A Prospective Event-Level Analysis of Condom Use Experiences Following STI Testing Among Patients in Three US Cities

Richard Crosby, PhD[1,2,3], **Lydia A. Shrier, MD, MPH**[4,5], **Richard J. Charnigo, PhD**[1], **Chandra Weathers, MPH**[1], **Stephanie A. Sanders, PhD**[2,3], **Cynthia A. Graham, PhD**[2,6], **Robin Milhausen, PhD**[7], and **William L. Yarber, HSD**[8]

[1]College of Public Health at the University of Kentucky

[2]Rural Center for AIDS/STD Prevention at Indiana University

[3]The Kinsey Institute for Research in Sex, Gender, and Reproduction

[4]Division of Adolescent/Young Adult Medicine, Children's Hospital Boston

[5]Department of Pediatrics, Harvard Medical School

[6]Oxford Doctoral Course in Clinical Psychology, University of Oxford

[7]Department of Family Relations and Applied Nutrition at the University of Guelph

[8]Department of Applied Health Science, Indiana University

Abstract

Background—This study prospectively assessed and compared the incidence of condom use errors/problems among clinic patients testing positive for one or more of 3 STDs and those testing negative. The study also identified event-level condom use errors associated with condom breakage and slippage during sex.

Methods—Enrolled clinic patients (N=928) were tested for 3 STDs, then patients electronically recorded sexual intercourse and condom use behaviors daily for up to 6 months. Data were available on condom use errors and problems for the more than 10,000 sex events involving condoms. Assessed errors/problems were: 1) not using a new condom, 2) allowing condoms to contact sharp objects, 3) not using condoms from start to finish of sex, 4) condoms drying out, 5) erection loss during condom use, 6) breakage, 7) slippage during sex, and 8) slippage after sex. Because the event-level measures were correlated within individual, Generalized Estimation Equation (GEE) models were used for analyses.

Results—All eight forms of errors/problems with condom use occurred, with varying levels of frequency, without significant differences by baseline STD status for either men or women. Condom breakage was associated with contact with sharp objects ($P < .0001$) and drying out ($P < .0001$). Slippage during sex was associated with erection loss ($P<.0001$) and drying out ($P<.0001$).

Conclusion—Subsequent to STD evaluation, much of the sex occurring with the use of a condom may not confer adequate protection. Problems found to be associated with condom breakage and slippage are potentially amenable to counseling interventions.

Correspondence: Richard Crosby, PhD, College of Public Health, 151 Washington Ave. Lexington, KY 40506-0003; telephone: 859-218-2039) /FAX: 859-323-2933/crosby@uky.edu..

Keywords

Condoms; men; women; sexually transmitted infections; sexual behavior

Introduction

In the United States, approximately 19 million new acquisitions of sexually transmitted diseases (STDs) occur each year.[1] However, these are cases, not people; subsequent infections among individuals are quite common.[2,3] Although condom use can be a highly protective method of averting these repeat infections, an expanding body of evidence suggests that user errors and problems may greatly compromise the value of condoms.[4–6] Given that clinicians and other health care professionals are specifically poised to help patients rectify their condom use errors and problems, it is important that a body of empirical literature be developed to guide their counseling efforts. In service of this goal, a rigorous study addressing condom use issues is warranted. Specifically, a study is needed that determines the incidence of not only unprotected vaginal sex (UVS), but also condom use errors and problems. Accordingly, the purpose of this study was to: 1) prospectively assess and compare the incidence of UVS and of condom use errors/problems among clinic patients testing positive for one of 3 STDs (chlamydia, gonorrhea, and trichomonas) and those testing negative (stratified by gender); and 2) identify event-level condom use errors that may cause the problems of breakage and slippage during sex.

Methods

Data for this study were taken from a large, NIH-funded, study of condom effectiveness against non-viral STIs. This was a prospective cohort study that tested men and women for non-viral STIs at three time points (baseline, 3 months, and 6 months) and used daily electronic diaries to assess key sexual behaviors including condom use.

