

Promising the Future:
Virginity Pledges as they Affect Transition to First Intercourse

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Abstract

Since 1993, in response to an organized social movement sponsored by the Southern Baptist Church, well over two and a half million adolescents have taken public “virginity” pledges, in which they promise to abstain from sex until marriage. This paper explores the effect of virginity pledges on the transition to first intercourse. On one hand, we show that adolescents who pledge, controlling for all of the usual characteristics of adolescents and their social contexts that are associated with the transition to sex, are much *less* likely than adolescents who do not pledge, to have intercourse. The delay effect is substantial and almost impossible to erase. Taking a pledge delays intercourse for a long time. On the other hand, the pledge effect depends on age. Pledging does not work for adolescents at all ages. Second, pledging delays intercourse only in contexts where there are some, but not too many, pledgers. Too few, and too many, pledgers in the adolescent world can negate the pledge effect. The pledge works because it is embedded in an identity movement. Consequently, like other identity movements, the pledge identity is relatively fragile and meaningful only in contexts where it is at least partially non-normative. Consequences of pledging are explored for those who break their promise. Promise breakers are less likely to use contraception at first intercourse.

Gonna give you all my love, boy/My fear is fading fast
Been saving it all for you/'Cause only love can last
Madonna: *Like a Virgin*

Introduction:

Since 1993, in response to an organized social movement sponsored by the Southern Baptist Church, well over two and a half million adolescents have taken public “virginity” pledges, in which they promise to abstain from sex until marriage. By the standard set by most social movements, the pledge movement has been a resounding success. Heralded in the popular press as a movement of, for, and by adolescents, the pledge movement has expanded to include hundreds of church, school and college chapters. It is associated with the development of new products and cultural symbols (most notably in music), and is home to numerous interlocked Internet pages where adolescents can pledge on-line, purchase pledge merchandise, and interact with other pledgers in pledge-dedicated chat-rooms. Pledgers can even go to summer camps where only other pledgers can be found. The movement has been successful in organizing mass rallies in which speakers extol the benefits of abstinence to stadiums full of eager adolescents. Its growth rate has been phenomenal, and with it, the movement has spawned a whole new subculture in which it ‘cool’ to say no to sex, and where, according to one account, ‘virginity is hot’ (Young and Modern, May 1998, in an issue featuring the 100 secrets of Leonardo DiCaprio).

The pledge movement is really a movement organized by adults for adolescents and so, not surprisingly, while pledging is *for* adolescents, the movement is also attractive to many adults¹. Movement rhetoric stresses value orientations that are loosely labeled as “family values.” Supporters of the pledge like the idea that adolescents can take individual responsibility for their sexual life simply by promising to say “no thank you” to sex – at least until marriage. Others, on the other hand, are not as sympathetic to the pledge movement. On one hand, pledge critics simply don’t believe that something as simple as a pledge can work.

¹ The pledge movement is loosely organized. More than eighty autonomous organizations sponsor public pledges, support chapter formation, and participate in organizing rallies of varied scale. Movement organizers claim disinterest in the number of adolescents who have taken a pledge. They keep no formal records, and they have few formal mechanisms in place to co-ordinate the efforts of participating organizations. The pledge movement is one of the activist arms of the more general abstinence only movement.

Partly, they feel uncomfortable endorsing an element of a program (in this case, the pledge) that is based on assumptions that are antithetical to a liberal vision of the world, for example, the assumption that sex should only occur in the context of marriage. Critics do not necessarily oppose the idea of "saving" sex until marriage, but they think that it is an unrealistic foundation for social policy. Partly, critics find themselves uncomfortable with the pledge because many pledge supporters think that sex education sends the wrong message to adolescents². And partly, critics don't like the fact that the pledge movement rests on, and reinforces, the imagery of romantic love³. This is not because critics of the pledge are cynics, but rather because pledge rhetoric seems to be associated with traditional gender roles, in adolescence as well as young adulthood⁴.

Whether pledge supporters or critics, most adults are concerned about adolescent sex, here defined as intercourse⁵. Critics are more concerned about the observable consequences of sex: heightened risk for teenage pregnancy, abortion, and STD transmission, increased likelihood of participation in other risk activities, such as drinking, smoking, and substance abuse (Resnick et al, 1997; Tubman et al, 1996a,b; AGI 1994; Martin 1996; Thompson 1995). In this view there is nothing wrong with sex per se⁶. The problem with sex is that it has often has negative consequences, especially for girls, who typically feel worse after sex than before sex (Joyner and Udry 1998), and who face the risk of unwanted pregnancy. Pledge supporters do not articulate their opposition to sex in terms of the consequences of sex, because this would appear to legitimize "good" sex. Instead, they stress moral systems that justify saying "no thank you" to sex in and of itself.

² On this issue, feelings sometimes run strong. After hearing an earlier version of this paper read at a Planned Parenthood of NYC workshop, the President and CEO of SEICUS led the assembled crowd of 300 or so participants in a rousing chant: "Abstinence programs do not work". (Planned Parenthood of NYC, October 26, 1998).

³ An irony is that within the adolescent world, it is the rhetoric of romantic love that provides boys with the key cultural mechanism by which they 'work out a yes' from girls (Kaminer 1996, Thompson 1995, Martin 1996).

⁴ Critics are also concerned that pledging sets standards that are unrealistic for most adolescents. This may lead them too marry too young, inducing as a consequence marriages with higher chances of divorce. In 1988, the average time between sexual maturity and marriage was 11.8 years for young women and 12.5 years for young men (AGI, 1994). That is a long time to wait for sex.

⁵ Of course "sex", also involves more than intercourse. Most teenagers, and some adults, think otherwise for the most part, though, and in this paper we focus only on intercourse.

⁶ Brook-Gunn and Paikoff (1993), for example, define 'sexual well-being' not in terms of sexual behavior per se but with respect to the consequences of such behavior for adolescents. The task is then to help adolescents avoid negative consequences of such behavior.

To anticipate the main empirical findings reported in this paper, there might be something for everyone. Pledge supporters will find comfort in the fact that the pledge has a substantial effect on the timing of first intercourse. Adolescents who pledge, controlling for all of the usual characteristics of adolescents and their social contexts that are associated with the transition to sex, are much *less* likely than adolescents who do not pledge, to have intercourse. The delay effect is substantial and robust. Pledging delays intercourse for a long time. In this sense, the pledge works⁷. Critics of the pledge should find solace from two important caveats. First, the pledge effect is strongly conditioned by age. Pledging does not work for adolescents at all ages. Second, pledging delays intercourse only in contexts where there are some, but not too many, pledgers. Too few, and too many, pledgers in the adolescent world can negate the pledge effect. The pledge effect is largely contextual⁸.

We reach these conclusions with data from The National Longitudinal Study of Adolescent Health (hereafter, *Add Health*), which was collected at the height of the pledge movement, the period between 1994 and 1996 (Bearman, Jones and Udry, 1997). *Add Health* provides detailed information on the social contexts in which adolescents are embedded. The clustered design of *Add Health* allows us to investigate the effect of pledging, in the same interacting communities, on pledgers and non-pledgers alike. The longitudinal design of *Add Health* allows us to order cause and effect without ambiguity. Because our analyses operate on complex data structures at multiple levels of observation, showing the findings we identify involves a number of steps. These steps are outlined below.

⁷Later, we show that there are no obvious psychological down sides to pledging and then having intercourse anyway. Pledgers who break their promise (hereafter, promise breakers) and end up having intercourse feel no worse about themselves than other adolescents who have intercourse. But, promise breakers are less likely than others to use contraception at first intercourse. This means that promise breakers are at greater risk to the negative consequences of sex. That pledgers who have sex are likely to be contraceptively unprepared is to be expected, for it is hard to imagine how one could both pledge to be a virgin until marriage and carry a condom while unmarried.

⁸The pledge does not operate by changing individuals in obvious and easy to measure ways that are known to be correlates of adolescent sexual behavior. Just thinking about girls, those who are smart, unattractive, on sports teams, doing well in school, close to their parents, and have high self-esteem are less likely than others to have sex. Adolescents do not get smarter once they have pledged, they do not become less attractive, they do not gain or lose self-esteem, they do not suddenly join sports teams, do better in school, have better relations with their parents, or feel more attached to their schools. But they do delay intercourse.

We first briefly review the literature on sexual debut. Because the pledge is embedded in an identity movement, we consider the specific aspects of such movements that provide the foundation for both their success and failure. We then describe the *Add Health* study, and the design and methods of our analysis. We then describe the transition to first sexual intercourse and look at differences between pledgers and others⁹. Because we restrict our analyses of pledging to adolescents for whom we can unambiguously order intercourse and pledging, our sample is selective. We discuss the impact of sample selectivity for our results in Appendix A. The impact is negligible for non-black adolescents.

We then turn to multivariate event history models of the transition to first intercourse. We focus on identifying main effects and observe the strong impact of the pledge on the transition to first intercourse, controlling for all of the relevant factors associated with pledging. As the transition dynamics are different for adolescent females and males, we next test a wide range of gender interactions with a model focusing on individual level and partnership characteristics. Because pledge rhetoric invokes the idiom of romantic love, we focus on the interaction between pledging, emotional commitment within relationships, and the transition to intercourse. The results show significant race and gender differences. Specifically, whereas emotional commitment within relationships is positively associated with the transition to sex within that relationship for most adolescents, the opposite is true for black males. Black males are not likely to have intercourse in relationships characterized by emotional closeness. They are likely to have intercourse in relationships that invoke little emotional commitment.

Next, we explore context effects on the transition to first intercourse, specifically, the proportion of pledgers in a respondents' school for both pledgers and others. Here we identify the core contextual effect described above. We also show how pledging is driven by the proportion of pledgers in school.

We then relax one important assumption underlying the event history models previously discussed. Specifically, we explore possible age dependencies of the estimated parameter effects. Here, we ask whether

⁹Appendix B reports a full multivariate model of the determinants of pledging.

the presence and magnitude of factors affecting the transition to first intercourse depends on the age in which their influence is exerted. We show that most factors are critically sensitive to age. The pledge effect also depends on an adolescents' age.

After the detailed analysis of the effects of pledging on sexual initiation, we look specifically at health outcomes and the health behavior of pledgers and others who have had intercourse. It is easy to say that the pledge is not likely to work in the long run because eventually most everyone will transition to intercourse before marriage. But this is misguided, for even if pledging works only to delay intercourse, and even if pledgers eventually have sex before they marry, pledging may be a way to bridge some of the difficult years in early adolescence without (unwanted) sexual activity¹⁰. Still, critics have argued that promise breakers will feel guilty after sex and consequently lose self-esteem. Consequently, we first ask whether pledgers are worse off in terms of the consequences of sexual debut for psychological well being than non-pledgers. We show that promise breakers are not worse off with respect to self-esteem.

