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ORIGINAL ARTICLE

Weekly and Seasonal Variation in Sexual Behaviors Among Adolescent Women with Sexually Transmitted Diseases

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Purpose: **The objective of this research is to describe aspects of the organization of adolescent sexual behavior in order to understand factors associated with risk for sexually transmitted diseases (STD).**

Methods: **Subjects were 82 females (ages 16–19 years; 77% African-American) participating in a larger STD study. Subjects completed diaries for each coital event, recording date of event, partner initials, condom use, and use of drugs or alcohol before intercourse. Partner change was defined as any event for which the sex partner initials differed from those listed for the most recent previous coital event.**

Results: **The 82 subjects recorded 1265 coital events; the average span of the records was 10 weeks. Intercourse was least likely on Sundays (154 of 1265; 12.2%) and most common on Friday and Saturday (221 of 1265 for each day; 17.5%). The proportion of coital events associated with drugs or alcohol increased from Sunday to Saturday, although the proportion of coital events in which a condom was used did not vary significantly. Intercourse was most common in spring and summer, and least frequent in winter.**

Conclusions: **These data indicate substantial temporal organization of adolescent sexual behaviors that may be related to risk of sexually transmitted diseases. Some STD-preventive interventions may be most effective when targeted to higher risk times.** *© Society for Adolescent Medicine, 1997*

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The purpose of this article is to examine the variation of adolescent sexual behaviors through the course of the 7-day week, and through the progression of seasons. Weekly variation in sexual activity may occur because of the larger societal organization of time into the "work-week" and "weekends" (1). Weekends represent periods of fewer school-related responsibilities, typically marked by relaxation of parental monitoring and greater amounts of time spent with peers (2,3). Other important sexually transmitted disease (STD)-risk behaviors (e.g., sex with different partners, use of alcohol or drugs in association with sex, use of condoms) may also vary if adolescents perceive weekends to be times of release from usual weekday responsibilities.

Relatively few data address seasonal variation in sexual intercourse, although seasonal patterns of births are consistently observed (4). Studies of adults suggest increases in sexual activity in warmer months, and less sexual activity in cool months (5,6). Seasonal variation in the timing of first sexual intercourse, with peak frequency of first intercourse occurring during summer months, has been demonstrated in at least two large adolescent samples (7). This study also suggested seasonal variation in ongoing sexual activity, but these patterns were less

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clearly established (7). We are not aware of data about seasonal variation in other STD-risk behaviors among adolescents.

Weekly and seasonal variation in adolescent women's sexual activity and sexual risk behavior was assessed using coital diaries. We hypothesized that sexual activity would occur more often during weekends and summer months. If these are periods of decreased obligations, increased pleasure-seeking and decreased parental monitoring, then increases in other risky sexual behaviors such as substance use in conjunction with intercourse, sex with new or different partners, or failure to use condoms might also be expected. Understanding of such cyclic influences could offer opportunity for focused interventions prior to times of greatest risk.

Methods

Data were obtained from coital diaries as part of a larger research project for STD prevention among adolescent women. Diary collection began in the winter of 1992 and continued through the spring of 1995. Visual inspection of returned diaries and exit interviews with participants did not reveal evidence of retrospective diary completion. We have found (consistent with the work of other investigators) a high degree of concordance between our subjects' diaries and questionnaire reports of sexual behaviors (8–12).

Subjects were females ages 16–19 years, of a metropolitan STD clinic and four community adolescent health clinics. Cervical infection with gonorrhea or *Chlamydia* (identified by standard culture methods), or vaginal infection with trichomonas (identified by culture or saline wet mount) were conditions for entry into the larger study.

A total of 82 women participating in the larger study of 582 adolescents agreed to maintain coital diaries during at least one time interval. Each participant in the larger study received a diary at enrollment, but most failed to return diaries at follow-up visits. Diary completers did not differ from other participants in terms of age, race, age at first sexual intercourse, intercourse frequency, number of sex partners in the previous 6 months, regularity of condom use, use of alcohol and drugs in the previous 30 days, or frequency of use of alcohol or drugs before intercourse. Thus, no baseline characteristics distinguished subjects who completed diaries from those who did not.

