EARLY SEXUAL DEBUT AND SEXUALLY TRANSMITTED INFECTIONS IN ADOLESCENTS AND YOUNG ADULTS

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ABSRACT

Objectives: To test the relationship between age of first vaginal intercourse and sexually transmitted infection (STI) and examine variation by current age, sex, race and ethnicity. **Methods**: A nationally representative sample of 9,844 respondents ages 18-26 was interviewed and tested for chlamydial infection, gonorrhea, and trichomoniasis in Wave III of Add Health. **Results**: Early ages of debut were associated with higher odds of STIs compared to later debut, but the effect diminished with increasing age. For example, the odds of having an STI for an 18 year old with debut at age 13 were over twice those of an 18 year old with debut at age 17. In contrast, the odds of an STI among 24 year olds with debut at age 13 vs. debut at age 17 were the same. **Conclusions**: Earlier sexual debut is strongly associated with STIs for older adolescents but not for young adults over age 23.

Sexual intercourse is commonly initiated during adolescence (1). Early initiation of sexual intercourse (sexual debut) 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 biological predisposition of the immature cervix to infection if exposed,(4-6) and to the increased likelihood of those who initiate sexual intercourse at younger ages to engage in riskier sexual behaviors (3, 7-9). Over the past several years, substantial funding has been directed towards programs to delay sexual debut among adolescents (i.e., prolong virginity) as a strategy to reduce risks of STIs (e.g., http://opa.osophs.dhhs.gov/titlexx/afl-grantees-ae.html)

Whether delaying sexual debut among adolescents influences risk of STIs in young adulthood is unknown. This is important because STIs during young adulthood can have significant adverse consequences for reproductive health. STIs can result in complications such as pelvic inflammatory disease, infertility, ectopic pregnancy, preterm birth, and fetal abnormalities (10, 11). STIs may also increase the risk of HIV transmission (11, 12). Young adults ages 18 to 24 report much higher annual rates of infection with STIs compared to older adults and carry a heavy disease burden (13, 14). If delaying sexual debut 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 to the population. If, alternatively, the benefits of later debut do not last into adulthood, then different strategies that address the health education and service needs of young adults should be emphasized.

Most studies investigating the link between age of sexual debut and risk of STIs among young adults have focused only on females and used convenience samples, self

reports of STIs, or both. Results have been mixed. In Europe, women age 16 to 44 attending family planning centers who reported debut at age 16 or younger did not have greater prevalence of *C. trachomatis* (15). In contrast, women attending Planned Parenthood clinics in Pennsylvania who reported first sex before age 15 were more likely to self-report an STI in the past 5 years (16). In the 1995 National Survey of Family Growth (NSFG), women who reported earlier debut were also more likely to report a history of infection with a bacterial STI (17).

Little is known about the relationship between age of debut and longitudinal risk of STIs for males and females, or for different race and ethnic groups. These demographic factors have been associated with variation in mean age of sexual debut and with extremely wide variation in prevalence of STIs (14, 17-19). It is possible that early debut may be more normative in some socioeconomic, racial, ethnic, or gender groups, and so may not be tied to deviant risk behaviors or to longitudinal risk for STIs (20-22). 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.

Our goal is to clarify the long-term sexual health consequences of the timing of sexual debut and to elucidate how such consequences may vary by the characteristics of the individual. Therefore, we examined the following research questions: (1) is early sexual debut associated with increased likelihood of testing positive for an STI among older adolescents and young adults? and (2) does the effect of early sexual debut on later STIs vary by the respondent's sex, race, ethnicity, or current age?

MATERIALS AND METHODS

Study sample

We used data from adolescents and young adults who (1) reported having ever had intercourse and (2) were tested for *Chlamydia trachomatis, Neisseria gonorrhoeae*, and *Trichomonas vaginalis* in Wave III of The National Longitudinal Study of Adolescent Health (Add Health) (23). Add Health was approved by the Institutional Review Board for the Protection of Human Subjects at the School of Public Health at the 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 grades 7-12 during the 1994-1995 school year. To construct the original Wave I sample that was representative of US schools with respect to region of country, urbanicity, school size, school type, and ethnicity, 80 high schools and 52 middle schools were selected using systematic sampling methods and implicit stratification. Wave I included an in-home questionnaire that was administered to over 20,000 adolescent students from the sample schools.

In Wave III, conducted from August 2001 through April 2002, 15,197 of the original Wave I respondents were re-interviewed. Add Health respondents ranged in age from 18 to 26 years old at Wave III. Of the 14,322 respondents with assigned sampling weights in Wave III, 12,334 reported ever having intercourse. Of those, 9,844 had complete data on our variables of interest, with almost all of the missing data attributable to respondents lacking results for the biological STI lab tests. Those 9,844 individuals make up our study sample.

