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Young Age at First Sexual Intercourse and Sexually Transmitted Infections in Adolescents and Young Adults

Christine E. Kaestle[1], Carolyn T. Halpern[1], William C. Miller[2,3], and Carol A. Ford[4]

[1] Department of Maternal and Child Health, School of Public Health, University of North Carolina at Chapel Hill, Chapel Hill, NC.
[2] Department of Epidemiology, School of Public Health, University of North Carolina at Chapel Hill, Chapel Hill, NC.
[3] Department of Medicine, School of Medicine, University of North Carolina at Chapel Hill, Chapel Hill, NC.
[4] Department of Pediatrics, School of Medicine, University of North Carolina at Chapel Hill, Chapel Hill, NC.

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The authors examined the relation between age at first vaginal intercourse and a positive nucleic acid amplification test for sexually transmitted infection (STI). A nationally representative sample of 9,844 respondents aged 18–26 years was tested for chlamydial infection, gonorrhea, and trichomoniasis in wave 3 (2001–2002) of the National Longitudinal Study of Adolescent Health. The authors used multiple logistic regression to assess the relation between age at first sexual intercourse and these STIs and to examine variation by current age, sex, race, and ethnicity. Younger ages at first intercourse were associated with higher odds of STI in comparison with older ages, but the effect diminished with increasing current age. For example, the odds of having an STI for an 18-year-old who first had intercourse at age 13 were more than twice those of an 18-year-old who first had intercourse at age 17 (prevalence odds ratio = 2.25, 95% confidence interval: 1.42, 3.59). In contrast, the odds of having an STI among 24-year-olds with first intercourse at age 13 versus those with first intercourse at age 17 were the same (prevalence odds ratio = 1.11, 95% confidence interval: 0.88, 1.39). Thus, earlier initiation of sexual intercourse is strongly associated with STIs for older adolescents but not for young adults over age 23 years.

adolescent behavior; *Chlamydia trachomatis*; *Neisseria gonorrhoeae*; sexually transmitted diseases; *Trichomonas vaginalis*

Abbreviations: Add Health, National Longitudinal Study of Adolescent Health; STI, sexually transmitted infection.

Sexual intercourse is commonly initiated during adolescence (1). Early initiation of sexual intercourse has been linked to increased risk of sexually transmitted infections (STIs) and pregnancy during adolescence (2, 3). The increased STI risk is due, in part, to a biologic predisposition of the immature cervix to infection if exposed (4–6) and to the increased likelihood of engaging in riskier sexual behaviors among persons who initiate sexual intercourse at younger ages (3, 7–9). Over the past several years, substantial funding has been directed toward programs designed to delay first sexual intercourse among adolescents (i.e., prolong virginity) as a strategy for reducing the risk of STI.

Little is known about the long-term consequences of early sexual intercourse. Life-course theory proposes that societal expectations exist regarding the appropriate times for important transitions, and there can be consequences if life events do not meet these normative expectations (10–12). With regard to sexual behavior, adolescents develop elaborate sets of ideas concerning sexuality and their sexual roles well before they actually engage in sexual activity (13). These sexual ''scripts'' serve as guidelines for what types of sexual behaviors and partners are appropriate at different ages, and they could vary based on an adolescent's sex, race, or ethnicity (13–15). Nonnormative sexual scripts and early first sexual intercourse (an off-time event) may represent a life-course transition that increases the likelihood of a longitudinal pattern of risky sexual activity. Negative consequences may accumulate to affect sexual functioning and relationship skills (16, 17). The subsequent sexual trajectory may produce adverse adult outcomes, such as elevated risk of STI.

Correspondence to Christine E. Kaestle, CB 7445, Department of Maternal and Child Health, School of Public Health, University of North Carolina at Chapel Hill, Chapel Hill, NC 27599-7400 (e-mail: kaestle@email.unc.edu).