Finally, using a sample of adolescents who have had first intercourse within our observation window only, we model contraceptive behavior at first intercourse and examine whether pledgers are less contraceptively prepared than others. We show that there are differences between promise-breakers and others in their contraceptive behavior. Pledgers are less likely to use contraceptives. We conclude by focusing on implications of identity movements for social policy.

Social Influences on Adolescent Sexual Debut

There is a large literature on the determinants of first intercourse. Our empirical work builds from this literature. The key insight that we exploit is the recognition that adolescents are embedded in multiple social contexts -- families, schools, peer groups, and romantic relationships, -- and that these social contexts, in interaction with individual characteristics, are important determinants of adolescent behavior (Udry and

¹⁰About one quarter of all adolescents report that they have felt pressure from peers to have sex (Alan Guttmacher Institute 1994). Pledging may provide a useful tool for fending off such peer pressure. For an analysis of peer effects on sexual debut and pregnancy risk among girls, see Bearman and Brückner (1999).

Bearman 1998; Perry et al. 1993, Brooks-Gunn and Paikoff 1993). Our goal in this short section is to identify the salient influences on sexual debut discussed in previous work in order to provide the foundation for a baseline model from which we can assess the pledge effect¹¹.

Many adolescent “problem behaviors” like sexual behavior, drinking, smoking, are behaviors that are socially sanctioned, acceptable, and enjoyable for many adults (Udry and Bearman 1998). While not socially sanctioned, it is reasonable to think that they are also enjoyable for adolescents. Consequently, one idea is that in the absence of social control, all adolescents would engage in non-normative (enjoyable) behavior¹². It follows that one determinant of sexual behavior is the extent to which adolescents are subject to, and influenced by, social controls that operate to constrain opportunity to engage in non-sanctioned behavior, or heighten the costs of such behavior. Conversely, social influence (especially the influence of partners, for sexual behavior) may operate to enhance the perceived benefits of non-normative behavior. Many of the social context variables that we use in our baseline model derive from the social control perspective. The central idea is to capture through measurement the social influences on adolescents that shape the costs, benefits, and opportunities for sexual initiation.

Table 1 identifies the main social (and developmental) influences on sexual debut. Within each domain, core variables identified in prior literature and their hypothesized relationship to sexual debut that we use in our analyses are listed. For each effect we note if it is hypothesized to be protective (negative) or risk enhancing (positive). Many of these factors are likely to influence sexual behavior differently across the adolescent “life-course”. There are also strong indications in the literature that the transition dynamic for girls is different than for boys. Consequently, gender interactions across many of the variables capturing social influence are expected. Potential gender interactions are listed in Table 1. Comparatively little work has been done that focuses on age dependencies with respect to adolescent transition to first sex, but such dependencies are likely

¹¹See Udry (1988) for a review of the social control perspective.

¹²See Udry (1988) for a summary and critique of social control theory; Hofferth (1987) for a summary of research with respect to sexual initiation, and Brooks-Gunn and Paikoff (1993) for a summary with respect to the sexual well-being of adolescents.

important. Physical and pubertal development, for example, is likely to be more differentiated among younger teens (Udry and Billy 1987). Consequently it is reasonable to expect that the effect of physical development on the transition to first sex is stronger for younger adolescents than for older adolescents. Likewise, as adolescents get older, peers may become more influential, while parents' influence may decline with adolescents' increasing autonomy (Hofferth 1987; Bearman and Bruckner 1999). Consequently, we would expect to observe enhanced peer influence and declining parental influence on sexual behavior as adolescents age. For each influence listed, we note whether or not there is an expected age dependency.

Table 1 about here

Family context as social influence on the transition to first intercourse

Family context has been shown to have consistent and strong effects on the timing of first intercourse. Teens living in single parent families or with step parents initiate sexual activity earlier than those in two-parent families (Alan Guttmacher Institute 1994, Brooks-Gunn and Paikoff 1993, Hayes 1987, Harris 1996, Miller 1998). Social control theory provides the central mechanism for this effect: adolescents in non-traditional families tend to be subject to less supervision, and/or more permissive attitudes towards sex, by adults. Less supervision provides greater opportunity for engagement in non-sanctioned behavior, including sex. Adolescents' relationship to their parents, net of socio-economic background and family context, is also seen as an important correlate of sexual behavior. Adolescent feelings of closeness and connectedness to parents has been shown to delay sexual activity, as well as parental disapproval of sex (Resnick et al. 1997; Jaccard et al. 1996; Shew et al 1999) and adolescents' perception of their parents' disapproval of sex (Dittus and Jacquard 1998)¹³. If parent attitudes towards sex are not perceived to be strongly and consistently negative, adolescents

¹³Adolescent perceptions of parental attitudes about sex are accurate less than half the time. There are few studies that explore gender differences in parents' normative influence on teenagers' sexual behavior, although social control may be stronger, and undesirable behavior more negatively sanctioned, for girls (Martin 1996). In any case, Udry (1988) shows that social control indicators are more important for girls than for boys, whose transition appears to be more governed by opportunity and hormones.

may also think that the cost of early sexual initiation is lower. In general, connectivity to parents and siblings is protective because it increases the costs of behaviors that are not socially sanctioned. Parents' educational attainment and occupational status have also been shown to delay sexual initiation (Miller 1998; Hofferth 1987). Typically, the costs associated with negative sequella arising from early sexual initiation (including but not limited to pregnancy) are higher for adolescents from high SES backgrounds. Consequently, the social control perspective hypothesizes that SES is positively associated with age at first sex.

Peer and partnership influences on the transition to first intercourse

Consistent with the expectations of control theory, Bearman and Bruckner (1999) show that peer influences (net of family, individual, and social demographic factors) on the transition to first intercourse are generally "positive" -- that is work to delay age at first intercourse. Connections to peers, as with connections to parents, raise the costs of engaging in non-sanctioned behaviors. In contrast, partnership effects are generally "negative", that is they hasten the transition to first intercourse. The more frequently, and the earlier, adolescents date, the earlier they have intercourse. Commitment to a romantic relationship also plays a role in the timing of first intercourse (Furstenberg 1976, Spanier 1975). Likewise, partner and partnership characteristics are seen to play a key role in the timing of first intercourse. Critical in this regard is the extent to which the partnership is embedded in larger social networks and is characterized by emotional commitment. Partnerships that draw adolescents away from peers (that isolate them) are more likely to be associated with sex. Except for black males, emotional commitment within the partnership, controlling for partnership duration, is positively associated with the transition to sex within that partnership. These partnership effects are thought to operate on adolescents by changing their perception of the costs and benefits of intercourse.

Individual, biological, and social demographic influences on the transition to first intercourse

Independent of background and family structure, adolescents who have reached puberty are more at risk to intercourse than those who have not¹⁴. Smarter adolescents are more likely to delay intercourse

¹⁴This is more true for whites than for blacks (Udry 1988).

(Bearman and Brückner 1999, Halpern et al. 1998). Cognitive skills, interests outside the dating culture, as well as self-esteem are seen to be important delaying factors of sexual initiation for girls. Academically inclined girls are less interested in, and less interesting for, boys (Hayes 1987, Hofferth 1987). In general, the more adolescents do (constraining their opportunities and increasing their investments in socially sanctioned activities) the later they have intercourse. Participation in extra-curricular activities— both academic clubs and sport teams – delays intercourse (Bearman and Brückner 1999), as do a cluster of variables associated with attachment to and commitment to school (Resnick et al. 1997). These attachments draw adolescents into a wider circle of peers and activities, all of which raise the costs associated with early sexual debut. More religious adolescents tend to engage in sexual activities later than their less religious counterparts(Thornton and Camburn 1989; Miller 1998; Bearman and Bruckner 1999). Behavioral measures of affiliation with one’s religion seem to be more important than membership in specific denominations (Resnick et al. 1997; Hayes 1987, Hofferth 1987). This suggests that it is not religious prescriptions against sex per se that are salient for delaying intercourse, but rather the effect of increased connectivity to others arising from participation in church and community groups.

As noted above, these influences are likely to operate differently for adolescents of different age. Connections to peers and partners are expected to become more salient with age, whereas family influences are expected to be strongest for younger adolescents. Likewise, different pathways to sexual intercourse for boys and girls are expected. In general, contextual factors are thought to be more salient for girls, since the risks associated with sexual activity are disproportionately shared by females. Consequently, social influences that shape adolescent investments in others – whether peers, partners, or parents – are likely to have a greater impact on girls’ transition dynamics than boys’.

Our interest in this paper is in the effect of taking a virginity pledge on the transition to first sex, by sex, age, and social context.. To be able to estimate the independent effect of a pledge, we need to estimate baseline models for sexual debut. The influences described above, arising in part but not exclusively from

control theory, are those most often seen to shape transition dynamics, and provide the conceptual foundation for our measurement of the peer, partner, family, and associational contexts in which adolescents are embedded. Because social demographic and developmental variables play an important role in structuring opportunity, interest, and capacity, to have sex, our models control for well-established co-variables of sexual debut – pubertal development, age, intelligence, race, self-esteem, SES, and a battery of attitudes towards sex, including but not limited to perceived costs, benefits, and risks.

Identity Movements

The pledge is not a government program. Adolescents who pledge can get pledge cards but no one requires them to show them. Schools do not sponsor pledges, although they may allow pledge groups and clubs to use their grounds before or after school. They offer no special incentives for pledging and pledgers are not rewarded for pledging by schools. Pledge groups may arise from church youth-groups, but they are not isomorphic with them, and many non-pledgers and pledgers belong to church groups¹⁵. Instead, the institutional foundation of the pledge is the local pledge group. These are only loosely coordinated with each other though weak national leadership. The movement recruits pledgers to local groups through the internet, through church groups, through Christian music, rallies, but mostly from the energies of adults and adolescents in the community. The incentives the movement selectively provides to its adherents are identity and fellowship with other pledgers. The pledge identity is induced and sustained through interacting with other pledgers in the community who distinguish themselves from non-pledgers by their public pledge and commitment to the group. The pledge movement, in this sense, is an identity movement --that is, a movement that provides a frame for self-understanding (and consequently action in pursuit of that understanding) effective only in the context of, and interaction with, similar others who constitute a self-conscious community differentiated from others. The

¹⁵We considered membership in youth church groups as an independent variable affecting pledging and/or pledge effectiveness but it is not significant.

key to identity movements is that they need the other to induce the “self” (Hardin 1995; Laitin 1998; Bearman 1993).