Measures

Respondents were asked at Wave III to provide a specimen of first stream urine for STI testing. These specimens were analyzed for the presence of *C. trachomatis, N. gonorrhoeae*, and *T. vaginalis*. A ligase chain reaction (LCR) assay was used to detect the presence of *C. trachomatis,* and *N. gonorrhoeae* DNA. *T. vaginalis* DNA was detected with a PCR-ELISA assay. In these analyses, we used a composite STI measure indicating a positive test for any of these STIs.

During the in-home interviews, sensitive questionnaire content on sexual activity was administered using computer-assisted self-interviewing (CASI) technology. Age of debut was defined as the respondent's answer to the question "How old were you the first time you had vaginal intercourse?" in the Wave III questionnaire (vaginal intercourse was defined as the insertion of the penis into the vagina). Age of debut was used as a continuous variable. Current age was defined as the respondent's age at the time of the Wave III questionnaire administration and was also used as a continuous variable. Other variables included sex of the respondent (male referent compared to female), ethnicity (non-Latino referent compared to Latino), and race (White referent compared to Black and other).

Data analysis

We used Stata (version 7.0) to incorporate weights and account for Add Health's sampling design in all analyses (24). All estimates are standardized to the U.S. Census Bureau estimates of the adolescent population demographics, as recommended by the Add Health research team (25). Preliminary analyses examined the frequency distributions of the variables of interest for the entire sample and for those positive for STIs. We used simple logistic regression to obtain adjusted estimates of the prevalence

odds ratios (PORs) of having an STI at Wave III. Respondent's sex, race, and ethnicity, which are associated with both sexual debut and STIs, were controlled for in multiple logistic regression analyses. Including both current age and age of debut in these models controls for the length of time an individual has been sexually active.

In addition to controlling for potential confounding in our models, we also examined if the relationship between early debut and STIs differed between different groups of respondents. Therefore, we included interaction terms in the full logistic regression model to determine if the association between age of debut and STI prevalence varied by the sex, race, ethnicity or current age of the respondent. In the initial full model, all variables and interaction terms with age of debut 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

The study sample of sexually experienced young adults was about half male and half female, and the majority of respondents were white and non-Latino (table 1). The mean current age in our study sample at Wave III was 21.8 years. Age of sexual debut ranged from 10 through 25 years of age, with a mean of 16.4 years. About a third of the sample had debuted by age 15 and over 90 percent had debuted by age 19. Age of debut was not associated with being dropped from the sample due to incomplete data. Almost 7 percent of the sample tested positive for at least 1 STI at Wave III. When examined in one-year age increments, the STI prevalence for all current ages was above 5 percent.

Bivariate relationship of debut age and STIs

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

Interaction with current age

In multiple logistic regression analyses, the relationship between debut and STI did not differ by sex, race, or ethnicity (interaction $p > 0.1$). However, the association of debut age with STIs varied between younger and older respondents ($p = 0.015$, table 2). For this reason, the prevalence odds ratios for age of debut were calculated for each current age group, using a reference debut age of 17 (figure 2). Although an early age of debut is consistently associated with higher STI levels compared to later debuts, the difference shrinks substantially among older respondents, suggesting that the association between debut age and STIs seems to dissipate with time (figure 2). For older adolescents, the age of debut makes a significant difference in the prevalence odds ratio. For example, the odds of having an STI for an 18 year old who had first intercourse at age 13 are over twice those of an 18 year old who had first intercourse at age 17 (POR: 2.30; CI: 1.44, 3.65). In contrast, the prevalence odds ratio comparing a 24 year old with a debut age of 13 to a 24 year old with a debut age of 17 is 1.12 (CI: 0.89, 1.41). Thus, earlier sexual debut is strongly associated with STIs for older adolescent males and females but not for young adults over age 23, when the association becomes insignificant.

DISCUSSION

To allocate resources optimally and design interventions for reducing STIs, public health professionals must understand the immediate and long-term impact of the interventions. Early sexual debut is often used as an indicator of risky sexual behavior and many interventions, such as virginity pledges and abstinence education, are designed to delay sexual activity (26, 27). Our study indicates that for older adolescents, as age of debut increases, there is a gradual decline in the probability of having an STI. Thus, programs that effectively prolong virginity most likely reduce STIs among adolescents, and make sense as part of a comprehensive strategy to reduce STIs among adolescents, who carry a substantial part of the STI burden.