Whether delaying first sexual intercourse among adolescents influences risk of STI in young adulthood is unknown. This is an important question, because contracting STIs during young adulthood can have significant adverse consequences for reproductive health. STIs can cause complications such as pelvic inflammatory disease, infertility, ectopic pregnancy, preterm birth, and fetal abnormalities (18, 19). STIs may also increase the risk of transmission of human immunodeficiency virus (19, 20). Young adults aged 18–24 years report much higher annual rates of STI than older adults and carry a heavy disease burden (15, 21). If delaying sexual intercourse in adolescence carries a lasting benefit of reduced STIs in young adulthood, this would represent a potentially huge impact for such a strategy in terms of long-term health benefits in the population. Alternatively, if the benefits of delaying intercourse do not last into adulthood, different strategies addressing the health education and service needs of young adults should be emphasized.

Most studies that have investigated the link between age at first sexual intercourse and risk of STI among young adults have focused only on females and have used convenience samples, self-reports of STI, or both. Results have been mixed. In Europe, women aged 16–44 years visiting family planning centers who reported first having intercourse at age 16 or younger did not have a greater prevalence of *Chlamydia trachomatis* (22). In contrast, women visiting Planned Parenthood clinics in Pennsylvania who reported first having sex before age 15 were more likely to self-report having an STI in the past 5 years (23). In the 1995 National Survey of Family Growth, women who reported earlier first intercourse were also more likely to report a history of bacterial STI (24).

Little is known about the relation between age at first sexual intercourse and longitudinal risk of STI by sex, race, or ethnicity. These demographic factors have been associated with variation in mean age of first sexual intercourse and with extremely wide variation in STI prevalence (21, 24–26). Early sexual intercourse may be more normative in some socioeconomic, racial, ethnic, or sex groups and thus may not be tied to nonnormative risk behaviors or to longitudinal risk of STI (27–29). Therefore, the long-term impact of programs aimed at prolonging virginity may vary among groups of young adults and may mitigate or exacerbate current disparities.

In this study, our goal was to clarify the long-term sexual health consequences of the timing of first sexual intercourse and to elucidate how such consequences might vary by characteristics of the individual. We examined the following research questions: 1) is early sexual intercourse associated with increased likelihood of testing positive for an STI among older adolescents and young adults? and 2) does the effect of early sexual intercourse on later STI vary by the respondent's sex, race, ethnicity, parental education, or current age?

MATERIALS AND METHODS

Study sample

We used data from adolescents and young adults who had reported engaging in sexual intercourse and had been tested for *Chlamydia trachomatis*, *Neisseria gonorrhoeae*, and *Trichomonas vaginalis* in wave 3 of the National Longitudinal Study of Adolescent Health (Add Health) (30). Add Health was approved by the Institutional Review Board for the Protection of Human Subjects at the School of Public Health, University of North Carolina at Chapel Hill. Add Health was designed to examine the determinants of health and health-related behaviors of adolescents who were enrolled in the study in grades 7–12 during the 1994–1995 school year. For construction of the original wave 1 sample, which was representative of all US schools with respect to region, urbanicity, school size, school type, and ethnicity, 80 high schools and 52 middle schools were selected using systematic sampling methods and implicit stratification. Wave 1 included an in-home questionnaire that was administered to over 20,000 adolescent students from the sample schools.

In wave 3, conducted from August 2001 through April 2002, 15,197 of the original wave 1 respondents were reinterviewed. Add Health respondents ranged in age from 18 years to 26 years at wave 3. Of the 14,322 respondents with assigned sampling weights in wave 3, 12,334 reported ever having had intercourse. Of those, 9,844 had complete data on our variables of interest, with almost all of the missing data being attributable to respondents' lacking results for the biologic STI laboratory tests (approximately 8 percent of respondents chose not to provide a specimen; approximately 2 percent were unable to provide a specimen at the time of the interview; 3 percent of specimens could not be processed because of shipping and laboratory problems; and 6 percent of the *N. gonorrhoeae* results were excluded after some of the ligase chain reaction assays were recalled by the manufacturer). The 9,844 persons with complete data made up our study sample.

Measures

Respondents were asked at wave 3 to provide a urine specimen for STI testing. These specimens were analyzed for the presence of *C. trachomatis*, *N. gonorrhoeae*, and *T. vaginalis*. A ligase chain reaction assay was used to detect the presence of *C. trachomatis* and *N. gonorrhoeae* DNA. *T. vaginalis* DNA was detected with a polymerase chain reaction enzyme-linked immunosorbent assay. We used a composite measure of STI indicating a positive test for any of these STIs. We chose this composite measure because of the low prevalence of *N. gonorrhoeae* and *T. vaginalis* in the study population, which limited the potential utility of separate models. Furthermore, although the sexual network structures may have differed somewhat between these infections, the sexual behavioral risks were likely to have been similar. This composite measure provided us with a more comprehensive measure of each respondent's sexual health status. Analyses using chlamydial infection alone as the outcome (not shown) produced results similar to those for all three STIs combined.