Consequently, identity movements are prone to self-limiting dynamics governing recruitment and commitment. Specifically, as a group becomes successful, commitment to the identity declines. On one hand, the unique nature of the identity disappears as it becomes more normative (Hardin 1995, Calhoun 1991). Consequently it no longer commands a strong grip on behavior. On the other hand, as the movement becomes more normative, followers come into increased routine contact with non-followers, in-group interactions become less dominant, and new influences come to bear (Bearman and Kim 1997; Blau 1977; Rytina and Morgan 1982). Recruitment dynamics shift as well, associated with the same threshold effect governing commitment. If the movement successfully bridges the gap between heterodoxy and orthodoxy, there are no more reasons to join. Consequently, identity movements are by their nature minority movements.

If, as we argue, the pledge movement is an identity movement it should be characterized by the same self-limiting dynamics governing recruitment and commitment described above. Specifically, within each focal point (the local community) we ought to observe two inter-related outcomes: declining significance of the pledge effect at the point that pledging becomes normative, and declining impact of the number of pledgers on the probability of pledging (recruitment) after the pledge becomes normative. We test for these expectations subsequently, and find that they are confirmed.

Data, Design, and Methods

Data for the analyses reported on in this paper are drawn from the National Longitudinal Study of Adolescent Health (hereafter, *Add Health*), a nationally representative study of American adolescents in grades 7-12. *Add Health* provides data from three waves of data collection. Adolescents were included based on a multi-stage cluster sampling design. *Add Health* is a school-based study. The primary sampling frame was derived from the Quality Education Database, which lists all high schools in the United States. From this list, *Add Health* selected a stratified sample of 80 high schools (defined as schools with an 11th grade and more than

30 students) with probability proportional to size. Schools were stratified by region, urbanicity, school type (public, private, parochial), ethnic mix, and size. For each high school selected, *Add Health* identified and recruited one of its feeder schools (typically a middle school) with probability proportional to its student contribution to the high school, yielding one school pair in 80 different communities. Schools varied in size from less than 100 students to more than 3,000 students. The *Add Health* sample includes private, religious, and public schools from communities located in urban, suburban and rural areas of the country. The schools, and the students in them, are representative samples. *Add Health* replaced schools or school-pairs in each strata where a school did not agree to participate in the survey. Almost 80% of the schools that were contacted by *Add Health* agreed to participate in the study.

From September 1994 until April 1995, in-school questionnaires were administered to all students in each sampled school. Each school administration occurred on a single day within one 45-60 minute class period. Students not in school on the day of the administration did not complete the in-school instrument. Over 80% of all students completed the questionnaire. Seven schools did not allow us to survey students in the school, but did provide us with a roster, thus we have completed in-school questionnaires from over 90,000 students attending 141 schools.¹⁶

The in-school questionnaire provided measurement on the social and demographic characteristics of respondents. Students were asked about the educational and occupational background of parents, their household structure, risk-behaviors, visions of the future, self-esteem, and health status. Students were also asked to nominate their five best male and female friends. They reported on frequency of contacts with friends and the sports and extra-curricular activities that they participated in during the school year. School administrators also completed a one-half hour self-administered questionnaire in the first and third years of the study.

¹⁶The discussion is complicated by the fact that some schools are K-12, therefore counting as a single school pair. *Add Health* provides data on 80 school pairs and 148 (not 160) unique schools. We lose data on 7 schools. For more detail on the *Add Health* design, see Bearman, Jones, and Udry (1997) and Udry and Bearman 1998.

For the second stage of data collection (the *Wave I* in-home survey), *Add Health* obtained rosters of all enrolled students in each school. From the union of students on school rosters and students not on a roster who completed an in-school questionnaire, *Add Health* randomly selected a sample for a 90-minute in-home interview. Students who did not participate in the in-school survey were eligible to be selected for participation in the in-home main sample. Consequently, the *Wave I* sample includes students who did not participate in the in-school survey as well as students who had dropped out of school. *Add Health* completed 20,745 *Wave I* in-home interviews, with an 80% response rate. Parental interviews are available for slightly more than 85% of all adolescents in the in-home sample.

Data collected during the in-home phase of *Add Health* provide measurement on more sensitive health risk behaviors, such as drug and alcohol use, sexual behavior, and criminal activities in addition to detailed measurement of health status, health utilization, peer networks, decision making, family dynamics, aspirations and attitudes. In addition, *Add Health* collected detailed data on romantic partnerships, including but not limited to the sequence of activities with partnerships and the structure of romantic and sexual networks. The adolescent in-home interview was conducted using audio-CASI technology for all sensitive health status and health risk behavior questions. Adolescents listened to questions through earphones and directly entered their responses into a laptop computer, thereby eliminating any potential for interviewer or parental effects on their responses. ACASI technology has been shown to reduce response bias associated with sensitive questions and non-normative behavioral items (Turner et al, 1998).

The first wave of in-home interviews was initiated in May 1995 and completed in December 1995. Most interviews were conducted during the summer. Follow-up, *Wave II*, interviews with adolescents who participated in the first wave of the in-home survey were conducted between April and September 1996. Interviews were not attempted with *Wave I* seniors in *Wave 2*. Over 85% of all eligible *Wave I* respondents participated in *Wave 2*, resulting in 14,787 interviews.

The analyses reported in this paper make use of data from both in-home waves, the in-school interview, the parent interview, and school administrator surveys. School and network information comes from the in-school survey; all measures of adolescents' and parents' characteristics and attitudes are derived from the *Wave I* in-home interview and parental questionnaire; information on the timing of sexual initiation and romantic involvement is taken from both waves of in-home interviews¹⁷.

Measurement:

The focus of this analysis is the effect of taking a abstinence pledge on the transition to first intercourse. Adolescents who were not married at the time of the first in-home interview were asked whether they had “ever taken a public or written pledge to remain a virgin until marriage”. In the following, we first describe social demographic variables, then turn to family and individual factors. Many of the contextual variables we use in this analysis are new or less commonly found in the literature. Specifically, we explore network correlates (popularity and isolation), the characteristics of romantic partnerships (their emotional closeness and their social embeddedness), and school context. We describe these variables below. Appendix C describes each variable in more detail.

As noted earlier, differences between the transition behavior of white and black adolescents are well documented in the literature (e.g. Alan Guttmacher Institute 1994, Brewster 1994, Furstenberg et al. 1987). Therefore, we stratify the analysis by race and test for gender interactions within each group¹⁸. Hispanic and Asian respondents are included with the white sample and identified with a dummy variable. We measure SES as a composite index of parents' education and occupation, combining information from in-home adolescent and parental questionnaires.

Family type is measured in three categories: Adolescents living with both biological parents (comparison category); adolescents living only with their mother or father; and adolescents living with two

¹⁷See Bearman, Jones and Udry (1997) for a detailed description of the *Add Health* design and instrumentation.

¹⁸Black respondents are defined as those who either reported only ‘African-American’ as their racial background or reported some other racial background but gave ‘African-American’ as their main background.

adults one or both of which are step or foster parent(s) . We control for perceived parental attitudes towards sex. To measure closeness to parents we constructed an index from three questions ($\alpha=.87$, see Appendix C for exact wording).¹⁹

Sexual debut is generally conditional on interest in and ability to have sex, both of which are associated with physical maturation and puberty. In this analysis, we make use of data on self-reported physical development. Specifically, we use an index constructed from the mean of three items ($\alpha=.65$). Girls were asked about breast and body development, boys about facial and body hair growth. Both were asked whether they looked younger, about the same, or older than adolescents in their age/sex group.²⁰ As an indicator for psychological well-being we use a scale of *self-esteem* constructed from 11 items reported in Appendix C ($\alpha=.86$) rated on a Likert scale. Cognitive ability is measured with the *Add Health* PPVT. In previous research adolescents with greater cognitive skills have been found to delay intercourse (Hofferth 1987; Halpern et al. 1998). There is some indication that the relationship between IQ and sex is curvilinear (Halpern and Udry 1999; Bearman and Brückner 1999). We test this hypothesis and find little support for it with respect to either pledging or age of first sex. In addition, we control for GPA as an indicator for academic orientation and achievement.

Adolescents' *religiosity* is measured with three behavioral items ($\alpha=.85$; see Appendix C for wording): frequency of praying, church attendance, and importance of religion.²¹ *School attachment* is constructed by

¹⁹ We explored an array of factors associated with parental supervision, including but not limited to, time with parents, parent attitudes towards sex, parental supervision, perceived autonomy of decision making, and the number of dinners with parents each week. None of these variables are significant, consequently the final models we report do not include them.

²⁰ *Add Health* also asked about age at first menarche. One could imagine using this as a measure of physical development for females, but the correlation with the other items was low and the index performed better in the multivariate models than the age at first menarche variable. Also, there is no equivalent measure for boys.

²¹ We also introduced a measure of parents' religiosity using the same items from the parental questionnaire. Because this variable did not add anything to the model but created additional problems with missing data, we dropped it from the analysis reported below. In addition, we controlled for religious denomination (Catholic, black Protestant, moderate Protestant, pledge supporters Protestant, other denomination, none). Since the resulting 5 dummy variables did not contribute to the model after controlling for the behavioral measure, and, in particular, did not modify the impact of pledging, below we report only the estimates for religiosity for the sake of brevity.

taking the mean of 5 responses to questions measuring closeness to others at school, sense of belonging to the school community, and getting along with other students and teachers (see Appendix C). Participation in school sports activities is measured by a count of how many activities an adolescent participates in.

Network, partnership, and school context variables:

A simple measure of how popular adolescents are is the number of nominations as friends (including romantic partners) they receive from others in their school. Because we need data on complete social networks to calculate in-degree, this information is taken from the self-administered in-school survey. Unpopular, socially isolated, teens may be both less attractive and lack opportunity to recruit romantic partners among their friends and friends' friends. Since the distribution of the number of nominations is highly skewed, we constructed a dummy variable indicating unpopular teens.²²

The in-home surveys contain a wealth of information about adolescents' romantic relationships. For the 18 months before the first in-home interview, *Add Health* provides full retrospective information on start and end dates of relationships as well as a description of the behaviors occurring in each relationship²³. In order to make full use of this information we construct four time-varying variables from the relationship questions. A dummy variable indicating whether respondent is currently in a romantic relationship or not and a count of how many romantic relationships the respondent has had (including the current relationship), serve as measures of exposure. The nature of the relationship is measured with two indices. Social embeddedness of the relationship is constructed from three items asking about the occurrence of specific social events, going out together in a group, meeting each other's parents, and telling others about the relationship (see Appendix C for the exact wording). We expect social embeddedness to delay the onset of sexual activity in the relationship,

²²Highly popular adolescents are not different in their transition behavior than those with average popularity (results not shown, see also Bearman and Brückner, 1999).