However, our study also indicates that delaying debut would not be a sufficient strategy when attempting to reduce STIs among young adults (e.g., abstinence-only programs). Even assuming programs could substantially delay sexual activity, by young adulthood an older age of debut is no longer protective against STIs. Therefore, programs to delay sexual debut will have limited returns in terms of reproductive health among young adults. Given that the prevalence of STIs in young adulthood is sizeable regardless of debut age and that these STIs cause substantial reproductive health complications for this age group, other factors should be emphasized in prevention efforts as well. Resources vital to maintaining sexual health, such as health care and sex education, should be provided to youths before they become sexually active, whether that activity begins early or late. Furthermore, mechanisms to reduce rates of STIs may be different among late adolescents versus young adults. These mechanisms must be elucidated to develop appropriately targeted prevention and intervention programs.

These results, based on biological STI tests, complement and expand upon the results from the NSFG study on female self-reports of lifetime STI infection (17). Furthermore, our study provides evidence that the long-term STI consequences associated with early debut apply not just to females but also to males, who have been regularly excluded from previous studies. While the focus of past research on females may be driven in part by data availability, it can also lead to the misconception that the timing of debut is less important for males in terms of their sexual risk trajectories. Our research found that the association between debut timing and STIs did not differ between males and females. This suggests that programs aimed at delaying sexual activity should strive to effectively target both genders equally during adolescence. Furthermore, future research on the consequences of debut timing should not focus exclusively on females.

We also found that the relationship between sexual debut and STIs does not vary by race or ethnicity. As early debut appears to impact different race and ethnic groups similarly, effective programs that delay sexual activity would be equally beneficial across race and ethnic groups. This strategy could provide substantial benefits as a component of programs targeting high risk communities.

Our study used biological tests for STIs whereas several previous studies have had to use self-reports (3, 16, 17). Because many STIs are asymptomatic and self-reports of symptoms correlate poorly with biological tests for STIs, using self reports probably results in substantial under-reporting of infection (28). Self-reports may also introduce bias into previous studies, as diagnosis may depend on access to regular health services. Furthermore, unlike reports of lifetime infections, our data included the age of the

respondents at the time their infections were detected. This allowed us to explore how early debut is associated with the prevalence of infection among specific age groups.

Because the Wave III STI data are cross-sectional, some of the observed associations may represent cohort differences rather than developmental change between the ages of 18 to 23. However, it seems unlikely that, for example, the older respondents experienced a historical event that altered not only the relationship of current age to STIs but also altered the nature of the association between age of debut and STIs. The gradual decline of the importance of age of debut in predicting STIs is more likely explained by the continued development of the individual as time passes. Additional longitudinal research on young adults is needed to confirm that the influence of debut timing fades over time and is eclipsed by other factors as individuals age.

Sexual debut is dependent on self-report, which may introduce misclassification problems (18, 29). However, Add Health used computer-assisted self-interviewing (CASI), which allows respondents to answer directly into the computer for sensitive sections of the survey. This technology reduces the risk of accidental disclosure to the interviewer, improves privacy, and may reduce non-response and increase reporting of sensitive or stigmatized behaviors (30, 31). Nevertheless, CASI cannot mitigate the possible influence of recall bias. Sexual debut is likely to be a relatively vivid event for many respondents, though, and the time gap between the event of first intercourse and the reporting of this event in our sample is relatively short.

While the age of sexual debut may be a helpful indicator of risk for STIs among adolescents, clinicians should be aware that young adults who started having sex recently are at similar risk for STIs as those who have been having sex through most of their

adolescence. Future research could explore the mechanisms underlying the convergence of the prevalence of infections for early and late debuters among young adults. Instead of targeting the act of first intercourse itself, perhaps we should focus on what distinguishes persistently higher risk individuals from others during adolescence. This strategy would require further investigation into the possibility that early debut is a marker for more persistent problems among some youth and that other experiences may substantially influence the relationship between early debut and long-term STI risk.

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TABLE 1. Weighted percent of sexually experienced respondents in study sample and of those with sexually transmitted infections (STIs) by selected characteristics. Add Health, 2001-2.

	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%
Current Age		
Less than 22	44.7%	46.9%
22 or greater	55.3%	53.1%
Age of Debut		
Less than 16	33.6%	46.3%
16 or greater	66.3%	53.6%

TABLE 2. Multiple logistic regression model of sexually transmitted infection (STI) prevalence associated with age of debut among sexually experienced respondents in study sample. Add Health, 2001-2.