During the in-home interviews, a questionnaire containing sensitive questions on sexual activity was administered using computer-assisted self-interviewing technology. Age at first sexual intercourse was defined as the respondent's

answer to the question ''How old were you the first time you had vaginal intercourse?'' on the wave 3 questionnaire (vaginal intercourse was defined as the insertion of the penis into the vagina). Age at first sexual intercourse was used as a continuous variable. Current age was defined as the respondent's age at the time of wave 3 questionnaire administration and was also used as a continuous variable. Other variables included the sex of the respondent (male (referent) vs. female), ethnicity (non-Latino (referent) vs. Latino), race (White (referent) vs. Black or other), and parental education (highest level of education attained by either parent, categorized as less than high school (referent), completion of high school, some additional training, and college graduation).

Data analysis

We used Stata software (version 7.0) to incorporate weights and account for the Add Health sampling design in all analyses (31). All estimates were standardized to US Census data on the demographic characteristics of the adolescent population, as recommended by the Add Health research team (32). In preliminary analyses, we examined the frequency distributions of the variables of interest for the entire sample and for persons testing positive for STIs. We used simple logistic regression to obtain adjusted estimates of the prevalence odds ratios for having an STI at wave 3. Respondent's sex, race, ethnicity, and parental education, which are associated with contracting an STI, were controlled for in multiple logistic regression analyses. Inclusion of both current age and age at first sexual intercourse in these models controlled for the length of time a participant had been sexually active. Therefore, our measure of age at first sexual intercourse does not represent the effects of exposure time.

In addition to controlling for potential confounding in our models, we also examined whether the relations between early sexual intercourse and STIs were the same for different groups of respondents. We included interaction terms in the full logistic regression model to determine whether the association between age at first intercourse and STI prevalence varied by the sex, race, ethnicity, parental education, or current age of the respondent. In the initial full model, all variables and terms for interaction with age at first sexual intercourse were entered simultaneously. Interaction terms that were significantly associated ($\alpha = 0.10$) with the outcome in the full model were retained in the final logistic regression model.

RESULTS

Sample

This study sample of sexually experienced young adults was approximately half male and half female. The majority of respondents were White and non-Latino (table 1). The mean current age in our study sample at wave 3 was 21.8 years. Age at first sexual intercourse ranged from 10 years through 25 years, with a mean of 16.4 years. Approximately one third of participants had had intercourse by age 15 years, and over 90 percent had had intercourse by age 19 years. Age at first sexual intercourse was not associated with being dropped from the sample due to incomplete data. A total of 742 participants (almost 7 percent of the weighted sample) tested positive for at least one STI at wave 3. When examined in 1-year age increments, the STI prevalence for all current ages was above 5 percent.

TABLE 1. Weighted percentages of sexually experienced participants and participants found to have a sexually transmitted infection,* according to selected characteristics, National Longitudinal Study of Adolescent Health, 2001–2002

Characteristic	Full sample (n = 9,844)	STI† positive (n = 742)
Sex		
Male	49.9	41.8
Female	50.1	58.2
Race		
White	79.9	44.3
Black	14.9	50.7
Other	5.2	5.1
Ethnicity		
Non-Latino	90.2	87.3
Latino	9.8	12.7
Parental education		
Less than high school	16.5	24.8
Completion of high school	31.3	34.2
Some additional training	20.5	16.2
College graduation	31.7	24.8
Current age (years)		
<22	44.7	46.9
≥22	55.3	53.1
Age (years) at first sexual intercourse		
<16	33.6	46.3
≥16	66.3	53.6

* *Chlamydia trachomatis, Neisseria gonorrhoeae*, or *Trichomonas vaginalis*.
† STI, sexually transmitted infection.