Participants were recruited from five clinics caring for individuals at high-risk for STI in three U.S. cities: a publicly-funded STD clinic in the Southern US; a publicly-funded STI clinic in the Midwestern US; an STD clinic of a large teaching hospital in Boston, MA; and two adolescent medicine clinics of a children's hospital in Boston. The STD clinics enrolled individuals aged 18 years and older; the adolescent clinics enrolled individuals as young as 15. Eligibility criteria included reporting penile-vaginal intercourse in the preceding 3 months; willing to be tested for chlamydia, gonorrhea, and trichomoniasis by providing a urine specimen; speaking English; willing to provide contact information; and providing written informed consent. Institutional review boards at the participating universities approved the study protocol with a waiver of parental consent for adolescents less than 18 years of age.

Recruitment procedures varied slightly across the five clinics. At the STD clinic nurses referred all potentially eligible patients to a study research assistant for possible recruitment and final eligibility screening. At the adolescent clinics, the study was listed on a research recruitment flag attached to the appointment paperwork of age-eligible patients. The research assistant used the flag to identify eligible patients and then solicit their potential participation, followed by final eligibility screening. This chart-flagging system at adolescent clinics precluded us from calculating a participation rate for those sites. Across the three remaining clinics, 1,424 patients agreed to be screened for eligibility. Of these, 1,297 were eligible and invited to participate; 794 enrolled, yielding a participation rate of 61.2%. With the remaining patients from the Boston clinics (n=135), the participant sample size was 929. Data were collected from December 2007 through April 2011.

Measures

Participants were instructed to complete daily sex event diaries using the Configurable Electronic Real-Time Assessment System (CERTAS, Personal Improvement Computer Systems, Inc. Reston, VA, USA) on a password-protected handheld computer (Tungsten E2 personal digital assistant). The handheld computer was programmed to beep once a day to prompt the report.

The daily diary asked participants to report whether they had had sex in the past 24 hours. Sex was defined as penile-vaginal intercourse. If sex occurred, participants were asked to report whether they used a condom. If condom use was reported, they were asked yes-no questions about three errors: 1) "Was the condom in a sealed package and never used?" 2) "Did the condom you were using contact sharp jewelry, fingernails, or teeth?" 3) "Was there a time in this sex event when the penis was in the vagina and not covered by a condom?" Also, if condom use was reported participants were asked yes-no questions about five problems: 1) "Did the condom dry out during sex?" 2) "Was there a loss of erection when you used the condom?" 3) "Did the condom you were using break during sex"? 4) "Did the condom you were using slip off during sex?" 5) "Did the condom you were using slip off the penis after sex was over?"

To ascertain STD status at enrollment, first-catch urine specimens were collected for nucleic acid amplification testing using the Becton Dickinson ProbeTec ET *Chlamydia trachomatis* and *Neisseria gonorrhoeae* Amplified DNA Assay (Sparks MD).[7] Aliquots were assayed for the presence of *T. vaginalis* using Taq-Man polymerase chain reaction (PCR). An Atlanta-based laboratory developed and validated this in-house PCR-ELISA with established and acceptable estimates of sensitivity and specificity.[8,9] Participants who tested positive for any STD returned to the clinic to receive appropriate single-dose treatment. Participants were provided with a gift card to compensate them for their time and they were provided a broad assortment of condoms as well as an assortment of lubricants.

Data Analysis

Using the daily reports, the occurrence of unprotected vaginal sex (UVS) was determined. Chi-squared tests were used to compare the proportion of persons reporting any subsequent UVS between those who were STD positive at baseline compared to those testing negative (stratified by gender). Event-level data for condom use errors/problems were also available from the daily reports. In cases where data for a given event was missing the event was counted as not involving a condom error or problem. The utility of using event-level data has been previously established.[10] Because the event-level data were correlated within individual, Generalized Estimation Equation (GEE) models were used for analyses pertaining to condom use errors and problems. Estimated odds ratios and corresponding 95% confidence intervals were calculated for the measures investigating potential causes of breakage/slippage. Based on findings from past studies[4,6,10] the error of letting condoms dry out during sex was assessed for association with both breakage and slippage during sex. Also, the error of allowing condoms to contact sharp objects was tested for association with breakage and the problem of erection loss during condom use was tested for association with slippage during sex. Version 19.0 of SPSS and Version 9.3 of SAS were used to analyze the data; statistical significance was defined by a P-value less than 0.05

