2.64	1.34	1.13–1.60
Partner emotional support	3.76	3.25–4.35	4.10	3.67–4.57
Hours spent with partner	6.49	5.51–7.66	8.28	7.21–9.52
Parent/family variables				
Supervision	1.07	.94–1.21	1.25	1.12–1.39
Parental monitoring	1.16	1.00–1.34	1.35	1.19–1.54
Number of household members	.82	.71–.94	.65	.58–.74
Parent attitudes about teenage sex	1.12	.97–1.28	.99	.88–1.11
Parents disapproval of teenage sex	1.13	.96–1.32	1.03	.89–1.18
Lives with partner†	.61	.42–.88	1.36	1.04–1.79
Mood and behavior variables				
Negative mood	.78	.70–.87	.78	.70–.87
Positive mood	1.43	1.28–1.61	1.73	1.58–1.89
Sexual interest	3.16	2.86–3.48	3.43	3.16–3.72
Coital days in past week	1.60	1.47–1.74	1.81	1.70–1.93
Sexual body image	1.08	.92–1.26	1.09	.96–1.25
Sexual arousability	.76	.64–.89	.92	.79–1.06
Age on diary day	1.17	1.01–1.34	1.33	1.17–1.51

* Reference category is vacation day.
† Reference category is no.

the scale, the odds of sex during both time points decreased by 15%.

Three additional variables were associated with afternoon but not evening/night sex. An argument with a partner increased the likelihood of afternoon sex by about 60%. Both supervised time and positive mood decreased the odds of afternoon sex by about more than 20% for each standard deviation increase (about 1.5 hours and 3.9 scale points, respectively). This is contrary to the bivariate results in which increased positive mood was associated with increased sex at both times of day and supervised time was unrelated to the occurrence of coitus. Of additional note is that after adjustment for these individual and partner-specific variables, the day category variables did not significantly affect the likelihood of afternoon sex. For the evening/night time period, the adjusted results showed a significant ($p = .04$) 34% increase in the odds of coitus for weekdays relative to weekday vacations. The estimated odds ratio was similar for weekend days versus vacation days (1.27), but the difference was not significant ($p = .11$).

To evaluate the effect of skipping school, analyses were limited to school days only. The skipping-school variable was added to the model derived for all days (omitting the day category variable). Skipping school had no effect on evening sex ($p = .17$) but increased the likelihood of afternoon sex 6-fold (odds ratio = 6.0; 95% confidence interval = 2.10–17.05) (data not shown in Table 3).

Discussion

Several findings have relevance to clinical practice and policy. First, coitus among adolescent women is relatively rare, occurring on only about 12% of days. Second, coitus during potentially unsupervised afternoon times accounts for less than one third of all coital events, and is least common on afternoons of school days. Most of the sexual activity of the adolescent women in our sample occurred after 6 PM and before noon. Third, parental supervision was associated with decreased likelihood of afternoon sex but did not affect the likelihood of evening/night sex. Finally, the data extend previous observations of the importance of intrapersonal factors such as mood and sexual interest, and interpersonal factors such as partner interactions. Each of these points is given additional consideration later.

Coital frequency and regularity may be pertinent especially for adolescents who are unlikely to have control over privacy and whose sexual relationships are proscribed socially. *Sporadic* is a term often used to describe coital patterns during adolescence [15,16]. The sporadic nature of sexual activity may complicate decisions about coitus-independent contraceptives [15,17]. However, the infrequency of sexual activity should not lead to the conclusion that such activity is unpredictable. As we have shown here and in other studies, the social organization of school and leisure means that sex is more likely on some days than others [14].