Bivariate relation between age at first intercourse and STIs

The weighted percentage of the sample with positive STI tests dropped gradually with increasing age at first sexual intercourse. In a simple (unadjusted) logistic regression model, the prevalence odds ratio for the relation between age at first intercourse and adult STIs was 0.89 (95 percent confidence interval: 0.85, 0.93). The decreasing probability of having an STI for respondents with higher ages of first intercourse is shown graphically in figure 1.

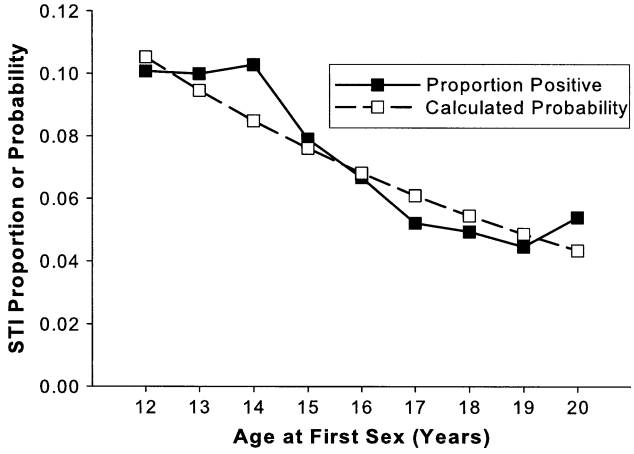

FIGURE 1. Weighted proportion of participants with a sexually transmitted infection (STI) (*Chlamydia trachomatis*, *Neisseria gonorrhoeae*, or *Trichomonas vaginalis*), by age at first sexual intercourse, and corresponding probability of having an STI, as calculated from simple logistic regression before adjustment for demographic factors ($n = 9{,}844$), National Longitudinal Study of Adolescent Health, 2001–2002.

Interaction with current age

In multiple logistic regression analyses, the relation between age at first sexual intercourse and STI did not differ by sex, race, ethnicity, or parental education (interaction $p > 0.1$). However, the association of age at first intercourse with STIs varied between younger and older respondents ($p = 0.017$; table 2). For this reason, the prevalence odds ratios for age at first intercourse were calculated for each current age group, using a referent first intercourse age of 17 years (figure 2). Although a young age at first sexual intercourse was consistently associated with higher STI levels compared with later initiation of intercourse, the difference was substantially smaller among older respondents, suggesting that the association between age at first intercourse and STI dissipates with time (figure 2). For older adolescents, age at first intercourse made a significant difference in the prevalence odds ratio. For example, the odds of contracting an STI for an 18-year-old who first had intercourse at age 13 were more than twice those of an 18-year-old who first had intercourse at age 17 (prevalence odds ratio = 2.25, 95 percent confidence interval: 1.42, 3.59). In contrast, the prevalence odds ratio for a 24-year-old with first intercourse at age 13 versus a 24-year-old with first intercourse at age 17 was 1.11 (95 percent confidence interval: 0.88, 1.39). Thus, earlier first sexual intercourse is strongly associated with STIs for older adolescents but not for young adults over age 23, at which point the association becomes nonsignificant.

DISCUSSION

Public health professionals must understand the immediate and long-term impact of behavioral interventions in order to allocate resources optimally and design strategies for reducing STIs. Early initiation of sexual intercourse is often used as an indicator of risky sexual behavior, and many interventions are designed to delay sexual activity, such as programs encouraging virginity pledges and delivering abstinence education (33, 34). Our study indicates that later initiation of sexual intercourse is associated with a lower probability of having an STI among adolescents. Thus, programs that effectively prolong virginity among adolescents make sense as part of a comprehensive strategy for reducing STIs among adolescents, who carry a substantial part of the STI burden.

However, our study also indicates that delaying first intercourse would not be a sufficient strategy when attempting to reduce STIs among young adults. Even assuming that intervention programs could substantially delay sexual activity, by young adulthood an older age at first sexual intercourse is no longer protective against STIs (by age 23, the timing of first sexual intercourse has no significant influence on STI prevalence). Therefore, programs designed to delay initiation of sexual intercourse will have limited returns in terms of reproductive health among young adults. Mechanisms for reducing rates of STI may differ between late adolescence and young adulthood. These mechanisms must be elucidated in order to develop appropriately targeted prevention and intervention programs. Given that STIs represent a serious problem among young adults, prevention efforts designed to have a long-term impact should emphasize other factors. Strategies such as providing health care and sex education to youths before they become sexually active should be considered, regardless of whether that activity begins early or late.