²³For the purpose of this analysis, we combine information on romantic and 'liked' relationships. For the former, the associated name generator was "In the last 18 months ... have you had a special romantic relationship with any one?" For the latter, the survey asked whether the adolescent had done each of the following three things with the same person (excluding family members): holding hands, kissing someone on the mouth, and telling him or her "that you liked or loved them".

since embedded relationships are more visible to parents and peers and thus more subject to social control. *Emotional commitment* combines the following events: going out alone with one's partner, seeing less of friends, thinking about oneself as a couple, giving each other presents, and saying "I love you" to each other (see appendix A). We expect emotional commitment to increase the likelihood for initiating intercourse (Martin 1996, Thompson 1995).

One central concern of this paper is how the effect of pledging is mediated by adolescents' social context. We subsequently show that the effect of an individual adolescent's pledge on his or her transition to first intercourse depends on the prevalence of pledging in his or her school. The effects of pledging depend on the extent to which dating relationships are confined to the school itself. Where the social environment beyond the school context provides ample opportunity for romantic involvement, the school context is likely to matter less than in schools where romantic partnerships are largely limited to the school. We therefore define *socially closed schools* as schools where the overwhelming majority of adolescents' friendships are within school. For each school, we calculated the ratio of opposite-sex friendship and romantic ties sent to other students in the same school over the total number of ties sent by students in the school.²⁴ As an indicator for social closure we use a cut-off point of 83 % within school friendship and romantic partnership ties. This corresponds to the 65th percentile of the distribution of within school ties over all ties. In order to explore these context effects we introduce interaction effects between pledging, proportion of female/male pledgers in the school, and social closure²⁵.

We explore a whole array of items that measure adolescent attitudes towards sex, including but not limited to indexes that capture positive (it would help me relax, feel pleasure, be less lonely, gain the respect

²⁴We tested both the overall friendship pattern and only the opposite-sex friendship pattern for schools ($r=.49$). Both specifications yield the same results. We report the results obtained when using the opposite-sex friendship.

²⁵The distribution when using persons as unit of analysis corresponds very closely to that obtained when using schools as unit of analysis, that is, socially closed schools comprise about 30 % of our schools ($N=44$) and 30 % of our adolescents. The results are not sensitive to choosing any particular cut-off above the median. We explore as well a whole array of other school context variables, including but not limited to, school type, centrality of pledgers in school, relative density of school, school size, and the interaction of school type, individual religiosity, and school religiosity. These variables are not significant and we have trimmed them in the final models we present.

of my partner) and negative (I would feel guilty, it would upset my mother, I would lose my partner's respect) motivations to have sex. These variables do not affect the results we report and are not included in the final trimmed models because they are available only for respondents fifteen and older.. Finally, we explored a set of measures that capture adolescent engagement with non-normative behaviors, including delinquency, drinking, and trouble in school with teachers and students.²⁶

Methods

In this section, we describe our modeling strategy. We estimate a hazard rate model, modeling the duration from age at the *Wave I* interview to first sexual intercourse. Data for respondents who never had sex are censored at the time of the second in-home interview. For this kind of problem, where we have both right censoring (the event has not yet occurred) and time varying covariates, event history methods are appropriate.

There are reasons to assume that the transition rate will not be constant over time even when controlling for all kinds of factors affecting the transition to first intercourse. A flexible approach to this time-dependence of a rate is provided by a piece-wise constant model with time periods (Blossfeld and Rohwer 1995). In this model, the process time axis (age) is divided into periods. The rate may change between periods but is assumed to be constant within each period. Formally, the rate from the origin state j to the destination state k is defined as follows:

$$r_{jk}(t) = \exp\{\alpha_l^{(jk)} + A^{(jk)}\beta^{(jk)}\} \text{ if } t \in I_l;$$

where $\alpha_l^{(jk)}$ is a constant coefficient for the l th time period, $A^{(jk)}$ is a vector of co-variates and $\beta^{(jk)}$ is an associated vector of coefficients (Blossfeld & Rohwer 1995, p.111). The coefficients for the time periods express the baseline rate (comparable to an intercept in a regression model), while the covariates shift the baseline rate upwards or downwards.²⁷ The effect of the covariates on the rate is assumed to be proportional

²⁶These measure do not affect the final results and are left out of the models we report. In general, engagement in the adolescent sub-culture at low levels (a little drinking, a little partying) is protective against early intercourse, since it is associated with greater connections to the peer world.

²⁷This model is equivalent to a logistic regression with person-months as unit of analysis.

over time in this type of model. That means that the effect of the covariates in relative terms is assumed to be constant over the course of adolescence, while the ‘baseline’ rate is allowed to change over time. The division of the time axis into periods is arbitrary to some extent. The strategy we followed is to make the periods as small as possible while assuring that there are enough events (i.e. transitions) in each period to obtain stable and robust estimates for the rate. An extension of this basic model, the piece-wise constant exponential model with period-specific effects, allows us to test the proportionality assumption by estimating a time period-specific coefficient for each of the independent variables in the model.

In addition to right-censoring, we also have to take left-truncation into account, since we lose all respondents who already had sex by the time of the *Wave I* interview. One solution to left truncation which is easily implemented with the kind of model we will estimate is to let the risk period for each person begin at the age they were interviewed for the first time (a detailed explanation and alternative solutions can be found in Guo 1993).²⁸

Values for the time-varying relationship covariates are introduced in the model by means of episode splitting (Blossfeld and Rohwer 1995). Initially, each respondent contributes one episode from birth to first sex or interview date. When the values of time-dependent covariates change, the episode is split into two sub-episodes. The first sub-episode is assigned the start value of the covariate and is coded as right-censored, while the second sub-episode is assigned the new value of the time-varying covariate and the appropriate destination state.

Results

Table 2 provides basic descriptive information about the variables used in the analysis by sex, race, and pledge status. As table 2 shows, on the bivariate level, we find a number of similarities and differences between pledgers and others. For all groups, except for black females, perceived parental disapproval of sex

²⁸The survivor functions in Figure A2, appendix A, for the restricted sample are based on this correction for left truncation.

is higher for pledgers than non-pledgers. Except for black males, pledgers are also closer to their parents than non-pledgers. Pledgers have lower verbal test scores than others (except for black females) but, for black females and non-black males only, higher GPA, higher school attachment, and higher self-esteem. Female pledgers in the non-black group come from families with lower socio-economic status than others and their romantic relationships tend to be more embedded in their peer groups. In all groups, pledgers are significantly more religious than others. In a bivariate context, it is clear that pledgers come from more normative backgrounds than non-pledgers. Compared to non-pledgers, pledgers think their parents like them better. They may not be as smart. Bivariate differences between pledgers and others in age at sexual debut are discussed in appendix A.

Table 2 about here

Multivariate analysis:

We turn now to the multivariate analysis of the transition to first intercourse. The goal is to test whether the differences between pledgers and others account for pledgers delayed sexual initiation (see appendix A), or whether there is an effect of pledging that is independent of other characteristics of pledgers. A baseline model is reported in Table 3. We then test gender interaction effects across both groups (Table 4). We then introduce the school context effect (Tables 5a and 5b, model 2) and ask whether the estimated effects are stable across time as assumed in our basic model (Tables 6a and 6b). In Tables 4-6 we report the results in terms of relative risk of experiencing the transition. Coefficients that express the effect of independent variables on the baseline transition rate in proportional hazard models, are often denoted as, β and calculated as, $\exp(\beta)$. The number corresponding to $[\exp(\beta)-1]*100$ provides the expected percentage change of the baseline rate given a one-unit change in the associated covariate, other variables being equal. For an easier interpretation of the results, we report estimated $\exp(\beta)$ and the associated 95 % confidence interval. For variables with confidence intervals that include 1, we cannot reject the null hypothesis. For interaction effects for which we have specific hypotheses about the direction of the effect we use a one-tailed significance test and

report the associated 90 % confidence interval. The relative risk for non-black pledgers of 0.66 reported in table 2, Panel A, for example, means that for this group, the baseline rate is reduced by 34 % $((0.66-1)*100)$ for pledgers compared to others, other things being equal.

In table 3, panel A, we report the results for the hazard model for white, Asian, and Hispanic respondents. The time (age) axis is split into 11 periods of 6 months, except for the first and last period, which, due to the small number of events, are longer. In this model, adolescent females are seen to transition at the same rate as males. Hispanic respondents are not different from whites. Asians' risk of sexual initiation is about 33 % lower than whites'. Adolescents living with single parents or in step/foster families have a higher risk of sexual debut than those living in families with two biological parents (27 % and 24 % respectively). As in previous research, socio-economic status decreases the risk of sexual debut.

Table 3 about here

Closeness to parents has the expected direction, but is not significant in this model, while perceived parental disapproval of sexual activity decreases the relative risk by 20 % for each unit change on the 5 point scale. Adolescents in romantic relationships are more than twice as likely to experience intercourse, and exposure through previous dating relationships increases risk of sexual debut by about 16 % for each additional previous romantic partner. Emotional commitment in the current relationship increases the relative risk by 14 % for each unit change on the 5 point scale, while embeddedness of the relationship is not significant. Higher school attachment and higher grades decrease the risk substantially, as expected, while participation in school sports and self-esteem are not significant. Socially unpopular adolescents are less likely to have intercourse, while adolescents that are more physically mature than their peers are more likely to have intercourse. Higher religiosity decreases the risk of sexual debut.

Pledging decreases the risk of intercourse substantially and independently. Pledgers' relative risk of sexual initiation is estimated to be 34 % lower than non-pledgers, even after controlling for a wide range of

personal characteristics, religiosity, and other protective factors. This is the main pledge effect. It is robust to model specification. And it is observed even when the main correlates of pledging (see Appendix B) are in the model²⁹. We discuss the pledge effect further below. In the next section, we focus on gender interaction effects.