All subjects provided written informed consent but the requirement for parental permission was waived because Indiana law recognizes adolescent consent for research on conditions associated with STD. This project was approved by the Institutional Review Board of Indiana University Purdue University at Indianapolis.

Diary Completion

Subjects were asked to record dates of each sexual intercourse, initials of the sex partner, whether a condom was used, and whether alcohol or drugs were used before intercourse. Partner change was defined as partner initials that differed from those recorded for the most recent prior coital event. Thus, change of sex partner identifies (for each coital event) whether the current partner also was involved in the most recent prior coital event. This coding scheme captures the variability in patterns of sexual partnerships, avoiding some of the conceptual limitations of simply counting number of unique partners or applying descriptors such as "casual" or "regular" partner.

Diaries were collected at follow-up visits at 3, 9, 15, and 21 months after enrollment. All records for all subjects were used, without regard for the time interval in which it was recorded. It is important to note, however, that most subjects completed diaries for a limited time period (see below); therefore, these data represent aggregate variations in sexual behaviors rather than intra-individual patterns of behavior. Subjects received a payment of $15.00 for completing a questionnaire at each visit; no additional compensation was provided for diary completion.

Data Analysis

Dates for each coital event were transformed to their corresponding day of the week (Sunday through Saturday) and month of the year (December through November). Seasons were derived from the month during which each coital event occurred: winter was defined as December through February (90 days except leap years), March through May as spring (92 days), June through August as summer (92 days), and September through November as autumn (91 days). We conducted alternative analyses adjusting for the small differences in season lengths. These analyses were nearly identical to those using the unadjusted seasonal proportions reported in this article.

Statistical analyses used SPSS for Windows.

Table 1. Coital Events Involving Substance Use, Sex Partner Change, or Condom Use, by Day of Week

	All Events*	Substance Use†	Partner Change‡	Condom Use
Sunday	154 (12.2)	7 (5.5) [128]	21 (13.6)	74 (50.0) [148]
Monday	183 (14.5)	8 (4.9) [162]	20 (10.9)	100 (54.9) [182]
Tuesday	163 (12.9)	6 (3.9) [153]	19 (11.7)	88 (54.7) [161]
Wednesday	165 (13.0)	15 (9.9) [152]	34 (20.6)	93 (57.1) [163]
Thursday	158 (12.5)	14 (9.7) [145]	31 (19.6)	84 (53.5) [157]
Friday	221 (17.5)	18 (9.5) [189]	41 (18.6)	114 (52.5) [217]
Saturday	221 (17.5)	25 (12.4) [201]	40 (18.1)	128 (58.4) [219]
Total	1265 (100.0)	93 (8.2) [1130]	206 (16.3)	681 (54.6) [1247]

Note: Numbers in parentheses are percentages. Substance use report omitted for 135 coital events; condom use omitted for 18 coital events. Numbers in brackets represent denominator for calculation of percentages.

* $p < 0.05$ by Kolmogorov–Smirnov test.

† $p < 0.05$ by Kruskal–Wallis test.

‡ First recorded coital event coded as partner change.

Weekly and seasonal differences in reports of sexual activity were assessed by the one-sample Kolmogorov–Smirnov goodness-of-fit test, which is appropriate for variables with ordered categories (13). These analyses were conducted with the assumption of uniform distribution of sexual behaviors throughout the week, and from season to season. Weekly and seasonal variation in substance-associated coitus, sex partner change, and condom use was assessed by the Kruskal–Wallis test. Statistical significance was defined as $p < 0.05$.

Results

Study enrollment was equally distributed through each season: 24.3, 24.4, 24.4, and 26.9% for winter, spring, summer, and autumn enrollments, respectively. The 82 women recorded 1265 coital events. The median number of coital events was seven (mean = 15.4); 13 women recorded only one episode of intercourse. Median intercourse frequency (among women recording more than one event) was 2.0 coital events/month (mean = 2.5), ranging from <1/month to 11/month. Of the total coital events, 8% involved alcohol or drugs, 16% involved a partner change, and 55% involved a condom (Table 1).