Results

Characteristics of the Sample

The participant sample included 928 clinic attendees. The mean age of the sample was 29.2 years (standard deviation=10.8). The majority identified as African American/Black (n=617,

66.5%) and the majority were women (n=510, 55.1%). Most (61.7%) of those 18 and older reported earning less than $1,000 per month in income or social assistance and 45.0% of those under 18 reported they qualified for a free lunch at school. The mean number of lifetime sex partners was 29.7 (SD=38.2) and the mean number of sex partners in the past 3 months was 2.9 (SD=6.4). Just under one-half of the sample (49.1%) reported ever being diagnosed with an STD. Just under one-fifth of the sample (18.4%) tested positive for one or more of the 3 STDs assessed by the study upon enrollment.

Retention of volunteers from publicly-funded clinics is often problematic.[3,11–13] Nonetheless, through the use of frequent reminder phone calls and text messages our retention rate at the end of the 6-month observation period was 67.0%. Among the men who were diagnosed with at least one of the 3 STDs assessed at baseline, 28.6% reported having any UVS on daily diary reports over the 6-month observation period. This was not significantly different than reports of UVS among men testing negative at baseline (31.0%, $P = .15$). However, fewer women testing positive for STDs at baseline reported subsequent UVS, compared to women testing negative (34.0% v. 39.7%, $P < .0001$).

Comparative and Descriptive Findings

Table 1 displays the comparative and descriptive findings regarding errors and problems separately for men and women. Over the 6-month period, participants with valid STD test results reported 10,970 penile-vaginal sex events that included use of a condom. As shown, no significant differences were found when comparing the frequency of errors/problems between those testing positive for STD versus those testing negative at baseline. The most frequently occurring errors/problems were not using the condom from start to finish of sex (incomplete use 10.6% – 17.1%, 1,699 total events); erection loss during condom use (8.0% – 18.4%, 1,141 total events); and the condom drying out during sex (13.0% – 15.1%, 1,468 total events). Breakage was less common (3.8% – 6.6%, 487 total events), as was slippage during sex (2.3% – 5.8%, 473 total events), and slippage after sex (3.5% – 7.2%, 539 total events). Allowing the condom to contact sharp objects (2.0 – 7.5%, 318 total events) was relatively less common. Finally, not using a new condom (3.0 – 6.8%, 625 total events) was a relatively common occurrence.

In extracting the number of condom-protected events involving one or more of the four errors and problems that directly cause condom failure (breakage, slippage during sex, slippage during withdrawal, and not using condom from start to finish of sex) and dividing by the total number of condom-protected events it was observed that 15.6% of the events were actually not protective in the 6-month observation period.

Table 2 displays the frequency of condom use errors and problems stratified by infrequent versus frequent occurrence. Infrequent occurrence was defined by counting the errors/ problems if they were reported at least once. Conversely, infrequent occurrence was defined by only counting the errors/problems if they were reported at least 25% of all times sex occurred. Because this calculation required an individual-level analysis, standard formulas for odds ratios and 95% confidence intervals were employed. As shown among those reporting ten or fewer acts of sex during the recall period, infrequent occurrence was significantly less likely for each of the assessed errors and problems in comparison to those reporting ten or more events of sex (left-hand side of Table 2). However, as shown in Table 3 (right-hand side), this pattern changed when frequent errors/problems were analyzed. When the error or problem was only counted as such if it occurred during at least 25% of the sex events then differences between persons reporting ten or fewer events and those reporting more than ten events only remained for four variables: not using new condoms, breakage, slippage during sex, and slippage during withdrawal. For each of these four

variables the significant difference favored those reporting more than ten sex events (meaning fewer were classified as having frequent errors/problems).