These results, which were based on biologic STI testing, complement and expand upon the National Survey of Family Growth results on female self-reports of lifetime STI infection (24). Furthermore, our study provides evidence that the long-term STI consequences associated with early initiation of intercourse apply not just to females but also to males, who have been regularly excluded from previous studies. While the focus on females in past research may have been driven in part by data availability, it can also lead to the misconception that the timing of first intercourse is less important for males in terms of their sexual risk trajectories. Our research found that the association between timing of first intercourse and STIs did not differ between males and females. The absence of a sex difference suggests that programs aimed at delaying sexual activity should strive to effectively target both sexes equally during adolescence. Furthermore, future research on the consequences of the timing of first intercourse should not focus exclusively on females.

We also found that the relation between first sexual intercourse and STIs does not vary by race, ethnicity, or parental education. Since early initiation of sexual intercourse appears to affect different racial, ethnic, and socioeconomic groups similarly for this outcome, effective programs that delayed sexual activity would be equally beneficial in all groups of adolescents. This strategy could provide substantial benefits as a component of programs targeting adolescents in high-risk communities.

TABLE 2. Odds of sexually transmitted infection* according to age at first sexual intercourse among sexually experienced respondents in multiple logistic regression analysis, National Longitudinal Study of Adolescent Health, 2001–2002

Characteristic	β coefficient	POR†	95% CI†	*p* value
Age (years)				
Age at first sexual intercourse (continuous variable)	−0.74	—‡		0.009
Current age (continuous variable)	−0.48	—‡		0.017
Age at first intercourse × current age	0.03	—‡		0.017
Sex				
Male		1.00§		
Female	0.31	1.37	1.12, 1.66	0.002
Ethnicity				
Non-Latino		1.00§		
Latino	0.57	1.76	1.24, 2.51	0.002
Race				
White		1.00§		
Black	1.80	6.02	4.80, 7.56	<0.001
Other	0.52	1.69	1.08, 2.66	0.023
Parental education				
Less than high school		1.00§		
Completion of high school	−0.25	0.78	0.61, 1.00	0.050
Some additional training	−0.47	0.63	0.46, 0.86	0.004
College graduation	−0.31	0.73	0.53, 1.00	0.048
Constant	8.76			0.057

* *Chlamydia trachomatis*, *Neisseria gonorrhoeae*, or *Trichomonas vaginalis*.
† POR, prevalence odds ratio; CI, confidence interval.
‡ PORs for the continuous variables age at first intercourse and current age, with the interaction term, are shown graphically in figure 2.
§ Referent.

Our study used biologic tests for STI, whereas several previous studies had to use self-reports (3, 23, 24). Because many STIs are asymptomatic and self-reports of symptoms correlate poorly with biologic tests for STI, using self-reports probably results in substantial underreporting of STI (35). Self-reports may also have introduced bias into previous studies, since diagnosis may depend on access to regular health services. Furthermore, unlike reports of lifetime infections, our data included the ages of the respondents at the time their infections were detected. This allowed us to explore how early first intercourse was associated with the prevalence of infection among specific age groups.

Because the wave 3 data on STI biologic tests were cross-sectional, some of the observed associations may represent cohort differences rather than developmental change between the ages of 18 and 23 years. However, it seems unlikely that, for example, the older respondents experienced a historical event that altered not only the relation of current age to STI but also the nature of the association between age at first intercourse and STI. The gradual decline of the importance of age at first intercourse in predicting STIs is more likely explained by the continued development of the participant as time passes. Additional longitudinal research on young adults using biomarkers for STIs is needed in order to confirm that the influence of timing of first intercourse fades over time and is eclipsed by other factors as participants age.

