

## Heterosexual Anal Sex Activity in the Year After an STD Clinic Visit

LIN H. TIAN, MD, MS,\* THOMAS A. PETERMAN, MD, MSc,\* GUOYU TAO, PhD,\* LESLEY C. BROOKS, BA,\*  
CAROL METCALF, MChB, MPH,† C. KEVIN MALOTTE, DrPH,‡ SINDY M. PAUL, MD, MPH,§  
JOHN M. DOUGLAS, JR, MD,\* AND THE RESPECT-2 STUDY GROUP

**Objectives:** To describe heterosexual anal sex activity during a year and to identify factors associated with heterosexual anal sex and condom use during anal sex.

**Methods:** Secondary analysis of data from a trial conducted in 3 public sexually transmitted disease (STD) clinics. Patients described sexual behaviors every 3-months for the year. Logistic regression models with generalized estimating equations were used to include multiple observations for each subject.

**Results:** Two thousand three hundred fifty-seven heterosexual subjects reported on 6611 3-month intervals that included 9235 partnerships. About 18.3% of subjects had anal sex in a particular 3-month interval and 39.3% in the year. About 23.5% of subjects had anal sex in at least two 3-month intervals in the year. Anal sex was associated with having more sex acts, 2 or more sex partners, unprotected vaginal sex, and a main partner. For anal sex in the past 3 months, 27.3% of subjects consistently used condoms, and 63% of subjects never used condoms. Consistent condom use for anal sex was associated with having consistent condom use for vaginal sex, 2 or more partners, and anal sex with casual or new partner.

**Conclusion:** STD clinic patients were commonly engaged in heterosexual anal sex, and most of them never used condoms during anal sex. Patients who had anal sex tended to also engage in other risk behaviors that put them at risk of STD/human immunodeficiency virus. Clinicians should ask about anal sex, appropriately examine and test patients who have had anal sex, and recommend condom use for both anal and vaginal sex.

ANAL SEX CAN TRANSMIT sexually transmitted infections (STIs) that may lead to proctitis or anal cancer<sup>1–7</sup> and is especially effective at transmitting *human immunodeficiency virus* (HIV).<sup>8</sup> Heterosexual anal sex has been reported by different populations during different recall periods including: 35% of US women and 40% of US men aged 25 to 44 years in their lifetime<sup>9</sup>; 23% of nonvirgin college students in their lifetime<sup>10</sup>; 21.7% of low-income women in their lifetime<sup>11</sup>; about a quarter of sexually active sexually transmitted disease (STD) clinic patients in the past 3 months<sup>12</sup>; and 19% of female and 20% of male injection drug users in the past 6 months.<sup>13</sup> However, most studies on heterosexual anal sex collected very little data about anal sex activities, and they usually measured a single time point.

The findings and conclusions in this paper are those of the authors and do not necessarily represent the view of the Centers for Disease Control and Prevention.

Correspondence: Lin Hui Tian, Centers for Disease Control and Prevention, 1600 Clifton Road NE, MS E-63, Atlanta, GA 30333. E-mail: LTian@cdc.gov.

Received for publication Mar 7, 2008, and accepted May 26, 2008.

\*Division of STD Prevention, Centers for Disease Control and Prevention, Atlanta, Georgia; †Human Sciences Research Council, Cape Town, South Africa; ‡California State University, Long Beach, CA; and §New Jersey Department of Health and Senior Services, Trenton, NJ

Consistent condom use can reduce the risk of transmission of HIV and other STI.<sup>14–16</sup> However, an extensive review has showed that condom use during heterosexual anal sex is low.<sup>17</sup> Few studies have identified factors associated with condom use for heterosexual anal sex. Only one study reported detailed information on heterosexual anal sex practices by subjects with their most recent 3 partners and assessed factors associated with anal sex and consistent condom use during anal sex.<sup>18</sup> Studies have not adequately examined the association between characteristics of partnerships and condom use during heterosexual anal sex.