Weekly Variation

Coitus was least likely on Sundays (154 of 1265; 12.2% of all coital events) and most common on Friday and Saturday (221 of 1265 each for Friday and Saturday; 17.5% for each day) ($p < 0.001$) (Table 1).

The proportion of coital events associated with drugs or alcohol increased from Sunday through Saturday: 5.5% of Sunday coital events were substance-associated, while 12.4% of Saturday coital events were substance-associated ($p < 0.04$ by Kruskal–Wallis test) (Table 1). Forty-six percent (43 of 93) of all substance-associated coital events occurred on Friday or Saturday.

Coital events involving a sex partner change appeared to be more common in the latter part of the week than in the early part, but this did not reach statistical significance (Table 1). The largest proportion of coital events involving partner change (20.6%), however, was on Wednesday.

Condom use ranged from 50% of coital events on Sundays to 58% of coital events on Saturdays ($p > 0.05$) (Table 1). The proportion of condom-protected coital events appeared to be relatively stable over the course of the week, although condom use was most common on Saturday.

Since substance use and sex partner change may share similar social environments (i.e., parties or bars), we attempted to identify behavioral interactions that might demonstrate weekly variation. Substance use at the time of sex with a different partner was recorded for only 1.5% (16 of 1130) of coital events. However, 56% (9 of 16) these events took place on Friday or Saturday (data not shown). Condoms were not used for 11 of 16 coital events representing substance-associated coitus with a different partner; however, 64% (7 of 11) of these events occurred on Friday or Saturday (data not shown). Thus, occurrence of the risky behavioral pattern of condom nonuse, substance use before coitus, and sex with a new partner is relatively infrequent, but most often occurs on Friday or Saturday.

Seasonal Variation

Peaks of sexual activity were identified in April and in August (Fig. 1). Intercourse was least commonly

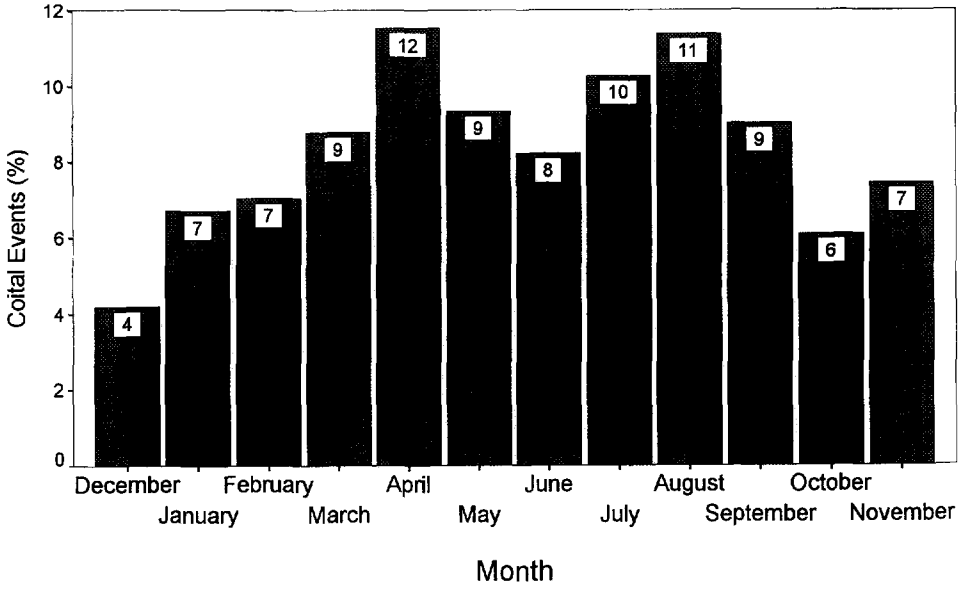

Figure 1. *Coital frequency, by month.*

recorded in winter (December through February; 18% of all coital events) and most commonly recorded in summer (June through August; 30% of all coital events) ($p < 0.001$) (Table 2).