Potential Causes of Breakage/Slippage During Sex

Table 3 displays the event-level associations between selected errors/problems with breakage/slippage. In events when the condom dried out during sex, breakage was more than five times as likely (15.1% vs. 2.8%). In events when the condom contacted a sharp object breakage was more than four times as likely (17.3% vs. 4.0%).

With regards to slippage during sex, in events when the condom dried out, slippage during sex was more than three times as likely (11.2% vs. 3.3%). Also, in events when the erection was lost during sex, slippage during sex was more than four times as likely (14.9% vs. 3.1%).

Discussion

This study observed a relatively low rate of UVS, assessed daily, following STD evaluation and diagnosis, among a sample of patients from five clinics in 3 US cities. Although rates of UVS subsequent to baseline did not differ significantly between men testing positive for STDs compared to those testing negative, the same was not true of women. Women testing positive were significantly less likely to report subsequent UVS than those testing negative. For either gender, however, it appears that upwards of one-third of the sample engaged in subsequent acts of unprotected penile-vaginal sex. Despite the encouraging observation that the majority did not engage in subsequent UVS, the study found that some condom use errors and problems may be common. In essence, the results suggest that about one of every six of all events of penile-vaginal sex that involved condom use were not truly "condom-protected" given the existence of one or more of four errors and problems (not using new condoms, incomplete use breakage, and slippage). From a clinical viewpoint, these issues can be viewed as behavioral and, as such, they are clearly worth correcting via counseling, especially given the high-risk nature of people attending clinics that diagnose and treat STDs.

The lack of significant differences in the frequency of subsequent condom use errors/problems between the STD-positive men and women and the STD-negative men and women is an important study finding. The importance lies in the observation that the experience of testing positive for an STD is apparently not sufficient to improve the quality of condom use (i.e., rectify user errors and problems) beyond that being reported by persons testing negative for STDs. Of note, this observation does not necessarily indicate that people testing positive are not committed to correct condom use. Instead, they may have characteristics as a couple that lead to these problems (e.g., undue friction, pain, loss of arousal). For example, for persons reporting that the condom dried out, clinicians and health care professionals may need to address how issues with female arousal may necessitate adding lubrication to condoms before and during sexual intercourse. It is noteworthy that a recent clinical trial established the efficacy of brief counseling interventions (targeting correct use) for patients testing positive for STDs.[3]

Study findings reported in Table 2 are noteworthy for two reasons. First, the data shown on the left-hand side validate the intuitive suggestion that experiencing an error or problem at least once in the recall period is more likely for persons reporting relatively greater numbers of sex events. Second, the data shown on the right-hand side of Table 2 suggests that persons reporting relatively more frequent sex are significantly less likely to have frequent issues with not using new condoms, breakage, slippage during sex, and slippage during

withdrawal. These findings validate the idea that "practice makes perfect" but only for these four measure of correct condom use.

The observed event-level associations with breakage and slippage reported in Table 3 are a particularly important feature of this study. To date, no other study has used comparable daily diary reports to test these event-level relationships. The likelihood of causal relationships is strengthened by the logical direction of occurrence. In each case the problem (i.e., breakage or slippage) is a logical extension of the error (i.e., condom dried out during sex, contacted sharp object, and erection loss during condom use). For example, when a condom loses its lubricant the increased friction during sex is likely to be a cause of slippage and possibly breakage. This observed associations from this study can be valuable for clinicians and other health care professionals in their efforts to address condom use issues when counseling patients being evaluated for STDs. Given the large estimated odds ratios, the study findings clearly suggest that enhanced patient counseling is warranted in regards to using lubricants to avoid condoms drying out, educating patients about avoiding contact of condoms with sharp objects, and counseling patients about the potential for condom slippage when erection loss occurs.

Finally, the descriptive data from this study also have some important implications. For example, given the number of reports that people did not use new condoms (reported for 625 events), clinics should provide large supplies of these relatively inexpensive products to patients regardless of diagnosis. Additionally, clinics may need to provide ongoing sources of free condoms to their patients as a service that is separate from clinical care. Counseling patients to help them find the optimal type (brand, size, shape, etc.) of condom for their needs is also likely to be important. In addition, given 1,468 events when people reported that condoms had dried out, clinics may benefit their patients by making pocket size vials of condom lubricants free and easy to access.