*Gender Interaction Effects*³⁰

We first discuss the results for non-black adolescents (table 4, panel A).³¹ In contrast to our expectations, family type and normative parental influences are not different for boys than for girls. While most interactions have the expected direction, they do not reach significance. Parents' socio-economic status, however, delays intercourse only for girls and not for boys³².

Table 4 about here

Although girls report having more relationships, are more likely to be in a relationship, and report higher emotional commitment and embeddedness in the relationships they are in, romantic involvement has the same effect on both sexes. Participation in school sports is significant only for girls. Self-esteem has positive effect on boys' sexual debut, whereas for girls, the positive effect of self-esteem is reduced to zero by the negative interaction effect.

For black respondents (table 4, panel B), the positive effect of pubertal development is greatly reduced for girls. Sports participation increases the likelihood of sexual debut for boys but not for girls. The most striking result is the gender difference in terms of black adolescents' emotional commitment. This is shown in

²⁹For black adolescents, (table 3, panel B) we observe few differentiating factors . The baseline time periods are fewer and longer for this sample, due to the smaller number of cases and events. The only significant factors here are being in a romantic relationship and GPA. The pledge does not make a difference.

³⁰Table 4 reports results for main and interaction effects in two separate columns for ease of comparison; i.e. we do not estimate a separate model for males and females. The first column in each panel in table 4 reports main effects, the second column interaction effects with gender. Thus, the effect for boys can be seen in column 1, whereas effects for girls are obtained by adding column 1 and 2 in each panel. The models reported in table 4 allow for gender differences in the effect of all independent variables on sexual debut, whereas the models reported in table 3 constrained the effects to be the same for boys than for girls.

³¹For reasons of space, we omit the coefficients for the baseline rate in table 4.

³²For girls, higher SES may indicate a more protective environment, for boys, higher SES may provide them with useful resources for attracting adolescent females, e.g. cars (table 4, panel A).

figures 1a (males) and 1b (females). In contrast to all other groups, emotional commitment within a relationship decreases black boys' transition rate. One interpretation of the impact of emotional commitment on black males' sexual behavior may be a 'double standard' common in populations with a large excess of females over males: that is, one does not love the women one has sex with and vice versa (Guttentag and Secord 1983).³³ This finding has implications for the pledge movement, which assumes that sex is the expression of romantic love. That this is not true for black males suggests one of the reasons why we cannot observe a pledge effect in our sample.

Figures 1a and 1b about here

In contrast to our hypotheses (see table 1), we find little evidence for gender differences in the effect of social control. Most important for this paper, there are no significant gender interactions with respect to the pledge, which works for white, Hispanic, and Asian adolescent males and females in the same way. The key finding for blacks is the inversion of the role of emotional closeness in relationships observed for black males. We return to this below.

The Pledge Effect in Context:

In this section we focus on the mediating role of school context in shaping the impact of the pledge (tables 5a and b). We first report a new baseline model in table 5a (model 1) for non-blacks and table 5b (model 1) for blacks, containing only gender interaction effects that turned out to be significant in the models reported in table 4 (panels A and B)³⁴. We then add the interaction terms described below in the second model

³³We find the same result when analyzing a more inclusive sample, starting the observation at the time retrospective data on relationships starts, namely 18 months before the first in-home interview. However, for this sample we cannot include a large part of the protective factors included in the model reported in table 2 since measurement occurred after we observe these relationships.

³⁴In these analyses, we include only significant gender interaction effects. Excluding non-significant interaction terms from the model does not reduce model fit. Including all interaction effects introduces collinearity (note that the standard errors in the model for blacks are already affected by collinearity as can be seen by the huge confidence interval for the coefficient for female). For reasons of space and ease of interpretation, we report only the estimates for the reduced model specification.

reported in tables 5a and b. We first distinguish schools with respect to their providing the focus for adolescent friendship and romantic relationships. For all groups, we can observe a significant three-way interaction between pledging, social closure in the school, and percent of pledgers of the same sex in the school.³⁵ We focus the discussion on the results for non-black adolescents (table 5a, model 2). The results for blacks (table 5b) are similar than those discussed below but more difficult to ascertain since the interaction terms are significant only at a .1 % level. The effect is complex.

In socially open schools, where less than 83 % friendship and romantic ties to the opposite sex are sent within the school itself, the delay effect of pledging on an individual's transition rate depends on how many other students of the same sex have pledged. Where no other pledgers were present at the time of the first in-home interview, pledgers transition at the same rate as others. In short, there is no delay effect. The more other pledgers are present in the school, however, the later pledgers initiate intercourse. Specifically, for non-black adolescents (table 5a, model 2), for every 1% additional same-sex pledgers, the rate of transition to first intercourse is delayed by 2%. In socially open schools, pledging works to delay intercourse only if there is an interacting community of pledgers.

Tables 5a and 5b about here

Call schools where the majority of cross-sex friendship and romantic relationship ties are sent to other students in the school "socially closed". For socially closed schools (30% of the schools in our sample), where social relations are largely confined within the school, the opposite obtains. Where no other pledgers are present, pledgers are much less likely than others to experience sexual debut. Where many other pledgers are

³⁵Introducing only interaction effect terms for pledging and percent same-sex pledgers results in non-significant coefficients. The context effect of pledging thus depends on whether social relations are largely confined within the school. This result is not substantively sensitive to the cut-off point chosen for social closure, but the estimates get smaller when using a lower cut-off and greater when using a higher cut-off. We present the full interactional model in tables 5a and b, including the estimates for non-pledgers; when restricting the model to the context effect for pledgers only, the interaction effects yield a significant improvement of the model fit ($\chi^2=8, 3 \text{ df}, p=0.04$). Excluding the non-significant parameters does not affect the estimates for the significant interaction effect parameters.

present in these schools, pledgers' transition rate is higher than that of pledgers in schools with few pledgers. These findings are illustrated in figure 2, which reports the estimated relative effect of % pledgers on the transition rate for non-black pledgers in both school types.

Figure 2 about here

For adolescents in schools with more than 30 % pledgers, the relative change in the baseline rate changes from negative to positive, indicating a threshold for pledging's effectiveness.³⁶ Once the pledge becomes normative, it ceases to have an effect. The pledge identity is meaningful, consequently, only if it is a minority identity, a common situation for identity movements³⁷. In socially open schools, all identities can be in the minority.

The pledge movement as an identity movement and the pledge effect as an identity effect would be consistent with an empirical observation that the effect of pledging approaches zero with increasing proportion of pledgers in a school. Instead, we observe a reversal of the effect, i.e. a positive effect of pledging on the hazard rate? To interpret this reversal recall that the rate is a 'temporally local' dimension.³⁸ As time goes by in each school, we assume more students pledge. If the proportion of pledgers in socially closed schools with a high proportion of pledgers converges on that of non-pledgers, pledgers have to 'catch up' with non-pledgers, resulting in a transition rate that is actually higher than that of non-pledgers. The same dynamic appears earlier in this article as well. Early gender differences and later convergence in the survivor functions for the transition

³⁶There are 14 schools in our sample with 30 % and more pledgers (that is about 10 % of all schools contained in this sample). These 14 schools, 8 of which are socially closed schools, contribute 348 adolescents to the sample. This results in 141 adolescents in socially closed schools with 30 % and more pledgers in them. Of these 141 persons, 85 are pledgers. Socially open schools with with 30 % and more pledgers contribute 206 adolescents, 136 of whom are pledgers.

³⁷The lack of a similar threshold for socially open school may simply mean that we capture more effectively the relevant social context, since the measurement of the context effect is more precise when social relations are largely taking place within the school.

³⁸The classic illustration of this property of a rate is the comparison between the volume of water in a container (i.e. the proportion of units experiencing some event) and the speed at which the water filling the container leaves the faucet (the transition rate).

to first sex (figure A 1) necessarily translates into different estimates of the gender effect on the baseline rate depending on which ages we look at. When looking at a sample that includes early transitioners, females are expected to have a lower transition rate than males. When looking at later ages, the rate for females is higher than for males — females have to ‘catch up’ with males in order for the proportions to converge, as they do in figure A 1.³⁹

Consider by analogy two tubs of water that both have to become full (e.g.. eventually transition to first sex). If one faucet is running at full blast it fills up quickly. The other faucet runs more slowly, so at a certain time it is less full than the first. But, in order for both tubs to be full at roughly the same time, the second faucet needs to release water more quickly at some time. This faster release of water to achieve parity is the positive effect on the baseline rate. Substantively, pledgers in schools with many pledgers would not transition to sex more quickly if they were not already delayed.

Our data are limited in a specific way: we do not observe the process of pledging in schools over time, and the data are right-censored and left-truncated. The best we can do with the data is to estimate a proportion of pledgers at a specific point in time and observe what happens after that. If we could operationalize context in a time-varying fashion we would most certainly observe a flattening-out of the context effect: because we could observe **individuals and the movement as they grow together**.⁴⁰ In the data that we have, we observe teens in socially closed schools with many pledgers on the average in a phase in which they are catching up with non-pledgers.⁴¹ Note, however, that figure 2 is assuming a proportional hazard rate. What we **can** do is

³⁹In the next section, we test for such age dependencies of the effect of pledging and other covariates on the transition rate.

⁴⁰We tested for non-linearity in the context effect by breaking up the distribution in sets of dummy variables (e.g. 0 up to 15%, 15 up to 30 %, 30 % up to 40 % pledgers, above 40 %). We tried out different cut-offs for the groups but there was no indication that the effect turns around. The model fit did not increase, and the dummy variables indicating high percentages of pledgers were significant in interaction with school type.

⁴¹AJS reviewers also suggested to use ‘social closure’ as continuous variable rather than as a dummy variable with an arbitrary cut-off point and to represent the resulting three-way interaction between pledging, context, and school closure as a three-dimensional plot. Unfortunately, the distribution of the social closure measure (proportion of opposite-sex friendship ties within school) is not normally distributed (most teens are in schools with very few outside ties). In addition, the use of a continuous variable for the three-way interaction implies a linear association of social closure with the interaction effect of pledging and proportion pledgers, an assumption that does not hold in these data

let the context effect vary across different ages. When we relax the proportional hazard assumption, we do see a decline of the context-school type interaction effect (see table 6a).⁴²

For adolescents who have not taken a pledge, in contrast, the school context effects are not significant.