The purpose of this article is to: 1) describe heterosexual anal sex practices over a year among patients who attended an STD clinic; and 2) identify factors associated with heterosexual anal sex and with condom use for anal sex.

### Methods

#### Data

This secondary analysis used data from RESPECT-2, a randomized controlled trial of STD/HIV prevention counseling. Primary analyses and detailed methodology have been described elsewhere.<sup>19</sup> Briefly, subjects were recruited from 3 public STD clinics in Denver, CO, Long Beach, CA, and Newark, NJ. Eligible subjects were those who came to the clinics during 1999–2000 for a full diagnostic STD examination, reported vaginal or anal sex in the past 3 months, were HIV-negative at enrollment, were aged 15–39 years, were able to speak English fluently, and were willing to return every 3 months for follow-up visits over the next year. Subjects were randomly assigned to receive prevention counseling with either a rapid HIV test or a standard HIV test, and half of the subjects received a booster counseling session 6 months after baseline. Subjects were examined, and tested for STIs and HIV as well as questioned about their behaviors at baseline. Outcomes including STI tests and sexual behaviors were measured at 13-week intervals, scheduled 3, 6, 9, and 12 months after enrollment. Behavioral data were collected using audio computer-assisted self-interview technology at baseline and each follow-up visit.

### Subjects, Partnerships, and Study Intervals

We limited our analysis to subjects who reported at least one opposite sex partner at baseline. We included the 3-month follow-up intervals in which subjects had vaginal or anal sex and had a clinic visit both before and after the interval. For example, a subject who returned at 3, 6, and 12 months could contribute 2 intervals; one from baseline to 3 months, and another from 3 to 6 months. Because subjects were asked about partnership characteristics for each of up to 3 different partners in the preceding 3 months, all analyses by partnership included only the first 3 partnerships.

To estimate heterosexual anal sex practices over all four 3-month intervals in the full year, we analyzed subjects who had completed all four 3-month visits.

### Sex Behaviors and Partnership Information

Subjects were asked to report sexual behaviors individually for up to 3 different partners in the preceding 3 months. A main partner was self-defined by the subjects as someone who had a relationship with the subjects, such as the subjects' spouse, girl or boyfriend, or lover. A causal partner was defined as a partner who was not the subjects' main partner. A new partner was a person whose first sexual contact with the subject was within the preceding 3 months.

Subjects with more than 3 partners in an interval were also asked about all other partners combined. Subjects were asked to report the number of vaginal sex acts, anal sex acts, and the number of times they used condoms during vaginal sex and anal sex with their first 3 partners individually and with all other partners in the past 3 months. Sex acts were classified as unprotected sex acts if condoms were not used.

### Data Analyses

We looked for characteristics of subjects or individual partnership that were associated with reporting anal sex in a 3-month interval by logistic regression models with generalized estimating equations (GEE).<sup>20,21</sup> GEE was used to account for the within-subject correlations with the outcome variable over time. Since GEE may be biased when missing data are not missing completely at random, we examined the association of missing data with the response variable (reporting anal sex) for all subjects included in our study. No significant association was seen, and this was interpreted as evidence of supporting the assumption of missing completely at random.<sup>22</sup> An independent working correlation matrix was first used to avoid potential bias for parameter estimates of time-varying covariates,<sup>23,24</sup> then exchangeable and autoregressive working correlation matrices were used to test models for robustness, and the results from these correlation matrixes were consistent. In the present analysis, exchangeable working correlation matrix was used in all GEE analyses.

We conducted similar multivariate analyses by subject and by individual partnership to identify factors associated with consistent condom use for anal sex in 3-month intervals. These analyses were restricted to intervals in which subjects or partnership had anal sex. We used anal sex acts as covariates instead of total sex acts. Similar model strategies were used as above.

