

ORIGINAL ARTICLE

A Daily Diary Analysis of Vaginal Bleeding and Coitus Among Adolescent Women

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Objective: To evaluate the effect of vaginal bleeding on the likelihood of coitus among adolescent women.

Methods: Participants were 191 sexually active women aged 14 to 21 years enrolled from a sexually transmitted disease clinic and three primary care adolescent clinics. Data were collected from diaries maintained for up to 7 months. Subjects recorded each occurrence of coitus, partner initials, condom use, and vaginal bleeding. Multivariable logistic regression was used for the analyses. Generalized estimating equations approach was used to adjust the estimated parameters for within-subject correlation.

Results: Subjects reported a total 21,334 diary days, with 2684 days with coitus (12.6% of diary days) and 1433 days with bleeding (6.7% of diary days). Only 65/2684 (2.4%) coital events were associated with vaginal bleeding. Multivariable analysis showed that absence of bleeding was associated with increased likelihood (odds ratio = 4.2) of coitus, independent of age, race, and usual coital frequency. Younger age and higher coital frequency were associated with increased likelihood of any coitus during vaginal bleeding.

Conclusions: For most sexually active adolescent women, bleeding is associated with avoidance of coitus.

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KEY WORDS:

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Coitus associated with vaginal bleeding is a risk factor for sexually transmitted infections (STIs), including human immunodeficiency virus (HIV) [1]. In particular, pelvic inflammatory disease is more common in association with menses [2]. Reasons for this increased susceptibility are unclear, although cyclic variations in vaginal microflora and local immunity may contribute. Serum complement-mediated anti-gonococcal effects are lowest at the time of menses [3].

Menstruation is a highly salient and intensely experienced event for young women [4]. However, many societies construe monthly bleeding as an embarrassing and debilitating event [5]. Advertisements in magazines targeted to teen audiences consistently focus on the hygienic aspects of menstruation [6]. Modern societies give little emphasis to ritualistic recognition of menarche, and young women are often left to cope alone with the more bothersome aspects of menses. For many, menstruation is associated with feelings of shame and disgust [7]. Adolescent women overwhelmingly feel required to conceal their condition, especially from males [7]. Concealment thus plays an important role in the relationship of menstrual bleeding and sexual activity.

Little is known about sexual activity associated with vaginal bleeding among adolescents. Sexual interest and coital frequency are generally lowest during menses, although few studies include significant numbers of adolescents [7]. A study of adult

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women found inconsistent associations of age and coitus during menses. For the most recent menstrual period, women aged 20–24 years had an increased likelihood of coitus during menses compared with women aged 35–37 years. However, young adult women did not differ from older women in terms of reports of usual patterns of sexual intercourse during menses [1]. Coital frequency was an important predictor of sex during menses, with women reporting frequent coitus (more than two times a week) more than eight times as likely to have sex during menses, compared with women with coital frequencies of once a week or less [1].

Examination of the association of vaginal bleeding on coitus is the primary objective of this paper. In addition, factors that may increase the likelihood of coitus while bleeding are evaluated. Diaries were used to record episodes of vaginal bleeding as well as coitus. Diaries provide a prospective, day-to-day record of coital activity with and without associated vaginal bleeding on the same day.

Methods

Data and Subjects

Subjects were recruited from a county sexually transmitted disease (STD)-clinic and three primary care adolescent health clinics. These clinics are located in areas with high STD-related morbidity and serve an urban population of low to middle income. The research was approved by the Institutional Review Board of Indiana University/Purdue University at Indianapolis.

Each subject completed a face-to-face enrollment interview assessing demographic variables, attitudes, and behaviors. Specifically, subjects were asked to provide their age (in years) at menarche and at first coitus. Subjects were also asked to complete daily sexual diaries that recorded occurrence of coitus, condom use, and any vaginal bleeding. Diaries were collected at return visits scheduled at 1, 3, 5, and 7 months after enrollment. Participants received \$2.00 for each completed diary as well as a \$20.00 bonus for completion of 80% of scheduled diaries.

The unit of analysis was individual diary days. Diary reports of sexual behavior generally agree with self-reports of behavior obtained by other methods [8].