That is, their transition rate is not affected by the presence of pledgers in the school. This suggests that the

(see footnote 22 for the choice of a cut-off point). It was also suggested to employ a ‘more naturally’ dichotomous school characteristic such as urban or regional characteristics as a substitute for the social closure measure. There is no one-to-one correspondence between rural settings or location and social closure, however, and it seemed preferable to use a concept that has direct bearing on the nature of the underlying sociological mechanism rather than a categorical proxy which introduces both measurement error (since there are socially open schools even in non-urban settings and in the South, for example) and conceptual ambiguity. Although characterizations of the environment such as urbanicity and region are associated with the outcomes studied in this paper, in the multi-variate context of the analysis shown they do not contribute to any of the models, most likely because we control for a great number of intervening variables such as individual and family characteristics.

This is the closest that we can come to modeling the process. Reviewers suggested using the estimates of the odds of pledging obtained in the logistic regression reported in appendix B instead of the observed pledge as a covariate in the hazard models, even though these estimates would be based on a different sample. The idea is to rule out the possibility of correlated errors resulting from the fact that pledging in schools where pledging is common is in part a measure of being in such a school. In other words, the proportion of pledgers in the school would be an indicator of the extent of ‘unobserved heterogeneity’ among pledgers, but only in some schools and not in others. It is a well-established finding that as a movement grows, members will be more heterogeneous with respect to their backgrounds and orientations. For the unobserved heterogeneity interpretation to be consistent with the reported results, however, social closure has to be interpreted as an indicator for heterogeneity of pledgers (albeit only when many pledgers are around). Hence, we also need to find some property of the school that accounts for both wide-spread pledging of heterogeneous students and a tendency for friendship ties to be organized within the school. We have tried to rule out the presence of any such property we could think of in terms of characteristics of students, parents, and schools. For example, small schools may have both more heterogeneous students (in spite of residential segregation) and be socially closed. Conversely, large schools may have a more heterogeneous but larger student body and thus could have a critical mass of homogenous pledgers AND be socially open. However, socially closed schools are on the average slightly bigger than socially open schools. In addition, the school type-context interaction effect cannot be reproduced/erased with a school size-context interaction effect. But beyond this, the proposed strategy cannot work for our analyses. The reason why we used observed rather than predicted pledging in the sexual debut models is a time-ordering issue. Recall that the strongest predictors of pledging are characteristics that vary over time (being in a romantic relationship, number of partners, and, most importantly, proportion of pledgers in the school). Because we have no information on the timing of pledges, we cannot use these predictors for estimating the odds of pledging for adolescents in the sample used for predicting the timing of sexual debut because we do not know their values. Imagine further if one would use the current values (e.g. romantic involvement, prop. pledgers) of the determinants of pledging to calculate the predicted log-odds of pledging for our debut models. Since all the variables predicting intercourse are also in the pledge prediction equation, by definition one throws away the unique contribution pledging makes because the predicted score would consist only of the contribution the other co-variables make to pledging. Since we control for all of these in the sexual debut model, the predicted odds of pledging should not have an effect by definition. Unobserved heterogeneity of pledgers, in a way, is exactly what makes them pledgers and different from others. Of course, in the debut models, this is not technically unobserved since we measure it as pledge. But it is unobserved in the pledge model – it’s exactly the part we would throw away if we used the predicted odds. This would not be the case if we had measures of the predictors of pledging before pledging occurs. But our data do not allow us to do this.

alternative interpretation of the threshold effect we identify in socially closed schools -- that once there are too many pledgers in a school, others concentrate their romantic efforts on trying to seduce pledgers since there are too few alternative outlets (a sort of opportunity argument) -- cannot be accurate. If this were true, we would expect to observe an effect of the proportion of pledgers on *non-pledgers*. The coefficient for the effect of the prevalence of pledging on non-pledgers, however, is not only not significant but is also very small.

The mechanisms by which the pledge operates are revealed through this contextual effect. If there are no pledgers, there is no pledge effect. Too many pledgers and the pledge effect disappears. Pledging will work only in so far as it is non-normative and constitutive of individual identity in the larger adolescent sub-culture. The upper bound on pledging's effectiveness provides a cautionary note to those interested in universal social policies. We discuss this further below.

Relaxing the proportional hazard assumption

The models presented so far assumed the effects of explanatory variables to be constant over time. There are reasons to assume, however, that some factors are more important early on in the process while others figure more prominently later on.

We are especially interested in the effectiveness of the pledge across the life course of adolescence. In the following analyses, reported in table 6a and 6b, we therefore relax the proportionality assumption and estimate a model in which the effect of all the independent variables is allowed to vary across time periods. This involves estimating a great number of parameters. To ensure that there are enough events and variation in the independent variables for each time period, we divide the observed age axis into three time periods which roughly correspond to early (12½ up to 15 ½), middle (15½ up to 17½), and late adolescence (17½ and older). For black adolescents, we choose slightly different age periods that reflect the earlier onset of puberty and sexual behavior. The results are reported in table 6a for non-blacks and table 6b for blacks. The results for blacks are based on a rather small number of events and should be interpreted with care.⁴³

⁴³We omit the interaction effects in the model for blacks due to convergence problems.

Tables 6a and 6b about here

The direct gender effect increases with age as girls catch up with boys. Hispanic adolescents differ from whites mainly in middle and later adolescence, Asians in middle adolescence (table 6a). Our expectation was that parents' influence on their teens behavior would be greatest in early adolescence and decline later as their children achieve more independence and autonomy. For non-black adolescents, this hypothesis is born out. Closeness to parents has a significant effect only in early adolescence. Recall that it was not significant in the simpler model reported in table 5a. With respect to family type, the results are less conclusive although there is a tendency for the effect size to be stronger in early and middle adolescence. For girls only, parents' socio-economic status has significant effects only in late adolescence. Perceived parental disapproval of sex, however, is a strongly delaying factor throughout adolescence (table 6a). The time-variant influence of family type is more pronounced for black adolescents (table 6b). The coefficients for closeness to parents and parental disapproval have the expected direction, are greater in early adolescence, but are not significant.

For both black adolescents and others, the effect of being in a romantic relationship is almost twice as large in middle and late adolescence than in early adolescence. The effect of number of prior romantic partners decreases. First sex happens in the context of a romantic relationship. Adolescents who date a lot at an early age will also have sex earlier than others. For non-black adolescents, emotional commitment within relationships and embeddedness of the relationship in the adolescents' social world have the most pronounced effects in middle adolescence.

School attachment is a protective factor in early and middle adolescence for non-black adolescents. For blacks, in contrast, it is only significant and negative in late adolescence (table 6b). The effect of social isolation is, compared to that in the model in table 4, reduced in size (except for late adolescence) and not significant. As expected, pubertal development is most important for young adolescents; each one-unit change in the 5-point scale is estimated to increase the transition rate by 41%, other things equal, while for young black

males, it is almost twice as large (83 %). As in the simpler proportional hazard model reported in table 5, cognitive ability is not related to the timing of first intercourse for non-blacks (but delays intercourse for older blacks). Both academic achievement and sports participation (for non-black girls only) have the strongest delay effect in early and middle adolescence. The gendered pattern of self-esteem's influence for non-blacks is pronounced only in late adolescence, when girls with high self-esteem are actually less likely to experience sexual debut than girls with low self-esteem. This negative effect of self-esteem for girls is consistent with the idea that girls with a developed sense of self find it easier to refuse sex when negotiating romantic behavior with their male partners (Martin 1996). The change of the effect over time and the gender interaction account for the fact that many studies do not find any effect of self-esteem on sexual initiation (Hofferth 1987; Brown and Theobald 1999). Religious adolescents are slower to experience first intercourse only in middle and late adolescence.

Pledging context and age dependency:

The context interaction effect between pledging, % pledgers, and school type is extremely strong only in early adolescence (table 6a).⁴⁴ In middle adolescence, the effect of pledging is 'individualized' while in late adolescence, neither pledging nor the interaction effects are significant. When omitting the interaction terms, we obtain an estimated relative risk for pledgers of .79 (p=0.28) in the early period, .49 (p=0.0002) in the middle period, and .72 (p=.11) in the late period: only the coefficient for middle adolescence is significantly different from zero. This timing pattern is similar in the model for blacks, although none of the coefficients are significant. This age dependency further conditions the effectiveness of the pledge. It works, but only for a subset of adolescents in specific social contexts defined by the proportion of other pledgers.

Overall, relaxing the assumption of time-constant effects yields different conclusions about the factors influencing sexual initiation. Focusing on age dependencies provides additional information about the

⁴⁴Because of convergence problems, we could not test the time dependence of the context effect for black adolescents (table 6b).

effectiveness of various factors across age periods. The idea that individual attitudes and personality become more important as adolescents get older is born out by this model. It is noteworthy that parental disapproval of sex is strong throughout adolescence.⁴⁵ For older adolescents, first sex is more likely to happen in the context of a romantic relationship. For non-blacks, the effect of pledging is highly context-dependent in early adolescence, more individualized in middle adolescence, and probably absent or much smaller in late adolescence. Thus, while it may be unlikely that most pledgers will delay intercourse until marriage, pledging significantly delays intercourse for the majority of pledgers in early and middle adolescence.

Promise keepers and promise breakers:

Critics of the pledge movement suggest that pledgers who break their promise and experience sexual intercourse will suffer negative psychological consequences. To assess this criticism, we consider two scales that measure psychological well-being, the self-esteem scale used in the transition models above, and an 11-item depression scale. For all groups except for black males, teens who had first intercourse experience a loss of self-esteem compared to those who remained virgins (results not shown; tables available from the authors). Female pledgers experience an increase in self-esteem between waves, and the interaction effect between pledging and having intercourse is not significant for any group. We found no indication that changes in self-esteem associated with intercourse depend on the timing of intercourse or on age at the time of the first wave interview. Hence, pledgers do not lose more self-esteem when they break their promises than others. The same obtains when using the depression scale, and in a multivariate model controlling for relationship with parents, religiosity, school integration, academic orientation, network position, and romantic involvement. Thus, pledging has no negative consequences in terms of psychological well-being, even for teenagers who break their promises.

⁴⁵Parents' own report of disapproval of their teens' having sex is only weakly related to adolescents' sexual behavior (results not shown). Most adolescents don't really know what their parents think. But what they think they think is what counts.