There were no significant differences by intervention arm for anal sex and consistent condom use for anal sex, so we did not adjust the effect of intervention arm. Since 95% of subjects from Newark were black, race and site variables were highly correlated. Therefore, in multivariate analyses by subject, we include race, but not study sites. All statistical analyses were performed using SAS System version 9.1 for Windows (SAS Institute, Cary, NC). An  $\alpha$

TABLE 1. Mean Number of Sex Acts and Unprotected Sex Acts During Intervals Where Subjects Reported Having Vaginal and Anal Sex in the Past 3 Mo ( $n = 1154$ )

	Anal Sex	Vaginal Sex
Mean no.		
Sex acts	4.7	38.0
Unprotected sex acts	3.3	30.4

level of 0.05 was considered statistically significant, and all statistical tests were two-tailed.

### Results

Among 3297 subjects who enrolled in RESPECT-2, we excluded 162 men who reported only sex with men at baseline, 628 who did not have follow-up visits or who had no follow-up intervals with both before and after visits, and 150 who reported neither vaginal sex nor anal sex during follow-up. This left 2357 subjects who reported heterosexual anal sex; they reported on 6611 3-month intervals and 9235 partnerships. The subjects contributed data from one interval (19.6%), 2 intervals (22.4%), 3 intervals (16.2%), or all 4 intervals (41.9%).

#### Anal Sex

At baseline, 22.4% of 2357 subjects reported anal sex in the past 3 months. During follow-up, anal sex was reported by subjects in 1208 (18.3%) of the 6611 3-month intervals. The number of anal sex episodes in 3 months was: 1 (40.7%); 2 to 3 (34.2%); 4 to 6 (15.2%); or  $\geq 7$  (9.9%). Among those 1208 intervals, subjects reported both anal sex and vaginal sex during 1202 3-month intervals. They had many more episodes of vaginal sex (mean 38.0) than anal sex (mean 4.7, Table 1). Among 1180 men who had sex with women, 23 also reported sex with male partner(s) at baseline; they had anal sex with female partners in 34.6% of 3-month intervals versus 17.5% for men who did not have male partners at baseline ( $P = 0.003$ ). Of 367 intervals in which subjects had anal sex and reported having both main partners and causal partners, anal sex was reported with main partner only (61.6%), the causal partner only (21.8%), or both (16.6%).

Among the 989 subjects who completed all four 3-month visits, the percent who reported anal sex was similar in each study

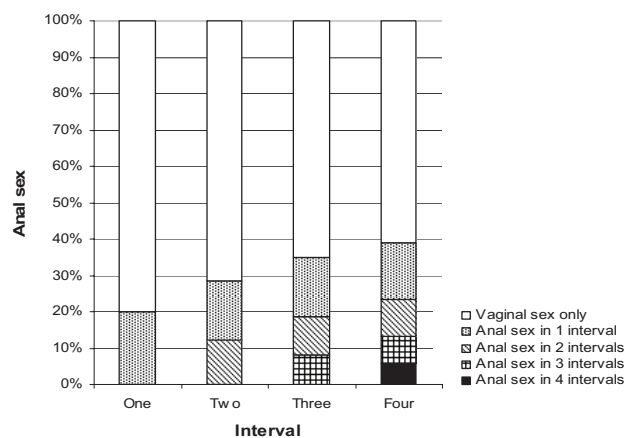


Fig. 1. Cumulative percent of subjects who had anal sex after 1, 2, 3, or 4 intervals among 986 who returned for all 4 intervals.

interval (20.1, 20.9, 21.2, and 20.2). The cumulative percent that reported anal sex was 28.6% after 2 intervals, 35.1% after 3 intervals, and 39.3% after 4 intervals (Figure 1). Among those 989 subjects, 23.5% reported anal sex in at least 2 intervals, 13.4% in at least 3 intervals, and 6.1% in all 4 intervals of the year.

