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## Condom use as a function of number of coital events in new relationships

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### Abstract

**Study Objective**—Assess condom use as a function of number of coital events in newly formed sexual relationships.

**Methods**—Participants who reported at least one new partner during the 12-week study interval (N=115; ages 18–29 years; 48% women; 90% African American) completed weekly sexually transmitted infections testing and three-times daily electronic diary collection assessing individual and partner-specific affect, daily activities, sexual behavior and condom use. We analyzed event-level condom use percentage and subject-level behavior response effects. Generalized Additive Mixed Models (GAMMs) were used to estimate condom use probability accounting for within-partner and within-subject correlations via random effects.

**Results**—The average condom use probability at the first coital event in new relationships was 55% for men and 36% for women. Analyses showed that smooth shapes of estimated condom use probabilities were similar for both sexes and were fitted using GAMMs. Relatively higher condom use percentage was followed by a sharp decline during the first 9 coital events decreasing to 16% for men and 8% for women. More rapid decline in condom use among women was highly associated with higher levels of relationship and sexual satisfaction.

**Conclusions**—The likelihood of condom use declines sharply for both men and women after the early accrual experience with a partner. Relationship and sexual satisfaction also influence declines in condom use, especially among women.

### Keywords

Condom use; Coital event; Relationship satisfaction; Sexual satisfaction

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Condom use follows changes in the larger interpersonal and sexual relationship, with the proportion of condom-protected coital events declining in new relationships within a few weeks of first sex between two partners.[1–3] Reasons for decline in condom use with increased relationship duration include diminished perceived sexually transmitted infection (STI) risk, increased within-dyad trust, and shifts to non-barrier contraception.[4] Dyad members' subjective assessments of sexual satisfaction, relationship quality, and relationship satisfaction are all related to relationship durability, which in turn affects condom use through decreased likelihood of partner change and increased coital frequency.[5]

Understanding the pace of decline of condom use in relationships is relevant for STI prevention efforts because the duration of infectiousness for an STI acquired in a previous sexual relationship may be several weeks or months, potentially extending past a period of relatively higher condom use in newer dyads.[6, 7] Concurrent sexual partners, as well as sequential partners for whom the interval between partners is less than the duration of infectiousness, could therefore be exposed to infection if condom use is irregular or ceases.[8–10] This may explain – at least in part – the often-observed association of STI and “new” sexual partners.[11] Relationship duration thus frames a number of issues of relevance to understanding of STI transmission and prevention.

However, relationship duration as a reflection of changes in condom use is potentially incomplete in that *coitus* is the exposure of interest, and some dyads – particularly adolescents – may have substantial intervals of non-coital sexual interaction that precede first coitus. Moreover, substantial between-dyad variability exists in the number of exposures per unit time (i.e., in coital frequency).[12] An alternative possibility is that the need for condoms is assessed by dyad members according to a metric such as the accrual of sexual exposures within the dyad, rather than by the time interval over which those events are dispersed. *First* coital exposure with a partner is an easily recognized signal for condom use.[13] Dyads' evaluations of condom use for *second* (and subsequent) coital exposures is much less clearly understood, as these events may occur within a few hours or days afterward. The interpersonal and neurohormonal reward effects of partnered sex accrue based on sexual experiences, contributing to development of interpersonal trust.[14] Trust is among the most commonly cited reasons for discontinuation of condom use.[3, 4, 15–17] Thus, perception of the need for condoms may be quite different for dyads whose second coital exposure occurs within 24 hours of the first, as compared to those whose subsequent coital exposure occurs after an interval of several weeks.[18]

The purpose of this paper, then, is to explore an alternative understanding of factors associated with condom discontinuation by prospectively assessing condom use as a function of the number of coital exposures reported with a specific partner. Because decisions to use condoms may also be influenced by interpersonal and sexual aspects of relationships, we assessed differences in condom use trajectories as a function of relationship quality, relationship satisfaction, and sexual satisfaction.[19] Because men and women may differ in the relative weight given to emotional and sexual characteristics of relationships, analyses were done separately for men and women.[20]

## Materials and Methods

Data were obtained from a prospective 84-days (12-weeks) study designed to examine sexual behaviors and incident STI. Participants were recruited from the patient population of a county sexually transmitted diseases clinic but were not necessarily clinic patients at the time of enrollment. Eligibility criteria were ages 18 to 29 years (inclusive), English speaking, and planning to reside in the area for the subsequent 84 days. The Institutional Review Board of Indiana University Purdue University Indianapolis approved this study. All participants provided informed consent.