Substance-associated intercourse showed significant seasonal variation, occurring most frequently in spring and autumn ($p < 0.01$ by Kruskal–Wallis test) (Table 2). Partner change was more likely in autumn (20.7% of all coital events involved a partner change in autumn) but this difference was not statistically significant (Table 2). Condoms were used during 61% of summer coital events, compared to 50.7, 50.1, and 54.7% for winter, spring, and autumn, respectively ($p < 0.02$ by Kruskal–Wallis test) (Table 2).

Discussion

We found modest but significant weekly variation in the sexual activity of adolescent women. This pattern of variation over a 7-day cycle is properly termed *hebdomadal,* although this usage is relatively rare. Sexual intercourse was more likely during the part of the week that is culturally associated with leisure (i.e., Fridays and Saturdays); sex on these days was also more likely to be associated with substance use. Change of sex partner and condom use, however, were more evenly distributed through the week, suggesting that these behaviors are associated with other factors. Sexual activity was more common in spring and summer months. Contrary to expectations, substance-associated sex was more common in spring and autumn rather than summer. Condom use was actually more common in summer months when adolescents presumably have greater opportunity for sexual intercourse.

These findings are consistent with a view of adolescent sexual activity as a behavior that is substantially organized by culturally defined patterns of

Table 2. Coital Events Involving Substance Use, Sex Partner Change, or Condom Use, by Season

	All Events*	Substance Use†	Partner Change‡	Condom Use†
Winter	227 (18.0)	10 (5.0) [200]	35 (15.4)	115 (50.7) [227]
Spring	375 (29.6)	37 (11.4) [325]	60 (16.0)	186 (50.1) [368]
Summer	378 (30.0)	18 (5.2) [344]	52 (13.8)	224 (61.0) [367]
Autumn	285 (22.5)	28 (10.9) [261]	59 (20.7)	156 (54.7) [285]
Total	1265 (100)	93 (8.3) [1130]	206 (16.3)	681 (54.6) [1247]

Note: Numbers in parentheses are percentages. Substance use report omitted for 135 coital events; condom use omitted for 18 coital events. Numbers in brackets represent denominator for calculation of percentages.

* $p < 0.05$ by Kolmogorov–Smirnov test.

† $p < 0.05$ by Kruskal–Wallis test.

‡ First recorded coital event coded as partner change.

work and leisure. Weekends are times of release from usual responsibilities of school or work, and may mark a time of relaxation of some rules of parental monitoring (2). The amount of time spent in the company of friends rather than family increases, especially on Friday and Saturday evenings (3). Thus, weekends are culturally validated as times of leisure and "having a good time." The finding of increased frequency of substance-associated sex during weekends is consistent with this perspective. We did not find, however, that weekends were times when responsible sexual activity was abandoned, since the proportion of coital events that were condom-protected did not significantly vary through the week.

We also found that sexual activity was more common during spring and summer than in autumn or winter. These findings are remarkably similar to those of Rodgers et al., who described similar summer peaks for first sexual intercourse experience and for ongoing sexual activity (7). Rodgers et al. suggested that both biological (i.e., seasonal hormonal changes that affect mood and sexual interest) and sociocultural (i.e., summer vacation) factors may explain such seasonal variations in fertility-related behaviors (7). Our finding of increased condom use during summer months is also consistent with findings of increased contraceptive use in summer months reported by Rodgers and Udry (4). Such seasonal variation in contraception has been associated with the consistent observations of seasonal variations in contraceptive use [highest in summer months (4)] and conceptions among both adolescents and adults (lowest in July, August and September) (14–16).

Several limitations of these data should be considered. The sample is limited to a small number of adolescent women, those initially infected with an STD who agreed to keep coital diaries. However, a large number of coital events (more than 1200) were evaluated. We found no important behavioral differences in sexual behaviors among subjects who did and did not keep coital diaries. Omission of key data (i.e., failure to record substance use or nonuse for about 11% of coital events) could produce bias if substance use was differentially omitted for coital events on some days compared to others. Other analyses showed that missing data for substance use was distributed throughout the week, but a significantly larger proportion of Friday coital events had missing substance use data. Analyses conducted assuming that all coital events with missing data were substance-associated did not alter the finding of more sexual activity associated with substance use during weekends.