In multivariate analyses of the 6605 3-month intervals in which subjects had vaginal sex, anal sex was not significantly associated with age, gender, race, or study intervals. The total number of sex acts had strongest association with having anal sex ( $c^2$  test for linear trend test,  $c^2 = 132, P < 0.0001$ ). Subjects who had 2 or more sex partners were more likely to report anal sex in the past 3 months than those who had 1 partner (AOR = 1.5, 95% C.I. (1.3–1.8)), and subjects who had unprotected vaginal sex were more likely to report anal sex than subjects who had no unprotected vaginal sex (AOR = 1.3, 95% C.I. (1.02–1.5)) (Table 2). In multivariate analysis of the 9229 partnerships that had vaginal sex, anal sex was more likely in main partnerships than in casual partnerships (AOR = 1.4, 95% C.I. (1.1–1.8)) and when either the subject or one of the partners was stoned or high from alcohol or drugs when they had sex at some time in the past 3 months compared to partnerships without this history (AOR = 1.4, 95% C.I. (1.2–1.7)) (Table 3).

TABLE 2. Percentage of Subjects Who had Heterosexual Anal Sex in a 3-Mo Interval, by Demographic and Behavioral Characteristics

	%	AOR <sup>†</sup>	95% CI <sup>†</sup>	
All (6605)	18.2	—	—	—
Age*				
15–18 (717)	16.2	0.85	0.61	1.19
19–21 (1386)	17.5	0.85	0.65	1.12
22–24 (1140)	18.9	1.03	0.78	1.37
25–29 (1552)	17.9	0.98	0.76	1.28
30–30+ (1538)	18.0	Ref	—	—
Gender*				
Male (3192)	17.7	Ref	—	—
Female (3412)	18.7	1.14	0.95	1.37
Race*				
Black (3220)	16.2	0.97	0.77	1.22
White (1503)	18.8	Ref	—	—
Hispanic (1224)	20.7	1.20	0.91	1.59
Other (656)	21.7	1.38	0.99	1.91
Number of partner*				
One (4476)	15.6	Ref	—	—
Two or more (2128)	23.8	1.54	1.33	1.78
Total sex acts*				
1–13 (3455)	10.1	Ref	—	—
14–26 (1349)	22.5	2.09	1.74	2.50
27–49 (857)	28.2	2.81	2.30	3.42
50–50+ (943)	32.5	3.79	3.07	4.67
Unprotected vaginal sex*				
No (1506)	10.0	Ref	—	—
Yes (4916)	20.9	1.25	1.02	1.52
Buy or sell sex*				
No (6371)	17.8	Ref	—	—
Yes (201)	30.9	1.51	1.06	2.16
Study visit*				
One (1889)	18.4	1.00	0.86	1.18
Two (1583)	18.3	0.97	0.83	1.15
Three (1554)	18.4	1.00	0.86	1.17
Four (1578)	17.7	Ref	—	—

\*Totals do not add up to 6605 because of missing values.  
<sup>†</sup>AOR indicates Adjusted odds ratio for all of the variables in the table; CI, confidence interval of AOR.

TABLE 3. Percentage of Partnerships that had Heterosexual Anal Sex in 3–Mo Interval, by Behavioral Characteristics

	%	AOR <sup>†</sup>	95% CI <sup>†</sup>	
All (9229)	14	—	—	—
Main partner*				
No (3457)	8.4	Ref	—	—
Yes (5770)	17.3	1.40	1.11	1.75
New partner*				
No (4868)	16.6	Ref	—	—
Yes (4359)	11.0	0.86	0.74	1.00
Either subject or partner stoned or high when they had sex at some time in the past 3 mo*				
No (6257)	12.1	Ref	—	—
Yes (2966)	17.9	1.42	1.21	1.66
Partner treated for STD*				
No (6997)	14.0	Ref	—	—
Yes (676)	20.7	1.19	0.95	1.50
Total sex acts with the partner*				
1–13 (6330)	8.8	Ref	—	—
14–26 (1261)	20.2	2.22	1.85	2.69
27–49 (753)	27.4	2.88	2.31	3.57
50+ (884)	30.5	3.50	2.79	4.41

\*Totals do not add up to 9229 because of missing values.  
<sup>†</sup>AOR indicates adjusted odds ratio for all of the variables in the table; CI, confidence interval of AOR.