Characteristic	Beta Coefficient	Prevalence Odds Ratio	95 Percent Confidence Interval	p
Debut Age (continuous)	-0.75	†		0.007
Current Age (continuous)	-0.48	†		0.016
Debut*Current Age	0.03	†		0.015
Male (referent)		1.00		
Female	0.32	1.38	1.14, 1.68	0.001
Non-Latino (referent)		1.00		
Latino	0.65	1.92	1.37, 2.70	<0.001
White (referent)		1.00		
Black	1.82	6.19	4.90, 7.82	<0.001
Other Race	0.53	1.71	1.08, 2.69	0.022
Constant	8.55			0.057

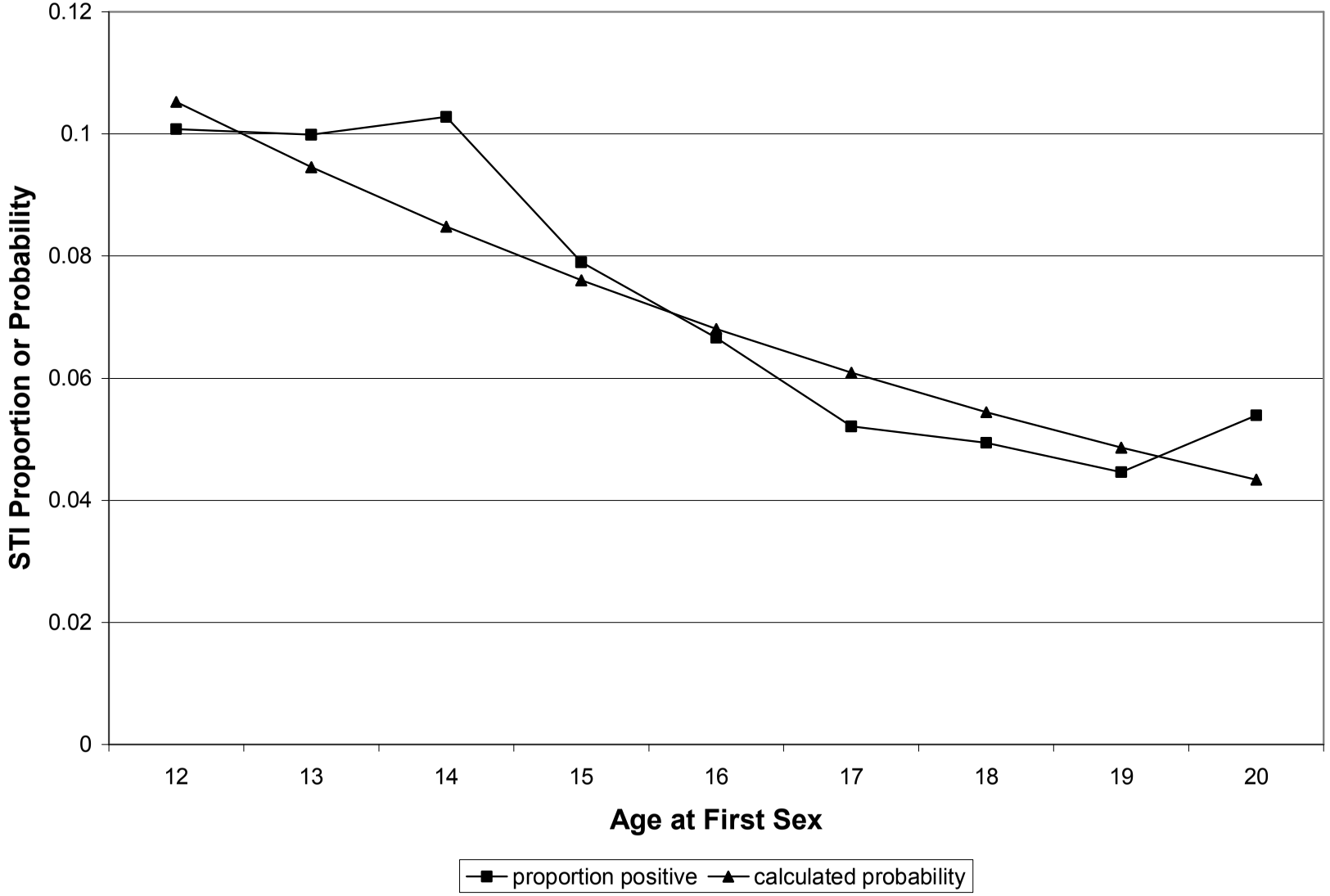
† Prevalence odds ratios for the continuous variables debut age and current age, with the interaction term, are shown graphically in Figure 2

LEGENDS FOR FIGURES

FIGURE 1: Weighted proportion with a sexually transmitted infection (STI) by age of first intercourse and corresponding probability of an STI calculated from simple logistic regression coefficients before adjusting for demographic factors. Add Health, 2001-2 (N=9,844).