The primary mode of data collection was via three-times daily self-reports of coital and non-coital sexual behaviors, condom use, and relationship assessments, recorded with project-furnished cellular telephones and service. The expected number of entries was thus 252 entries per participant. Daily diary completion rate was 87.7%. Other methodological details are previously published [21]. At pre-selected 8-hour intervals, participants responded to a series of questions to identify sexual and non-sexual interactions with specific partners. In each eight-hour reporting period, participants identified any partner, time of each coital event (up to four events within the same eight-hour reporting period), condom use for each coital event, as well as relationship satisfaction and sexual satisfaction. Relationship and sexual satisfaction were measured by single item rankings from 1 ('very low') to 10 ('very high').

Coital events were analyzed on the basis of sequences of coital events (not necessarily on successive days) with a specific sexual partner. Each new sequence of events formed a separate analytic frame, even if the partner had been identified earlier. Number of sequences of exposures did not necessarily equal number of partners, because sexual exposures with different partners could be interspersed.[2]

Statistical analyses were based on the generalized additive mixed models (GAMMs, an extension of generalized linear models) that uses smooth functions to model the mean trajectory and account for the hierarchical structure of longitudinal data. To apply GAMMs to our data, we included two nested random effects (at a partner level and a subject level respectively) to account for correlations among repeated within-partner coital events and correlations among the partners of the same subject. Specifically, a logistic additive mixed model was used to estimate the association between the event-specific condom use (coded as no/yes), cumulative number of coital events and other covariates of interest. As the dependence of the condom use on cumulative number of coital events was of primary interest, this predictor was always kept in the model. Instead of using parametric method of modeling condom use probability with cumulative number of coital events (e.g., linear models with quadratic or polynomial forms, which would be inappropriate for our data), we used a smoothing function as a more flexible, data-driven nonparametric approach.

Relationship satisfaction, sexual satisfaction and gender were included as additional covariates. Because of a substantial positive correlation between the relationship satisfaction and sexual satisfaction, models including either satisfaction score were considered separately. To study the association between event-specific condom use probability and each

related covariate, we first considered models including age, gender, relationship satisfaction and sexual satisfaction separately. Age was not associated with condom and was not included in subsequent analyses.

Multivariable models including gender and either relationship satisfaction or sexual satisfaction were established consecutively to study the interaction of those covariates. R-2.15.3 ([www.r-project.org](http://www.r-project.org)) was used to conduct the data analysis. Level of statistical significance was set at  $p < 0.05$  and 95% confidence intervals of estimates were reported.

## Results

The sample consisted of 115 participants (55/115 [48%] women; 103/115 [90%] African-American). Median number of lifetime partners was 31 and 22 for women and men, respectively. About 24% of women and 18% men had chlamydia, gonorrhea, or trichomonas at enrollment.

Participants reported 676 intervals of sex (419 for men; 257 for women) with a new partner. Preliminary analyses showed that less than one percent of sexual sequences consisted of more than 40 coital events. To reduce risk of biases analyses due to this extreme skew, number of coital events was truncated at 40 per participant.

Overall relationship satisfaction and sexual satisfaction scores were high, with 67.7% and 74.2% of relationship satisfaction and sexual satisfaction scores, respectively, at 9 or 10. To highlight potential influences of very high relationship and sexual satisfaction on condom use, and to reduce bias due to the skewed distribution of scores, we recoded both relationship satisfaction and sexual satisfaction: low satisfaction was defined as less than or equal to 8 and high satisfaction as more than 8.

Exploratory data analysis using a simple summary of the condom use percentage defined as the total number of condom-protected events divided by the total number of coital events vs. the cumulative number of coital events is presented in Figure 1. The estimated percentages for men and women are displayed in the left and right panels, respectively. Both men and women experienced a sharp decline in condom use percentage during the first few coital events. Men started at a higher average condom use percentage of 56% and quickly declined to 26% during the first 17 coital events, with condom use stabilizing around 25% for the subsequent coital events. Women started at a lower average condom use percentage of 43% and sharply dropped to 6% during the first 17 coital events, remaining at this low level during subsequent events.

The univariable analyses show that there is no significant difference in condom use probability by gender (odds ratio {OR} = 0.81, 95% confidence interval {CI} = [0.25, 2.64]). In addition, neither the dichotomized relationship satisfaction (OR = 1.08, CI = [0.76, 1.54]) nor sexual satisfaction (OR = 0.85, CI = [0.60, 1.19]) scores were associated with condom use probability.

Separate multivariable analyses were conducted to include effects of gender relationship satisfaction, and cumulative coital events, and gender, sexual satisfaction, and cumulative

coital events on probability of condom use. The multivariable models showed that the interaction effect of gender by relationship satisfaction was a significant predictor of condom use probability with women reporting high relationship satisfaction being the least likely to use condoms. Men with higher relationship satisfaction had significantly higher odds of condom use (OR = 1.53, CI = [1.02, 2.30]) than the men with lower relationship satisfaction, while women with higher relationship satisfaction have significantly lower odds of condom use (OR = 0.40, CI = [0.21, 0.79]) than the women with lower relationship satisfaction.