We do find, however, an effect of pledging on the likelihood of using contraception at first intercourse. In this analysis, reported in table 7, we look only at teens who had first intercourse between waves. We use a set of predictors similar to that used in our model of first intercourse.⁴⁶

Table 7 about here

Table 7 shows the results of a logistic regression of the probability of using contraception as a function of socio-economic background, relationship to parents, school integration, academic achievement, religiosity, and pledge status⁴⁷. Neither parents' socio-economic status, age at first intercourse, nor cognitive ability are significant in this model. On the other hand, GPA, which is conceptually closer to academic aspirations, has a strong effect on contraceptive use. This suggests that contraceptive use is strongly associated with investments adolescents make in school. Hispanics and Asian are less likely to use contraception than whites. We found no indication for gender/ethnicity interaction effects. The key finding for this paper is the effect of pledge status. The estimated odds for contraceptive use for pledgers are about one third lower than for others. Pledgers are less likely to be prepared for an experience that they have promised to forego. It is hard not to imagine the dissonance that would arise if they were contraceptively prepared. This suggests that pledgers, like other adolescents, may benefit from knowledge about contraception and pregnancy risk, even if it appears at the time that they do not need such knowledge.

Discussion:

Many adults are concerned about adolescent sex. Many adolescents are concerned as well. Many adults worry about the negative consequences arising from early transitions to sexual behavior. They seek ways to

⁴⁶Information on romantic relationship is averaged over the observation period (until first intercourse occurs). Alternative specifications (last or current relationship) yield the same conclusions.

⁴⁷We have omitted black respondents from this model because we know the sample to be selective. In this sample, blacks are more likely than any other group to use contraception at first intercourse — about 75 % of all black teens do, and the multivariate model used for blacks yields little information about blacks' contraceptive behavior. With the exception of GPA, none of the predictors accounts for differences between users of contraception and others for blacks.

help adolescents negotiate the complex and contradictory messages they get about sex. The pledge movement is organized by adults for adolescents. It is designed to help adolescents say “no thank you” to sex. In general, if adolescents do say “no thank you”, they are better off. They have fewer health risks and they feel better about themselves. Programs that work to delay first intercourse make a contribution to adolescent health. Even if we did otherwise, or if some adolescents felt that they ought to do otherwise, they are better off waiting. This is especially true for girls who are better able to negotiate better (safer) sex the older they are.

Pledgers come from normative backgrounds. They pledge because they do not want to have sex. They do not need to pledge to avoid sex, but pledging helps them not have sex. On the average, it reduces the baseline rate of time to sexual debut by 34%. A pledger with 4 romantic partners has the same relative risk of sexual debut as a comparable non-pledger with no romantic partners. The pledge effect is not a selection effect. It is real and it is substantial. But it is not a panacea for all our ills or all of our adolescents. It works the most for younger adolescents. It works only in specific contexts. The limits of the pledge’s effectiveness provide insight into the mechanisms by which it operates.

The key mechanism is that pledging creates a moral community. Pledgers participate in this community and take on a pledge identity. Their joint participation sustains this identity and makes it meaningful for their behavior. Movement organizers are well aware that their movement will be successful if it builds a new identity. Pledge paraphernalia available on the Internet provide visible markers of identity, pledge rings, pledge music, pledge books. Pledgers need to be visible to others. This is because pledging outside of a community of pledgers provides no protection for adolescents. Pledgers may pledge, but they cannot determine the effect of the pledge all by themselves.

The importance of pledging for the pledge movement itself is significant. As reported in Appendix B, the effect of other pledgers among same sex adolescents in each school on pledging is curvilinear. Up to a threshold of around 40% pledgers, all other covariates of pledging considered at their means and modes, the probability of pledging increases by 1% for every additional 1% same-sex pledger in an adolescent’s school.

At higher levels of pledgers, the curve flattens out and the effect turns negative. This relationship is illustrated below, in Figure 3.

Figure3 about here

Pledging thus provides fuel for its own growth and success, up to a limit. This phenomenon of self-sustained growth, with an associated threshold, is common to identity movements. For an identity to be meaningful – that is to have a meaningful relationship to behavior – it must be embedded in and sustained within an interacting population of persons. Public pledge events work to encode pledging into a moral community. The community is effective only if it has self-conscious recognition, which presumes minority status.

The contextual effects we identify point to the mechanisms through which the pledge effect operates. When the pledge works it works because pledgers are embedded in an identity movement. Like other movement identities, the pledge identity is relatively fragile and meaningful only in contexts where it is at least partially non-normative. If everyone took the pledge there would be no pledge effect on the transition to intercourse.

Not surprisingly, as with most social movements, the pledge movement has contradictory elements. Pledge rhetoric stresses making your own decision and getting away from the crowd. But the movement produces as a by-product of its core activity (public-pledging) something even better than a crowd, specifically, a visible moral community. Because pledging generates a public moral community, pledging also provides, consequently, both a cognitive foundation for new identity (someone who has made a commitment) and the structural context (a community of interacting pledgers) in which identity can be articulated and practiced. The moral community of pledging is the key to its success and failure.

Critics of the pledge movement are as concerned about adolescent sex as are the supporters of the movement. They are both wrong and right about the pledge. They are wrong when they think it does not work. But they are right when they think that it cannot work as a universal strategy. Of course, pledging will not work for adolescents who want to have sex. That is always true. But pledging does not work in some social

contexts even for pledgers who do not want to have sex. If pledgers attend a school which is the focal point of their social relationships, and if too many other students in their school pledge, the pledge effect disappears. In these contexts, about one-third of schools in the *Add Health* sample, pledgers transition to first sex at the same rate as non-pledgers. Beyond this, if pledgers do have sex, they are less likely to be contraceptively prepared than non-pledgers.

Implications for social policy

Individuals decide to pledge or not to pledge. The pledge movement attracts adults and adolescents who are pledge supporters. Pledgers do not want to have sex when they pledge. But they cannot determine the effect of the pledge all by themselves. In some contexts, if there are no other pledgers around, the pledge effect disappears. In other contexts, if there are too many pledgers around, the pledge effect disappears. The contextual effect we identify suggests interesting limits to the applicability of a universal pledge-based policy. Like most other things, pledging works in moderation. Universal pledge-based policies will succeed only if they fail. Pledging is rooted in its nature as a minority identity movement. Movement leaders are aware of this as well. They recognize that pledging is not for everyone. They understand the non-linear effect of other pledgers on the probability of pledging. Policy makers should recognize that the pledge works because not everyone is pledging.

References

- Alan Guttmacher Institute (AGI). 1994. *Sex and America's Teenagers*. New York/Washington: Alan Guttmacher Institute.
- Bearman, Peter S. and Hannah Brückner. 1999. *Peer Effects on Adolescent Girls' Sexual Debut and Pregnancy*. Washington, D.C.: National Campaign to Prevent Teen Pregnancy.
- Bearman, Peter S., Jo Jones, and Richard J. Udry. 1997. *The National Longitudinal Study of Adolescent Health: Research Design*. Carolina Population Center. University of North Carolina at Chapel Hill: WWW document: <http://www.cpc.und.edu/projects/addhealth/design.html>.
- Bearman, Peter S. 1992 "Army Unit Solidarity, Group Norms and Desertion: Desertion as Localism in the U.S. Civil War." *Social Forces*. 70:2-91.
- Blau, Peter. *Inequality and Heterogeneity*: 1977. A Primitive Theory of Social Structure. Free Press, NY.
- Blossfeld, Peter and Götz Rohwer. 1995. *Techniques of Event History Modeling. New Approaches to Causal Analysis*. Mahwah, New Jersey: Erlbaum.
- Brewster, Karin L. 1994. "Race Differences in Sexual Activity Among Adolescent Women: The Role of Neighborhood Characteristics." *American Sociological Review* 59:408-24.
- Brooks-Gunn, Jeanne and Roberta L. Paikoff. 1993. "'Sex Is a Gamble, Kissing Is a Game': Adolescent Sexuality and Health Promotion." Pp. 180-208 in *Promoting the Health of Adolescents. New Directions for the Twenty-First Century*, Editors Susan G. Millstein, Anne C. Petersen, and Elena O. Nightingale. New York/Oxford: Oxford University Press.
- Brown, B. B. and Wendy Theobald. 1999. "Peers Matter: A Research Synthesis of Peer Influences on Adolescent Pregnancy." Washington, D.C.: National Campaign To Prevent Teen Pregnancy.
- Calhoun, Craig. 1991. "The Problem of Identity in Collective Action" pp 51-75 in Huber, Joan. Ed. *Macro-Micro Linkages in Sociology*. Sage, Beverly Hills, CA.
- Dittus, Patricia J. and James Jaccard. 1998. "Adolescent Perceptions of Maternal Disapproval of Sex and the Mother-Adolescent Relationship: The Impact on Sexual Outcomes." University at Albany, State University of New York. Manuscript .
- Furstenberg, Frank. 1976. *Unplanned Parenthood: The Social Consequences of Teenage Childbearing*. New York: Free Press.
- Furstenberg, Frank, Jeanne Brooks-Gunn, and S. P. Morgan. 1987. "Race Differences in the Timing of Sexual Intercourse." *American Sociological Review* 52:511-18.
- Guo, Guang. 1993. "Event-History Analysis for Left-Truncated Data." *Sociological Methodology* 23:217-43.
- Guttentag, Marcia and Paul Secord. 1983. *Too Many Women? The Sex-Ratio Question*. Newbury Park, CA: Sage.
- Halpern, Carolyn T., Kara Joyner, and Richard J. Udry. 1998. "Smart Teens Don't Have Sex (Or Kiss Much Either)." Carolina Population Center. Manuscript .