Condom Use During Anal Sex

Condom use for vaginal and anal sex information was available for 1154 of the 1202 intervals in which subjects had anal sex and vaginal sex. Condoms were used consistently for both anal sex and vaginal sex (10.8%), for anal sex only (16.5%), or for vaginal sex only (2.1%). Condoms were never used for anal sex (63%). During 149 intervals in which subjects reported consistent condom use for vaginal sex, condoms were also used consistently for anal sex by 83.9%. During 1005 intervals in which subjects did not report consistent condoms for vaginal sex, condoms were used consistently for anal sex by 18.9%.

Multivariate modeling of subject characteristics indicated that consistent condom use for anal sex was more likely for subjects who reported 2 or more partners compared with one partner (AOR = 1.6, 95% C.I. (1.2–2.1)) and for subjects who used condom consistently for vaginal sex compared with subjects who did not (AOR = 17.4, 95% C.I. (10.8–28.1)); and consistent condom use for anal sex was not significantly associated with age, gender, race, number of anal sex acts, buying or selling sex, or study intervals (Table 4). Multivariate analysis of partnerships indicated that consistent condom use was more likely with casual partners than main partners (AOR = 2.1, 95% C.I. (1.5–2.9)) and more likely with a new partner than other partners (AOR = 1.4, 95% C.I. (1.04–1.8)); and consistent condom use for anal sex was not significantly associated with partners who were treated for STD, or when either subjects or partner was stoned or high when they had sex at some time in the past 3 months (Table 5).

Discussion

During follow-up after a STD clinic visit, 18.3% of subjects had anal sex in a given 3-month interval and 39.3% had anal sex at some point during the year. Our estimate of anal sex in a year is as high as an estimate of anal sex over a lifetime (35%–40%) in the National Survey of Family Growth in 2002.<sup>9</sup> Also, our finding that

TABLE 4. Percentage of Subjects Who Consistently Used Condom for Anal Sex in a 3-Mo Interval, by Demographic and Behavioral Characteristics

	Consistent Use (%)	AOR <sup>†</sup>	95% CI <sup>†</sup>	
All (1202)	27.3	—	—	—
Age*				
15–18 (115)	31.3	1.25	0.64	2.47
19–21 (237)	24.1	0.88	0.51	1.51
22–24 (212)	28.3	1.15	0.68	1.96
25–29 (273)	28.2	1.05	0.64	1.73
30+ (263)	26.6	Ref	—	—
Gender*				
Male (554)	30.9	Ref	—	—
Female (619)	24.7	0.72	0.51	1.02
Race*				
Black (504)	32.5	1.42	0.90	2.25
White (275)	20.4	Ref	—	—
Hispanic (252)	29.8	1.29	0.77	2.15
Other (141)	20.6	0.67	0.34	1.31
Number of partner*				
One (681)	24.5	Ref	—	—
Two or more (492)	31.9	1.59	1.18	2.13
Anal sex acts*				
1–3 (877)	29.1	Ref	—	—
4–4+ (296)	23.3	0.83	0.60	1.14
Unprotected vaginal sex*				
No (149)	83.9	17.4	10.8	28.1
Yes (1005)	18.9	Ref	—	—
Buy or sell sex*				
No (1109)	27.8	Ref	—	—
Yes (59)	25.4	0.74	0.37	1.45
Study visit*				
One (333)	28.5	0.92	0.64	1.33
Two (281)	27.4	0.91	0.61	1.37
Three (282)	26.6	1.07	0.76	1.50
Four (277)	27.8	Ref	—	—

\*Totals do not add up to 1202 because of missing values.

<sup>†</sup>AOR indicates adjusted odds ratio for all of the variables in the table; CI, confidence interval of AOR.