Measures

The outcome variable was occurrence of coitus on a given day ("no"/"yes"). The predictor variables ob-

tained from interviews were number of years since menarche, age at enrollment, months since first sexual experience, and race. "Age at enrollment" (in years) was taken from enrollment self-reports. "Years since first sexual experience" and "Years since menarche" were calculated by subtracting age at enrollment from enrollment reports of ages at first coitus and age at menarche. These measures were included to assess potential developmental and experiential changes in coitus associated with vaginal bleeding. "Race" was coded as non-black/black. This variable was included as a crude surrogate for potential sociocultural differences in attitudes about coitus associated with vaginal bleeding.

Variables obtained from diaries included bleeding, usual condom use and recent sexual activity. "Bleeding" on a given day was coded as "no" if bleeding did not occur and "yes" if bleeding was recorded.

"Recent sexual activity" ("no"/"yes") was defined as any coitus during the 3 weeks before a given day. This measure was chosen to control for usual coital frequency that predicts coitus on any given day. Three weeks was chosen to allow for variability of sexual behavior within a menstrual cycle.

"Usual condom use" was defined as the proportion of reported condom protected coital events to all coital events.

The primary outcome variable was "coitus" on a specific day ("no"/"yes").

Procedure

The SAS statistical package (version 8, SAS Institute, Cary, NC) was used to perform all analysis. We modeled a binary variable denoting days with coital events ("yes") and days with no coital events ("no") using logistic regression. Each subject could have had many coital events reported in the diaries. To adjust for within-subject correlation, generalized estimating equations (GEE) approach was used. GEE allows for correct estimation of the magnitude and significance of the covariates used in the coital events' prediction [9].

To explore the relationship between bleeding and coitus, as well as the effects of other covariates upon coitus, two logistic regression models were evaluated:

$$\begin{aligned} \text{Logit (coitus)} = & b_0 + b_1(\text{bleeding}) + b_2(\text{age}) \\ & + b_3(\text{recent sexual activity}) + b_4(\text{race}) \\ & + b_5(\text{years since menarche}) \end{aligned}$$

Table 1. Coitus and Vaginal Bleeding—Selected Subject Demographic and Sexual Behaviors

Demographic	
Age at menarche (yrs) (SD)	11.9 (1.7)
Age at first coitus (years) (SD)	14.0 (1.7)
African-American, n (%)	154 (80.6)
Total coital events, n (%) [*]	2,684 (12.6)
Total bleeding days, n (%) [*]	1,433 (6.7)
Condom use, n (%) ^{**}	1,220 (45.4)

^{*} Based on 21,357 diary days.

^{**} Based on 2,684 coital events.

+ b_6 (years since first sexual experience);

Logit (coitus on bleeding days) = $b_0 + b_1$ (age)

+ b_2 (recent sexual activity) + b_3 (race)

+ b_4 (years since menarche)

+ b_5 (years since first sexual experience)

+ b_6 (usual condom use).

Regression coefficients were considered statistically significant when p -value < .05.

Results

Interview and Diary Reports of Sexual Behavior

Diary reports were available for 191 subjects, with an average diary length of slightly over nine weeks. Baseline demographic and sexual behavior data are summarized in Table 1. Subjects reported a total 21,357 diary days, with 2684 days with coitus (12.6% of diary days) and 1433 days with bleeding (6.7% of diary days). Only 65/2684 (2.4%) coital events were associated with vaginal bleeding ($p < .05$; Table 2.) Thus, coitus associated with bleeding is a relatively rare event among adolescent women.

Variables associated with coitus on a specific day are shown in Table 3. Not bleeding (OR = 4.1; $p < .001$) and any sexual activity in the past 3 weeks (OR = 12.0; $p < .001$) were associated with increased probability of coitus on any given day. This suggests

Table 2. Daily Diary Reports of Coitus and Vaginal Bleeding^{*}

Coitus	No n (%)	Yes n (%)	Total N (%)
No	17,305 (86.9)	1,368 (95.5)	18,673 (87.4)
Yes	2,619 (13.1)	65 (4.5)	2,684 (12.6)
Total	19,901 (93.3)	1,433 (6.7)	21,357

^{*} $\chi^2 = 90.0$; $df = 1$; $p < .001$.

Table 3. Bleeding and Other Predictors of Coitus^{*}

Variable	B	SE	OR	p
Bleeding ("no/yes")	1.40	.28	4.07	<.0001
Age, years	.12	.08	1.13	.13
Race (black/non-black)	-.36	.26	.69	.17
Years since menarche	-.04	.07	.96	.62
Years since first coitus	.03	.10	1.03	.74
Coitus, past 3 weeks	2.49	.19	12.0	<.0001

^{*} Multivariable logistic regression adjusted for within-subject correlations by generalized estimating equations.

that young women alter usual patterns of sexual activity in the presence of vaginal bleeding.