Table 3
Multivariable, multinomial logistic model for time of coitus

	Afternoon		Evening	
	Odds Ratio	95% confidence interval	Odds Ratio	95% confidence interval
Type of day				
Weekend*	.94	.66–1.33	1.27	.95–1.69
School day*	1.00	.72–1.39	1.34	1.01–1.77
Partner variables				
Argument with partner†	1.59	1.19–2.10	1.02	.80–1.29
Partner emotional support	1.72	1.43–2.06	1.57	1.35–1.82
Hours spent with partner	4.83	3.96–5.88	6.32	5.33–7.49
Parent/family variables				
Supervised time	.78	.66–.93	.91	.78–1.06
Mood and behavior				
Negative mood	.85	.73–.99	.85	.74–.96
Positive mood	.79	.66–.93	.90	.77–1.04
Sexual interest	2.85	2.51–3.24	2.89	2.59–3.22
Coital days in past week	1.20	1.09–1.33	1.35	1.24–1.46

Note: Reference category is no coitus.
* Reference category is vacation day.
† Reference category is no.

Evidence for some patterning of adolescent sexual activity suggests that times of potentially increased opportunity such as unsupervised time after school might be associated with increased likelihood of sex on school days. However, rather than suggesting increased likelihood of coitus during afternoons of school days, our data suggest increased risk for coitus during evenings and nights of school days, compared with vacation days. A decreased likelihood of afternoon coitus associated with parental supervision is consistent with the idea that parental supervision is strictest during the day and relaxes during evening and nighttime hours, even while school is in session.

The role of parents and other adults as arbiters of adolescent sexual behavior has received substantial popular and research attention in recent years, although substantial effects have not been identified in all studies. Parental values, communication, and supervision are identified as important factors [2,18,19] Parental supervision and monitoring have received extensive attention because of the large numbers of working parents, and linkage of the lack of supervision during after-school hours to tobacco, alcohol and drug use, and increased sexually transmitted infection risk [3,20,21]. The distinction of supervision from monitoring may be important. Some studies show that substance use among adolescents who were monitored but not directly supervised after school was no different from those who were monitored directly [21]. We found, however, that reports of supervision, rather than monitoring or parents' attitudes about adolescent sexual activity, were associated with decreased likelihood of afternoon sexual activity. This means that a traditional role of family, as guards against premarital sexual activity, remains relevant. The finding that none of the parental factors, including supervision, affected sexual activity during evening/night hours suggests the limits of either direct or indirect parental influence on sexual activity.

These data should be considered within the context of their limitations. The sample was homogenous racially from a single geographic area. Generalizations to other populations of adolescents should be made with caution. However, the clinical population from which the current sample was drawn is characterized by high rates of sexual activity, early pregnancy, and sexually transmitted infections. From this perspective, the sample represents a scientifically and clinically important population, and may provide insight into the sexuality and sexual behaviors of other adolescent populations as well. The diary methodology used in this research also has limitations. For example, we cannot identify the order of behaviors within a given day. It is possible (although we consider it unlikely) that sexual activity causes people to skip school, rather than skipping school to have sex. Each of the within-day mood and partner interaction measures used in this research are subject to this same limitation. In discussing these results, we have noted carefully that days with coitus, either afternoon or evening/night, are associated with the specific diary measures. Although a sequence often is logical (e.g., increased levels of sexual interest preceding rather than after sexual activity), one cannot use these data to support or refute a specific within-day causal sequence.

Perhaps the most important message to be drawn from the analyses presented here is the complexity of adolescent sexuality and adolescent sex. Public health and clinical interventions are implemented most easily when a single risk factor in a causal chain can be targeted. However, the multifaceted roles of sexuality as risk factors and as key tasks of healthy adolescent development create difficult-to-

resolve policy and clinical conflicts [22]. These conflicts may explain why sex and its untoward health consequences have proven largely resistant to simple interventions, including those focused only on sexual abstinence [23]. We believe that adolescents can be helped by families, schools, and health care systems to achieve a healthy sexuality and a decreased risk for adverse consequences. However, preparation of adolescents for the responsibilities and pleasures of sex likely requires long-term investment in creating connections to others (parents, teachers, other adults), connections to institutions (family, school, community), and provision of a broad range of social and psychologic skills [8,24,25].

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