23.5% of heterosexual subjects had anal sex in at least 2 three-month intervals exceeds a 1991 estimate that about 10% of American women and their male partners engaged in anal sex with some regularity.<sup>5</sup> Anal sex may be more commonly practiced among persons who attend STD clinics than among persons in the general population. However, 12.5% of women who attended an STD clinic in San Francisco reported anal sex in the previous 2 months and 13% of women surveyed in the California Department of Motor Vehicle office reported anal sex in the previous 3 months.<sup>25</sup>

Anal sex may be more commonly practiced now than in the past. At enrollment 22% of participants in RESPECT-2 reported anal sex in the previous 3 months compared with 9% of participants enrolled in a similar study in those STD clinics 5 years earlier.<sup>26</sup> These findings are supported by temporal trends in sexual behavior from surveys in the United States and Great Britain.<sup>9,27–30</sup> A survey in Seattle reported an increase in anal sex during recent partnerships from 4.3% in 1995 to 8.3% in 2004, while a national survey in Great Britain reported increased anal sex in the past year between 1990 and 2000 for women (6.5%–11.3%) and men (7.0%–12.3%).<sup>28,30</sup> It should be noted that some of the increased reporting of anal sex could be caused by methodological issues including enrollment criteria, wording of questions, or survey methodology such as computer assisted interviews.<sup>26,30</sup> However, even less dramatic increases in anal sex could have implications

TABLE 5. Percentage of Partnerships that Consistently Used Condom for Anal Sex in 3-Mo Interval, by Behavioral Characteristics

	Consistent Use (%)	AOR <sup>†</sup>	95% CI <sup>†</sup>	
All (1263)	29.6	—	—	—
Main partner*				
No (284)	35.0	2.12	1.53	2.93
Yes (978)	24.9	Ref	—	—
New partner				
No (795)	25.4	Ref	—	—
Yes (468)	36.8	1.38	1.04	1.84
Either subject or partner stoned or high when they had sex at some time in the past 3 mo				
No (747)	33.3	Ref	—	—
Yes (516)	24.2	0.71	0.53	0.94
Partner treated for STD*				
No (965)	29.1	Ref	—	—
Yes (132)	25.8	0.98	0.66	1.44
Anal sex acts				
1–3 (986)	31.2	Ref	—	—
4–4+ (277)	23.8	0.81	0.58	1.13

\*Totals do not add up to 1263 because of missing values.

<sup>†</sup>AOR indicates adjusted odds ratio for all of the variables in the table; CI, confidence interval of AOR.

for the incidence of anal cancer in women, which has been increasing since 1973.<sup>31</sup>

For those who had anal sex, the mean number of unprotected anal sex acts (3.3 times) was much fewer than the mean number of unprotected vaginal sex acts (30.4 times) in a 3-months interval. However, the risk of male-to-female transmission of HIV has been estimated to be 20–500 times greater for anal sex compared with vaginal sex.<sup>8,11</sup> Thus, the risk of HIV transmission from unprotected anal sex acts could be very high.

Compared with subjects who did not have anal sex, subjects who reported anal sex were more likely to have more total sex acts, have 2 or more sex partners, to have unprotected vaginal sex, and to have been high or stoned when they had sex at sometime in past 3 months. These associations were similar to the findings of previous studies,<sup>10,13</sup> suggesting that people who engage in anal sex tend to engage in other behaviors that put them at risk for STD/HIV.

Consistent condom use during vaginal sex was the strongest determinant of consistent condom use for anal sex. Subjects who used condoms consistently during vaginal sex were 17.4 times more likely to use condoms consistently for anal sex than subjects who did not use condoms consistently for vaginal sex. Among those who had anal sex and vaginal sex in the past 3 months, only 27.3% of subjects consistently used condom during anal sex; 63% of subjects never used condoms during anal sex. These findings suggest that clinicians should ask their patients about anal sex, tell them unprotected anal sex is an efficient path for HIV/STD transmission, and recommend consistent condom use for both anal sex and vaginal sex. For women who have had receptive anal sex, clinicians should examine the anal area and consider testing for the most common sexually transmitted pathogens (*N. gonorrhoeae*, *C. trachomatis*)<sup>7,32,33</sup> for those with symptoms or signs of anal infection. Further research is needed in persons who have had anal sex to determine the role of screening for asymptomatic infections as is currently recommended for men who have sex with men.<sup>34</sup>