FIGURE 2: Prevalence odds ratios from multivariate logistic regression analysis showing the relationship between age at first intercourse (reference debut age 17) and sexually transmitted infections (STIs) by current age, adjusted for respondent's sex, race and ethnicity. Add Health, 2001-2 (N=9,844).

FIGURE 1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STI Proportion or Probability
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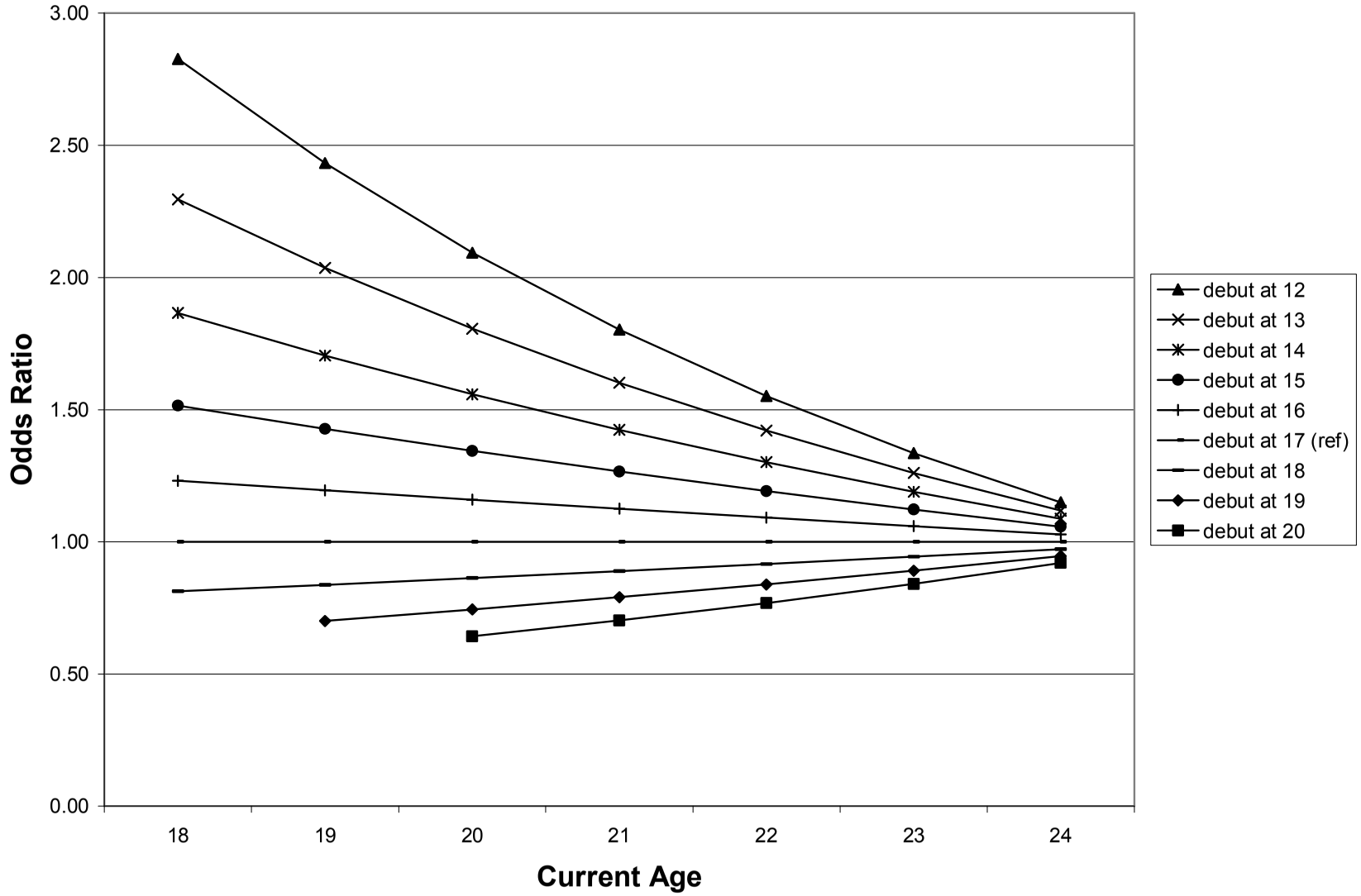
FIGURE 2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