Limitations

The geographic diversity of the sample is limited to patients attending clinics in only three US states, thus generalizability of the findings to the entire country is problematic. Also, study findings are limited by the validity of participants' self-reports of condom use errors/ problems; however, problems associated with recall are minimized by the use of daily electronic reporting. Indeed, evidence suggests that this type of momentary reporting may be far superior to other methods of data collection.[14] However, while daily reporting may reduce recall bias it is not known whether self-presentation bias is also reduced by this method of data collection. It is possible that people experiencing errors/problems may not have disclosed this information despite the confidential nature of the data collection strategy. Further, having only two-thirds of the sample complete the full 6-month observation period creates a potential bias that may yield either underestimation or overestimation of the true incidence of condom use errors/problems. Finally, missing data regarding the occurrence of any given error/problem may have led an underestimate of true occurrences.

Conclusion

Overall, the findings suggest that patients of clinics that diagnose and treat STDs experience a substantial number of condom use errors/problems subsequent to their clinic visit. Because these subsequent errors/problems occur with similar frequencies among those testing positive and those testing negative for STDs, it may be prudent to counsel all patients about the correct use of condoms. Such counseling efforts should potentially utilize a more complete view of how couples experience condoms as well as the multiple errors and problems that may occur. Correct and adequate condom use is likely to be a complicated endeavor for many couples implying that clinician guidance regarding product selection and

arousal may be quite beneficial. To avoid breakage and slippage, this event-level analysis suggests that three focal points of these counseling efforts should be to avoid condoms drying out during sex, to avoid contact between condoms and sharp objects, and to halt penile-vaginal penetration when erection loss occurs during condom use (holding onto the rim of the condom during withdrawal). Clinics may also benefit their patients by providing ongoing supplies of free condoms and lubricant vials; however, this provision should be linked with counseling efforts that focus on helping patients find a condom brand and size that works best for their needs.

Acknowledgments

References

1. Weinstock H, Berman S, Cates W. Sexually transmitted diseases among American youth: Incidence and prevalence estimates, 2000. Perspect Sex Reprod Health. 2004; 36:1–10.

2. Reitmeijer C, Van Benmelen B, Judson FN, Douglas JM. Incidence of repeat infection rates of Chlamydia trachomatis among male and female patients in an STD clinic: Implications for screening and rescreening. Sex Transm Dis. 2002; 29:65–72. [PubMed: 11818890]

3. Crosby RA, DiClemente RJ, Charnigo R, Snow G, Troutman A. Evaluation of a lay health advisor model risk-reduction intervention for promoting safer sex among heterosexual African American men newly diagnosed with an STD: A randomized controlled trial. Am J Public Health. 2009; 99:S96–S103. [PubMed: 19218185]

4. Sanders SA, Yarber WL, Kaufman E, Crosby RA, et al. Condom use errors and problems: A global view. Sex Health. in press.

5. Crosby, RA.; Noar, S.; Head, S.; Webb, E. Condoms and other barrier methods of STI and HIV prevention. In: Gupta, S.; Kumar, B., editors. Sexually transmitted infections. Elsevier Publishing; New Delhi, India: 2011. p. 2e

6. Crosby RA, Sanders SA, Yarber WL, Graham CA. Condom Use Errors and Problems: A Neglected Aspect of Studies Assessing Condom Effectiveness. Am J Prev Med. 2003; 24:367–370. [PubMed: 12726876]

7. Van der Pol BD, Ferrero L, Buck-Barrington E, Hook E, et al. Multicenter evaluation of the BDProbeTec ET system for detection of *Chlamydia trachomatis* and *Neisseria gonorrhoeae* in urine specimens, female endocervical swabs, and male urethral swabs. J Clin Micro. 2001; 39:1008–1016.