Our study has several limitations. Although audio computer-assisted self-interview may increase reporting of stigmatized behavior,<sup>35</sup> some subjects may still have underreported anal sex. Also some may not remember all their activities with their partners for the entire 3-month period. Our subjects had visited STD clinics and enrolled in a trial, so our findings may not generalize to other populations. Because all subjects received STD/HIV prevention counseling, reported risk behaviors were probably lower than they would have been without counseling. Only a few RESPECT-2 participants were tested for anal infection, so we could not assess the association between anal sex and anal infection.

Heterosexual anal sex was quite common during the year following the STD clinic visit, and condom use for anal sex was quite rare. Although subjects tended to have anal sex with their main partners, they were also more likely to have 2 or more total partners, and have unprotected vaginal sex. With extremely low consistent condom use for anal and vaginal sex, subjects could be at high-risk for transmitting STD and HIV.

Clinicians should ask patients about anal sex, appropriately examine and test patients who have had anal sex, and recommend condom use for both anal and vaginal sex.

### References

- Ho GY, Bierman R, Beardsley L, et al. Natural history of cervicovaginal papillomavirus infection in young women. *N Engl J Med* 1998; 338:423–428.
- van de Laar MJ, Termorshuizen F, Slomka MJ, et al. Prevalence and correlates of herpes simplex virus type 2 infection: evaluation of behavioural risk factors. *Int J Epidemiol* 1998; 27:127–134.
- Schwandt M, Morris C, Ferguson A, et al. Anal and dry sex in commercial sex work, and relation to risk for sexually transmitted infections and HIV in Meru, Kenya. *Sex Transm Infect* 2006; 82:392–396.
- Padian NS, Shiboski SC, Glass SO, et al. Heterosexual transmission of human immunodeficiency virus (HIV) in northern California: results from a ten-year study. *Am J Epidemiol* 1997; 146:350–357.
- Voeller B. AIDS and heterosexual anal intercourse. *Arch Sex Behav* 1991; 20:233–276.
- Frisch M, Glimelius B, van den Brule AJ, et al. Sexually transmitted infection as a cause of anal cancer. *N Engl J Med* 1997; 337:1350–1358.
- Hamlyn E, Taylor C. Sexually transmitted proctitis. *Postgrad Med J* 2006; 82:733–736.
- Leynaert B, Downs AM, deVincenzi I. Heterosexual transmission of human immunodeficiency virus: variability of infectivity throughout the course of infection. *Am J Epidemiol* 1998; 148:88–96.
- Mosher WD, Chandra A, Jones J. Sexual behavior and selected health measures: men and women 15–44 years of age, United States, 2002. *Adv Data* 2005; 15:1–56.
- Baldwin JI, Baldwin JD. Heterosexual anal intercourse: an understudied, high-risk sexual behavior. *Arch Sex Behav* 2000; 29:357–373.
- Misegades L, Page-Shafer K, Halperin D, et al. Anal intercourse among young low-income women in California: an overlooked risk factor for HIV? *AIDS* 2001; 15:534–535.
- Baker SA, Morrison DM, Gillmore MR, et al. Sexual behaviors, substance use, and condom use in a sexually transmitted disease clinic sample. *J Sex Res* 1995; 32:37–44.
- Bogart LM, Kral AH, Scott A, et al. Sexual risk among injection drug users recruited from syringe exchange programs in California. *Sex Transm Dis* 2005; 32:27–34.
- Davis KR, Weller SC. The effectiveness of condoms in reducing heterosexual transmission of HIV. *Fam Plann Perspect* 1999; 31:272–279.