A concern with longitudinal studies such as Add Health is that some of the highest-risk adolescents may have been lost to follow-up. However, an Add Health study of wave 1 respondents who were lost to follow-up in wave 2 did not find statistically significant differences between wave 2 respondents and those lost to follow-up in terms of sex, race/ethnicity, or any of the wave 1 self-reports of STI. Participants lost to follow-up were significantly older, a difference that was due primarily to the design decision not to follow wave 1 seniors at wave 2 (36). Recent analyses of nonresponse in wave 3 of Add Health suggest that potential bias due to loss to follow-up is small (37). Furthermore, sampling weights for wave 3 were recalculated using poststratification techniques, which helps to ensure the representativeness of the sample.

Approximately 8 percent of wave 3 Add Health respondents refused to provide a urine sample, which may have

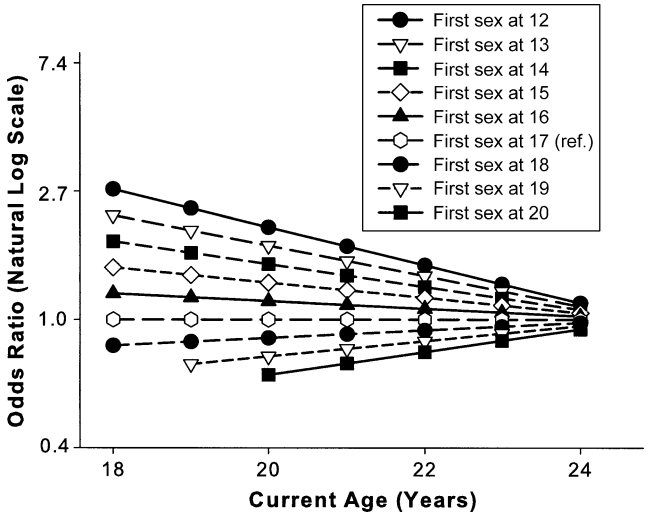

FIGURE 2. Prevalence odds ratios from multivariate logistic regression analysis showing the relation between age at first sexual intercourse (referent (ref.) age, 17 years) and sexually transmitted infection (*Chlamydia trachomatis*, *Neisseria gonorrhoeae*, or *Trichomonas vaginalis*), by current age, with adjustment for respondent's sex, race, and ethnicity and parental education (n = 9,844), National Longitudinal Study of Adolescent Health, 2001–2002.

introduced bias if persons who refused had different prevalence patterns than other respondents. In our study sample, age at first sexual intercourse was not associated with being dropped from the sample because of incomplete data. Furthermore, a detailed sensitivity analysis of potential systematic differences between persons who did and did not provide a urine specimen in wave 3 found that conclusions regarding chlamydial infection prevalence were robust to differences in nonrespondent characteristics (21). However, it is possible that respondents who suspected that they might be infected may have refused to provide a sample out of fear that the information would be disclosed (resulting in underestimation of prevalence) or may have volunteered in order to take advantage of the opportunity to verify their infection status at no cost (resulting in overestimation of prevalence).

Information on first sexual intercourse is dependent on self-reporting, which may introduce misclassification problems (25, 38). However, Add Health used computer-assisted self-interviewing, which allows respondents to answer questions about sensitive topics directly on the computer. This technology reduces the risk of accidental disclosure to the interviewer, improves privacy, and may reduce nonresponse and increase reporting of sensitive or stigmatized behaviors (39, 40). Nevertheless, computer-assisted self-interviewing cannot mitigate the possible influence of recall bias. However, first sexual intercourse is likely to be a relatively vivid event for many respondents, and the time gap between first sexual intercourse and the reporting of this event was relatively short in our sample.

While age at first sexual intercourse may be a helpful indicator of STI risk among adolescents, clinicians should be aware that young adults who started having sex recently are at similar STI risk as those who have been having sex throughout most of their adolescence. Future research could explore the mechanisms underlying the convergence of infection prevalences for persons with early and late first intercourse among young adults. Instead of targeting the act of first intercourse itself, perhaps we should focus on what distinguishes persistently higher-risk persons from others during adolescence. This strategy would require further investigation into the possibility that early initiation of sexual intercourse is a marker for more persistent problems among some youth and that other experiences may substantially influence the relation between early first intercourse and long-term STI risk.

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Persons interested in obtaining data files from the National Longitudinal Study of Adolescent Health should contact Add Health, Carolina Population Center, 123 West Franklin Street, Chapel Hill, NC 27516-2524 (www.cpc.unc.edu/addhealth/contract.html).

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