Because this sample may include subjects with clinical reasons for prolonged bleeding that might also affect sexual activity (e.g., pelvic inflammatory disease), a sensitivity analysis was conducted. Three subjects with 7 or more days with concurrent bleeding and coitus and two subjects with over 50% of the total diary days with concurrent bleeding and coitus were excluded. Significant variables associated with coitus included not bleeding (OR = 7.3; $p < .001$), age (OR = 1.2; $p = .01$), any sexual activity in the past 3 weeks (OR = 11.4; $p < .001$) and non-black race (OR = 0.62; $p = .05$) (data not shown). The sensitivity analysis suggests that, even with the exclusion of outliers, the overall conclusions did not change about effects of bleeding on coital activity.

Coital Events Associated With Vaginal Bleeding

Twenty-one subjects (11% of sample participants) reported at least one day with concurrent coitus and bleeding. Coitus occurred on 65/1433 (4.5%) days with vaginal bleeding, compared with 2619/19,909 (13.2%) days without vaginal bleeding ($\chi^2 = 90.0$; $p < .001$) (Table 2). Although coitus associated with vaginal bleeding accounted for only a small proportion of all coital events, factors associated with coitus while bleeding were assessed. Of the factors, younger age (OR = .72 per year of age; $p = .02$) and any sexual activity in the past 3 weeks (OR = 7.3; $p = .003$) were associated with increased likelihood of coitus while bleeding (Table 4).

Discussion

Coitus is substantially less likely on days when vaginal bleeding is present than on days without bleeding. Recent sexual activity (i.e., within the previous 3 weeks) also significantly influenced the likelihood of coitus on any given day. Age, race, and

Table 4. Predictors of Coitus Associated With Vaginal Bleeding*

Variable	B	SE	OR	p
Age, years	-.33	.14	.72	.02
Race (black/non-black)	-.43	.71	.65	.54
Years since menarche	.14	.16	1.15	.37
Years since first coitus	.11	.25	1.12	.65
Coitus, past 3 weeks	1.98	.66	7.25	.003
Usual condom use, %	.29	1.1	1.34	.79

* Among participants reporting any coital events associated with bleeding; Multivariable logistic regression adjusted for within-subject correlations by generalized estimating equations.

variables representing years of experience with menses and with sexual activity did not influence the day-to-day probability of coitus in this sample. Only a small proportion of adolescent women reported any days of coitus associated with vaginal bleeding. Both younger age and recent coital activity were associated with coitus while bleeding.

We have not identified other research assessing adolescents' coital behaviors associated with vaginal bleeding. As with adult women, both younger age and greater coital frequency are associated with increased likelihood of coitus during times of bleeding [1]. Our finding of greater likelihood of coitus associated with bleeding suggests a least one explanation of increased rates of some STIs among sexually active young adolescents. The reasons for increased likelihood of coitus with bleeding among younger adolescents are not clear. Younger adolescents may have fewer opportunities for sex and may be more reluctant to avoid sex if opportunities are available.

Limitations

Several caveats should be considered in the interpretation of these results. First, subjects were recruited from patient populations with STIs at the time of enrollment. Therefore, the results must be applied with caution to other populations. Second, the diary data cannot distinguish vaginal bleeding associated with menses from vaginal bleeding associated with hormonal contraceptives or other causes. Differential alteration of sexual behavior on the basis of perceived cause of bleeding is possible, although we can

find no data to support this hypothesis. Given the small proportion of coital events associated with bleeding, even in a relatively large sample of diary days, other techniques for assessing differential behavior associated with contraceptive bleeding are likely necessary. We also have no data from the male partners regarding their attitudes about coitus in the presence of vaginal bleeding. The absence of such information from the larger literature illustrates the importance of greater attention to temporal phenomena associated with adolescent sexual activity.

The vulnerability of adolescent women, both behaviorally and biologically, presents unique challenges in clinical and public health efforts to control STDs. The efforts clearly require specific attention to areas particular to experience of young women. As the results from this study show, vaginal bleeding may be an important component of adolescent women's sexual decision-making and warrants further investigation.

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