Our sample was limited to adolescent women. Gender differences in weekly and seasonal patterns of sexual activity may exist, although similar patterns have been identified for both males and females in other work (7). Finally, most of our sample consisted of women of African-American ethnic identity. Patterns identified in this research could differ among other American racial or ethnic groups.

Similarity of these data on seasonal variation to that obtained in other research (where substantially different methodology was used) provides some convergent validity for coital diaries and supports wider use of this methodology as a research tool for understanding the several coitus-specific risk and protective behaviors that may be associated with adolescent sexual activity. Such subsequent research may need to focus on individuals' temporal organization of sexual behavior to better understand factors amenable to interventions.

The findings offer useful insights into the organization of adolescent sexual behavior. Although sometimes characterized as a spontaneous or random occurrence, we find that adolescents' sexual activity follows well-defined distinctions of work and leisure. Understanding of these patterns offers opportunities to target prevention messages to times of highest risk for sexual activity. For example, Friday afternoons may be a particularly appropriate time for school-based health services to emphasize STD prevention.

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References

1. Lewis JD, Weigert AJ. The structures and meanings of social time. Social Forces 1981;60:432–62.
2. Fine GA, Mortimer JT, Roberts DF. Leisure, work, and the mass media. In: Feldman SS, Elliott GR, eds. At the Threshold: The Developing Adolescent. Cambridge MA: Harvard University Press, 1990:225–52.
3. Csikszentmihalyi M, Larson R. Being Adolescent: Conflict and Growth in the Teenage Years. New York: Basic Books, 1984.
4. Rodgers JL, Udry JR. The season-of-birth paradox. Soc Biol 1988;35:171–85.

5. Udry JR, Morris NM. Seasonality of coitus and seasonality of birth. Demography 1967;4:673–9.
6. Reinberg A, Lagoguey M. Circadian and circannual rhythms in sexual activity and plasma hormones (FSH, LH, testosterone) of five human males. Arch Sex Behav 1978;7:13–30.
7. Rodgers JL, Harris DF, Vickers KB. Seasonality of first coitus in the United States. Soc Biol 1991;39:1–14.
8. Fortenberry JD, Cecil H, Zimet GD, Orr DP. Concordance between diary and self-report questionnaires of sexual behaviors of adolescent women. In: Bancroft J. Researching Sexual Behavior. Bloomington, IN: Indiana University Press (in press).
9. Hornsby PP, Wilcox AJ. Validity of questionnaire information on frequency of coitus. Am J Epidemiol 1989;130:94–9.
10. Reading AE. A comparison of the accuracy and reactivity of methods of monitoring male sexual behavior. J Behav Assess 1983;5:11–23.
11. Berk R, Abramson PR, Okami P. Sexual activities as told in surveys. In: Abramson PR, Pinkerton SO, eds. Sexual Nature, Sexual Culture. Chicago, IL: University of Chicago Press, 1995:371–86.
12. McLaws M-L, Oldenburg B, Ross MW, Cooper DA. Sexual behavior in AIDS-related research: Reliability and validity of recall and diary measures. J Sex Res 1990;27:265–81.
13. Zar JH. Biostatistical Analysis, 2nd ed. Englewood Cliffs, NJ: Prentice-Hall, 1984.
14. Naeye RL. Seasonal variations in coitus and other risk factors, and the outcome of pregnancy. Early Hum Dev 1980;4:61–8.
15. Warren CW, Gwinn ML, Rubin GL. Seasonal variety in conceptions and various pregnancy outcomes. Soc Biol 1986; 33:116–26.
16. Petersen DJ, Alexander GR. Seasonal variation in adolescents conceptions, induced abortions, and late initiation of prenatal care. Pub Health Rep 1992;107:701–6.