Similarly, the interaction of gender by sexual satisfaction was significant with women reporting high sexual satisfaction being less likely to use condoms, while men with higher sexual satisfaction were not significantly different in condom use probability (OR = 1.16, CI = [0.78, 1.74]) from the men with lower sexual satisfaction, while women with higher sexual satisfaction had significantly lower odds of condom use (OR = 0.38, CI = [0.21, 0.72]) than the women with lower sexual satisfaction.

We tested the possibility of gender differences in the shape of the condom use probability curve as coital exposures accrued. Based on the adjusted  $R^2$  comparison between the models, assuming different gender smoothing function showed trivial improvement of model fit (relationship satisfaction: 0.058[same shape] vs 0.057[different shape]; sexual satisfaction: 0.066 [same shape] vs 0.064 [different shape]). Therefore, we used the same smoothing function for both genders in final GAMM analysis of condom use probability.

Figure 2 shows the estimated condom use probability as a function of the cumulative number of coital events for participants with high relationship satisfaction. From the trajectory of the predicted curve, women's condom use probability shows a rapid decrease from 36% to 8% during the first 9 coital events, followed by a low level between 3% and 8% afterwards. Men's condom use probability in the high relationship satisfaction group also decreases rapidly from 55% to 16% during the first 9 coital events and stays between 7 and 15% during the following coital events

## Discussion

We showed that condom use declines sharply for both men and women during the first 9 coital exposures in a relationship, then remains stable at much lower levels. This suggests that dyads evaluate the need for condom use based – at least in part – on accrual of exposures rather than relationship duration *per se*. It may be that decisions to continue a relationship with second and subsequent sexual exposures incorporate assessments of familiarity, trust and intimacy that mitigate perceptions of risk.[22] These decisions may contribute to condom non-use in the face of continued objective STI risk. In addition to providing data on condom use in an adult sample of both men and women, these data add to existing literature by shifting focus to specifically sexual aspects of relationships rather than relationship duration.

We also showed that higher levels of both relationship satisfaction and sexual satisfaction are associated with even more rapid declines in condom use, after very few coital exposures,

particularly for women. The association of relationship satisfaction with decline in condom use suggests that differential investment in relationships, particularly in terms of the relationship affirming functions of sex are associated with different experiences of condom use as relationships progress.[23] The association of sexual satisfaction and condom use may reflect influence of higher levels of coital frequency in dyads with high levels of sexual satisfaction, with consequent rapid decline in condom use.[24] Alternatively, common perceptions that condoms interfere with pleasure and sexual function may lead dyads to abandon condoms in order to preserve high levels of sexual satisfaction.[25, 26]

Taken together, our findings have several implications for enhancing condom use for STI prevention. The data call attention to condom use as a dynamic prevention behavior enacted (or not) in the immediate context of a sexual event. Each coital exposure after the first builds on dyad members' accrued experience as partners. These experiences may generate trust and intimacy in addition to fulfilment of sexual needs.[27, 28] The finding that condom use is not a fixed characteristic of a given dyad's sexual relationship means that approaches to teaching condom use negotiation skills may change as well.[29] Public health messages that emphasize associations of STI and condom use with risky "casual" sex means that dyads with ongoing sexual relations – by definition no longer casual – feel out of danger as the number of sexual exposures increases.[30, 31] It may be that supplementing the long-established "risk" paradigm of STI prevention with a "sexual health" perspective could help dyads better align long-term condom use with the interpersonal demands of close relationships.[32, 33]

Inferences drawn from these data should be considered in light of several issues of the study design and research methods. First, the sample is of young adults with relatively high rates of STI reflective of an STI clinic population. Young adults – particularly those less than age 25 – have very high STI rates although condom maintenance is relatively less studied. This means, however, that adolescents under age 18 – also at high STI – are not represented in these data. We also measured coitus three times daily rather than daily or retrospectively as in previous research. This methodological difference necessarily emphasizes coital events over elapsed time. Finally, we included a small number sequences of coital events with a previously identified partner when those events were separated by coitus with another partner. We treated these sequences as unrelated, although condom use may decline after even fewer coital events in such concurrent relationships.

Number of coital events may serve as an important source of sexual risk evaluation and inform decisions about condom use. Women's condom use, in particular, is associated with relationship satisfaction and sexual satisfaction. A relationship focused approach to condom use and condom maintenance may be particularly important in STI prevention among relatively well-established couples.