- Pinkerton SD, Abramson PR. Effectiveness of condoms in preventing HIV transmission. *Soc Sci Med* 1997; 44:1303–1312.
- Holmes KK, Levine R, Weaver M. Effectiveness of condoms in preventing sexually transmitted infections. *Bull World Health Organ* 2004; 82:454–461.
- Halperin DT. Heterosexual anal intercourse: prevalence, cultural factors, and HIV infection and other health risks, Part I. *Aids Patient Care STDs* 1999; 13:717–730.
- Erickson PI, Bastani R, Maxwell AE, et al. Prevalence of anal sex among heterosexuals in California and its relationship to other AIDS risk behaviors. *AIDS Educ Prev* 1995; 7:477–493.
- Metcalfe CA, Douglas JM Jr, Malotte CK, et al. Relative efficacy of prevention counseling with rapid and standard HIV testing: a randomized controlled trial (RESPECT-2). *Sex Transm Dis* 2005; 32:130–138.
- Liang KY, Zeger SL. Longitudinal data analysis using generalized linear models. *Biometrika* 1986; 73:13–22.
- Zeger SL, Liang KY, Albert PS. Models for longitudinal data: a generalized estimating equation approach. *Biometrics* 1988; 44:1049–1060.
- Stokes ME, Davis CS, Koch GG. *Categorical Data Analysis using SAS System*, 2nd ed. Cary NC: SAS Institute, Inc, 2000.
- Pepe MS, Anderson GL. A cautionary note on inference for marginal regression models with longitudinal data and general correlated response data. *Comm Stat Simulat Comput* 1994; 23:939–951.
- Diggle PJ, Heagerty P, Liang KY, et al. *The Analysis of Longitudinal Data*. New York: Oxford University Press, 2002.
- Barry PM, Kent CK, Philip S, et al. Female anal sex prevalence and correlates San Francisco, 1997–2006. 17th ISSTD conference abstracts; P-585.
- Satterwhite CL, Kamb ML, Metcalfe C, et al. Changes in sexual behavior and STD prevalence among heterosexual STD clinic attendees: 1993–1995 Versus 1999–2000. *Sex Transm Dis*. In press.
- Leichliter JM, Chandra A, Liddon N, et al. Prevalence and correlates of heterosexual anal and oral sex in adolescents and adults in the United States. *J Infect Dis* 2007; 196:1852–1859.
- Aral SO, Patel DA, Holmes KK, et al. Temporal trends in sexual behaviors and sexually transmitted disease history among 18-to 39-year-old Seattle, Washington, residents: results of random digital surveys. *Sex Transm Dis* 2005; 32:710–717.
- Gilbart VL, Mercer CH, Dougan S, et al. Factors associated with heterosexual transmission of HIV to individuals without a major risk within England, Wales, and Northern Ireland: a comparison with national probability surveys. *Sex Transm Infect* 2006; 82:15–20.
- Johnson AM, Mercer CH, Erens B, et al. Sexual behaviour in Britain: partnerships, practices, and HIV risk behaviours. *Lancet* 2001; 358:1835–1842.
- Johnson LG, Madeleine MM, Newcomer LM, et al. Anal cancer incidence and survival: the SEER experience, 1973–2000. *Cancer* 2004; 101:281–288.
- Klausner JD, Kohn R, Kent C. Etiology of clinical proctitis among men who have sex with men. *Clin Infect Dis* 2004; 38:300–302.
- Ivens D, Macdonald K, Bansi L, et al. Screening for rectal chlamydia infection in a genitourinary medicine clinic. *Int J STD AIDS* 2007; 18:404–406.
- Centers for Disease Control and Prevention. Sexually transmitted diseases treatment guideline, 2006. *MMWR* 2006; 55 (No RR-11), 1–94.
- Metzger DS, Koblin B, Turner C, et al. Randomized controlled trial of audio computer-assisted self-interviewing: utility and acceptability in longitudinal studies. *Am J Epidemiol* 2000; 152:99–106.