8. Caliendo AM, Jordan JA, Green AM, et al. Real-time PCR improves detection of Trichomonas Vaginalis infection compared with culture using self-collected vaginal swabs. Infect Dis Obstet Gyn. 2005; 13:145–150.

9. Smith KR, et al. Evaluation of ligase chain reaction for use with urine for identification of Neisseria gonorrhoeae in females attending a sexually transmitted disease clinic. J Clin Micro. 1995; 33:455–457.

10. Crosby RA, DiClemente RJ, Yarber WL, et al. An event-specific analysis of condom breakage among African American men at risk of HIV acquisition. Sex Transm Dis. 2008; 35:174–178. [PubMed: 18090176]

11. Kamb ML, Fishbein M, Douglas JM, et al. Efficacy of risk-reduction counseling to prevent human immunodeficiency virus and sexually transmitted diseases: a randomized controlled trial. JAMA. 1998; 280:1161–1167. [PubMed: 9777816]

12. Boyer CB, Barrett DC, Peterman TA, Bolan G. Sexually transmitted disease (STD) and HIV risk in heterosexual adults attending a public STD clinic: evaluation of a randomized controlled behavioral risk-reduction intervention trial. AIDS. 1997; 11:359–367. [PubMed: 9147428]

13. NIMH Multisite HIV Prevention Trial Group. The NIMH Multisite HIV Prevention Trial: reducing HIV sexual risk behavior. Science. 1998; 280:1889–1894. [PubMed: 9632382]

14. Shiffman, S. Real-Time Self-Report of Momentary States in the Natural Environment: Computerized Ecological Momentary Assessment. In: Stone, AA., editor. The science of self-report : implications for research and practice. Vol. xi. Lawrence Erlbaum; Mahwah, NJ: 2000. p. 380

TABLE 1

Incidence of Condom Use Errors and Problems by STD History, Stratified by Gender

	Women			Men		
	STD +	STD[minus]	Est OR (95% CI) *P*	STD +	STD[minus]	Est OR (95% CI) *P*
	No. (%)	No. (%)		No. (%)	No. (%)	
	n = 1082	n = 5494		n = 528	n = 3866	
Condom not new	42 (3.9)	373 (6.8)	1.26 (0.58, 2.74) 0.56	16 (3.0)	194 (5.0)	1.22 (0.44, 3.34) 0.70
Condom contacted sharp object	81 (7.5)	133 (2.4)	1.36 (0.52, 3.56) 0.53	27 (5.1)	77 (2.0)	2.26 (0.81, 6.35) 0.12
Incomplete use	126 (11.6)	855 (15.6)	0.83 (0.57, 1.20) 0.32	56 (10.6)	662 (17.1)	0.68 (0.37, 1.26) 0.22
Condom dried out	142 (13.1)	715 (13.0)	0.81 (0.54, 1.21) 0.30	80 (15.2)	531 (13.7)	1.35 (0.67, 2.74) 0.40
Erection loss during sex	181 (16.7)	555 (10.1)	1.06 (0.60, 1.86) 0.85	97 (18.4)	308 (8.0)	1.58 (0.87, 2.85) 0.13
Breakage during sex	71 (6.6)	235 (4.3)	1.28 (0.72, 2.25) 0.40	35 (6.6)	146 (3.8)	1.35 (0.70, 2.61) 0.37
Slippage during sex	63 (5.8)	266 (4.8)	1.03 (0.53, 2.00) 0.93	12 (2.3)	132 (3.4)	0.71 (0.28, 1.79) 0.47
Slippage after sex	62 (5.7)	303 (5.5)	0.86 (0.48, 1.52) 0.60	38 (7.2)	136 (3.5)	1.50 (0.72, 3.12) 0.27

Raw numbers and percentages are presented for descriptive purposes to indicate the frequencies of errors and problems across sex events among men and women with and without STD's. However, to account for nonindependence of outcomes across repeated sex events for the same persons, odds ratios comparing those with and without STD's are estimated (Est OR), 95% confidence intervals (CI) are provided, and *P* values are obtained via generalized estimating equations.