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**Summary**

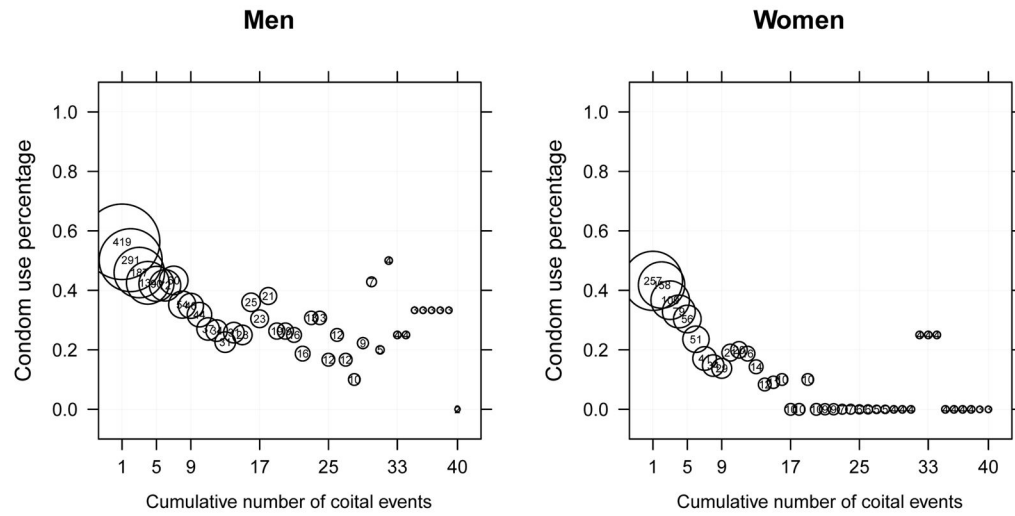
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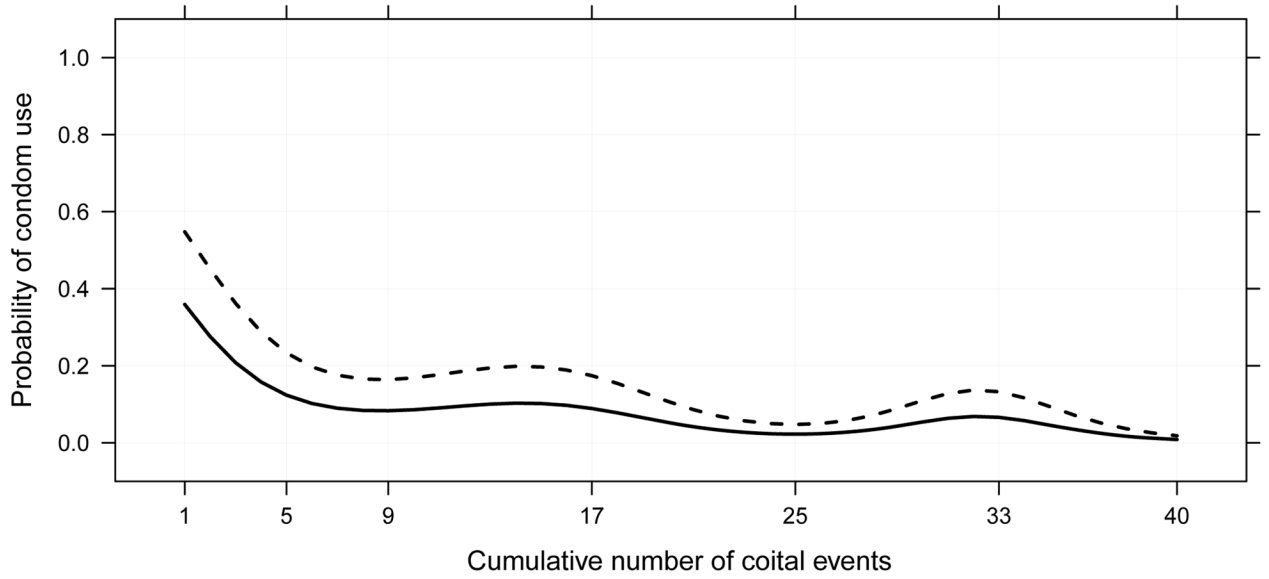
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**Figure 1.** Condom use percentage as a function of the cumulative number of coital events for men (left panel) and women (right panel). The center of each circle indicates the average condom use percentage for all 676 intervals of sex with a new partner. The radius of each circle reflects the numbers of intervals included in each ordered coitus event.



**Figure 2.** Estimated condom use probability trajectory (solid curve) for women and (thick dash curve) men with high level of relationship satisfaction based on the multivariable GAMM.