TABLE 2

Individual Level Analysis of Condom Use Errors and Problems by No. Events

	Error/Problem Occurred in at Least One of the Individual's Events			Error/Problem Occurred in at Least 25% of the Individual's Events		
	[lt]10 Events	[mtequ]10 Events	Est OR (95% CI) *P*	[lt]10 Events	[mtequ]10 Events	Est OR (95% CI) *P*
	No. (%)	No. (%)		No. (%)	No. (%)	
	n = 297	n = 312		n = 297	n = 312	
Condom not new	70 (23.6)	120 (38.5)	2.03 (1.43, 2.88) [lt]0.0001	35 (11.8)	10 (3.2)	0.25 (0.12, 0.51) [lt]0.0001
Condom contacted sharp object	21 (7.1)	60 (19.2)	3.13 (1.85, 5.29) [lt]0.0001	17 (5.7)	8 (2.6)	0.43 (0.18, 1.02) 0.06
Incomplete use	113 (38.1)	248 (79.5)	6.31 (4.40, 9.05) [lt]0.0001	72 (24.2)	80 (25.6)	1.08 (0.75, 1.56) 0.71
Condom dried out	98 (33.0)	213 (68.3)	4.37 (3.11, 6.14) [lt]0.0001	66 (22.2)	67 (21.5)	0.96 (0.65, 1.41) 0.84
Erection loss during sex	86 (29.0)	183 (58.7)	3.48 (2.48, 4.88) [lt]0.0001	56 (18.9)	47 (15.1)	0.76 (0.50, 1.17) 0.23
Breakage during sex	52 (17.5)	158 (50.6)	4.83 (3.33, 7.02) [lt]0.0001	28 (9.4)	13 (4.2)	0.42 (0.21, 0.82) 0.01
Slippage during sex	61 (20.5)	130 (41.7)	2.76 (1.93, 3.96) [lt]0.0001	31 (10.4)	16 (5.1)	0.46 (0.25, 0.87) 0.02
Slippage after sex	59 (19.9)	141 (45.2)	3.33 (2.32, 4.78) [lt]0.0001	34 (11.5)	14 (4.5)	0.36 (0.19, 0.69) 0.002

In this table, individuals rather than events are the units of analysis. Since the distribution of events per individual was highly skewed (minimum 1, first quartile 4, median 10, third quartile 22, maximum 206, mean 18.1, standard deviation 23.5), as were the distributions of the fractions of events with errors/problems, we used a median split for events per individual and then compared those with more events to those with fewer events on: (i) whether their fractions of events with errors/problems were nonzero, and (ii) whether their fractions of events with errors/problems were [mtequ]25%. Standard formulas for odds ratio estimates (Est OR) and 95% confidence intervals (CI) were used; *P* values were obtained via Fisher exact test.

TABLE 3

Associations Between Selected Errors/Problems and Condom Breakage/Slippage

	Outcome			
	No. (%)	Est OR	95% CI	*P*
	Breakage			
Condom dried out during sex				
Yes (n = 1475)	223 (15.1)	5.57	4.09, 7.58	[lt]0.0001
No (n = 9553)	264 (2.8)	Reference		
Condom contacted sharp object				
Yes (n = 318)	55 (17.3)	5.42	3.46, 8.48	[lt] 0.0001
No (n = 10,710)	432 (4.0)	Reference		
	Slippage			
Erection loss during sex				
Yes (n = 1144)	171 (14.9)	4.63	3.39, 6.31	[lt]0.0001
No (n = 9884)	307 (3.1)	Reference		
Condom dried out during sex				
Yes (n = 1475)	166 (11.3)	3.05	2.33, 4.00	[lt]0.0001
No (n = 9553)	312 (3.3)	Reference		

Raw numbers and percentages are presented for descriptive purposes to indicate the frequencies of breakage and slippage across sex events among those with and without selected errors/problems. However, to account for nonindependence of outcomes across repeated sex events for the same persons, odds ratios comparing those with and without the errors/problems are estimated (Est OR); 95% confidence intervals (CI) are provided; and *P* values are obtained via generalized estimating equations.