- Hardin, Russell. 1995. *One For All: The Logic of Group Conflict*. Princeton University Press. Princeton, NJ.
- Harris, Kathleen M. 1996. "The Impact of Family Structure and Father Involvement on Risk Behavior Among Adolescents." Paper presented at the NICHD Conference on Father Involvement, Bethesda, MD: October 10-11, 1996 University of North Carolina at Chapel Hill.
- Hayes, Cheryl D., Editor. 1987. *Risking the Future: Adolescent Sexuality, Pregnancy, and Childbearing*. Washington, DC.: National Academy Press.
- Hofferth, Sandra L. 1987. "Factors Affecting Initiation of Sexual Intercourse." Pp. 7-35 in *Risking the Future: Adolescent Sexuality, Pregnancy, and Childbearing, Vol. II*, vol. II, eds. Sandra L. Hofferth and Cheryl D. Hayes. Washington, DC: National Academy Press.
- Jaccard, James, Patricia J. Dittus, and V. V. Gordon. 1996. "Maternal Correlates of Adolescent Sexual and Contraceptive Behavior." *Family Planning Perspectives* 28:159-65.
- Joyner, Kara and Richard J. Udry. 1998. "Adolescent Romance and Depression." Carolina Population Center. Unpublished Manuscript .
- Kaminer, Wendy. 1996. *True Love Waits*. Perseus Press.
- Kim, Hyojoung and Peter S. Bearman. 1997. "Who Counts in Collective Action? The Structure and Dynamics of Movement Participation." *American Sociological Review*. 62:70-93.
- Laitin, David. 1998. *Identity in Formation: The Russian-m Speaking Populations in the Near Abroad*. Cornell University Press. Ithaca, NY.
- Martin, Karin A. 1996. *Puberty, Sexuality, and the Self. Boys and Girls at Adolescence*. London and New York: Routledge.
- Miller, Brent C. 1998. *Families Matter: A Research Synthesis of Family Influences on Adolescent Pregnancy*. Washington, D.C.: National Campaign to Prevent Teen Pregnancy.
- Moore, Kristin A., Anne K. Driscoll, and Laura D. Lindberg. 1998. *A Statistical Portrait of Adolescent Sex, Contraception, and Childbearing*. Washington, D.C.: National Campaign to Prevent Teen Pregnancy.
- Newcomer, S. F., Richard J. Udry, and F. Cameron. 1983. "Adolescent Sexual Behavior and Popularity." *Adolescence* 18:515-22.
- Perry, Cheryl L., Steven H. Kelder, and Kelli A. Komro. 1993. "The Social World of Adolescents: Families, Peers, Schools, and the Community." Pp. 73-96 in *Promoting the Health of Adolescents. New Directions for the Twenty-First Century*, Susan G. Millstein, Anne C. Petersen, and Elena O. Nightingale. New York/Oxford: Oxford University Press.
- Resnick, Michael D., Peter S. Bearman, Robert Wm. Blum, Karl E. Bauman, Kathleen M. Harris, Jo Jones, Joyce Tabor, Trish Beuhring, Sieving Renee E., Marcia Shew, Majorie Ireland, Linda H. Bearinger, and Richard J. Udry. 1997. "Protecting Adolescents From Harm: Findings From the National Longitudinal Study on Adolescent Health." *Journal of the American Medical Association* 278(10):823-32.

- Shew, Marcia, G. Spanier, Clea A. Sucoff, Trish Beuhring, Sieving Renee E., Brent C. Miller, and Robert W. Blum. "Mother's Influence on Adolescents' Sexual Behavior." Unpublished Manuscript.
- Spanier, G. 1975. "Sexualization and Premarital Sexual Behavior." *Family Coordinator* 24:33-41.
- Thompson, Sharon. 1995. *Going All the Way. Teenage Girls' Tales of Sex, Romance, and Pregnancy*. New York: Hill and Wang.
- Thornton, A. and D. Camburn. 1989. "Religious Participation and Adolescent Sexual Behavior and Attitudes." *Journal of Marriage and the Family* 51:641-53.
- Tubman, Jonathan G., Michael Windle, and Rebecca C. Windle. 1996a. "Cumulative Sexual Intercourse Patterns Among Middle Adolescents: Problem Behavior Precursors and Concurrent Health Risk Behaviors." *Journal of Adolescent Health* 18:182-91.
- . 1996b. "The Onset and Cross-Temporal Patterning of Sexual Intercourse in Middle Adolescence: Prospective Relations With Behavioral and Emotional Problems." *Child Development* 67:327-43.
- Turner, C. F., L. Ku, M. Rogers, L. D. Lindberg, J. H. Pleck, and F. L. Sonenstein. 1998. "Adolescent Sexual Behavior, Drug Use, and Violence: Increased Reporting With Computer Survey Technology." *Science* 280(May):867-68.
- Udry, Richard J. 1988. "Biological Predispositions and Social Control in Adolescent Sexual Behavior." *American Sociological Review* 53:709-22.
- Udry, Richard J. and Peter S. Bearman. 1998. "New Methods for New Research on Adolescent Sexual Behavior." *New Perspectives on Adolescent Risk Behavior*, ed. Richard Jessor. Cambridge: Cambridge University Press.
- Udry, Richard J. and John O. G. Billy. 1987. "Initiation of Coitus in Early Adolescence." *American Sociological Review* 52(6):841-55.
- Upchurch, Dawn M., Lene Levy-Stroms, Clea A. Sucoff, and Carol S. Aneshensel. 1998. "Gender and Ethnic Differences in the Timing of First Sexual Intercourse." *Family Planning Perspectives* 30(3):121-27.
- Whitehead, Barbara D. and Theodora Ooms. 1999. *Goodbye to Girlhood: What's Troubling Girls and What We Can Do About It*. Washington, D.C.: National Campaign to Prevent Teen Pregnancy.
- Young and Modern. May 1998. "Virginity Is Hot." .

Table1: Social Influences on Sexual Debut

	Relationship to Sexual Debut	Gender Interactio n	Age Dependency	Main Source(s)
<i>Individual-Level Characteristics</i>				
Cognitive Ability	-	yes	no	Halperin et al. 1999
Maturity	+	yes	yes	Udry and Billy 1987
Religiosity	-	possible	no	Thornton and Camburn 1989
Self-Esteem	-	yes	no	Martin 1996
Academic Achievement	-	possible	no	Resnick et al. 1997, Whitehead and Ooms 1999
School Attachment	-	possible	no	Resnick et al. 1997, Whitehead and Ooms 1999
Extra-Curricular Activities (Sports)	-	possible	no	Martin 1996, Resnick et al. 1997
<i>Family Variables</i>				
Two Biological Parents	-	no	no	Miller 1998, Thorton and Camburn 1987
Step or Foster Family	+	no	no	see above
Single Parent Family	+	no	no	see above
Closeness to Parents	-	possible	yes	Miller 1998, Resnick et al. 1997
Perceived Disapproval of Sex	-	possible	yes	Jaccard et al. 1996, Dittus and Jaccard 1998, Miller 1998
<i>Socio-Demographic Background</i>				
White	-	no	no	Upchurch et al. 1998, Moore et al. 1998,
African-American	+	yes	no	see above, and Brewster 1994, Furstenberg et al. 1987, AGI 1994
Asian	-	no	no	see above
Hispanic	+/-	yes	no	see above
SES	-	no	no	Miller 1998
<i>Network and Romantic Relationships</i>				
In Romantic Relationship	+	no	no	Bearman and Brückner 1999
Number of Prior Partners	+	no	no	Furstenberg 1976
Embeddedness of Relationship	-	no	no	Whitehead and Ooms 1999
Emotional Commitment	+	possible	no	Hofferth 1987, Thompson 1995
Popularity	+	no	no	Newcomer et al. 1983, Brown and Theobald 1999

Table 2: Descriptive Statistics on Pledgers and Non-Pledgers

	Females				Males			
	With Pledge		Without Pledge		With Pledge		Without Pledge	
	Mean	Std.	Mean	Std.	Mean	Std.	Mean	Std.
A. White, Asian, Hispanic								
Hispanic	0.25	0.43	0.19	0.39	0.20	0.40	0.16	0.37
Asian	0.10	0.29	0.09	0.28	0.14	0.35	0.11	0.31
Single Parent Family ^b	0.18	0.38	0.17	0.38	0.14	0.34	0.16	0.37
Step or Foster Family ^b	0.15	0.36	0.18	0.38	0.16	0.37	0.18	0.39
Socio-economic Status ^b	5.95*	2.60	6.17	2.55	6.46	2.58	6.29	2.47
Closeness to Parents ^b	4.44*	0.59	4.39	0.59	4.52*	0.51	4.45	0.52
Perceived Parental Disapproval ^b	3.83*	0.46	3.72	0.60	3.65*	0.72	3.47	0.77
In Romantic Relationship ^e	0.36	0.48	0.34	0.47	0.30	0.46	0.27	0.44
Number of Romantic Partners ^e	0.88	1.19	0.87	1.20	0.76	1.15	0.70	1.11
Emotional Commitment ^e	1.30	1.92	1.17	1.82	1.08	1.84	0.93	1.72
Embeddedness in Peer Group ^e	0.90*	1.30	0.79	1.22	0.71	1.20	0.60	1.12
School Attachment ^b	2.89	0.69	2.85	0.67	2.92*	0.72	2.82	0.67
Unpopular in School Network ^c	0.22	0.42	0.21	0.41	0.25	0.43	0.29	0.45
Pubertal Development ^b	3.17	0.82	3.18	0.81	2.74	0.71	2.73	0.70
Add Health Verbal Test Score ^b	99.71*	15.67	102.79	14.44	102.22*	15.00	105.17	13.77
GPA ^b	3.10	0.74	3.09	0.72	3.01*	0.75	2.88	0.75
School Sports Participation ^c	0.91*	0.95	1.02	1.04	1.22	1.07	1.25	1.08
Self-Esteem ^b	3.02	0.53	2.98	0.54	3.25*	0.49	3.14	0.50
Religiosity ^b	2.44*	0.80	1.92	1.00	2.44*	0.80	1.76	1.03
Percent with Pledge ^b	23.0				16.6			
N ^b	703		2351		357		2268	
B. Blacks								
Single Parent Family ^b	0.38	0.49	0.45	0.50	0.37	0.49	0.34	0.47
Step or Foster Family ^b	0.22	0.42	0.16	0.37	0.17	0.38	0.21	0.40
Socio-economic Status ^b	6.03	2.75	5.97	2.82	6.62	2.28	6.39	2.44
Closeness to Parents ^b	4.52*	0.53	4.41	0.60	4.63	0.41	4.55	0.50
Perceived Parental Disapproval ^b	3.72	0.69	3.68	0.64	3.62*	0.78	3.36	0.87
In Romantic Relationship ^e	0.37	0.48	0.34	0.48	0.23	0.42	0.21	0.40
Number of Romantic Partners ^e	0.73	1.08	0.76	1.14	0.45	0.69	0.47	0.88
Emotional Commitment ^e	1.35	1.89	1.12	1.75	0.95	1.80	0.75	1.61
Embeddedness in Peer Group ^e	0.87	1.26	0.74	1.16	0.54	1.08	0.42	0.94
School Attachment ^b	2.81*	0.71	2.62	0.76	2.85	0.77	2.79	0.67
Unpopular in School Network ^c	0.30	0.46	0.29	0.45	0.38	0.49	0.33	0.47
Pubertal Development ^b	3.07	0.95	3.14	0.89	2.44	0.66	2.48	0.69
Add Health Verbal Test Score ^b	95.05	12.93	95.21	14.53	92.63*	17.72	97.89	15.07
GPA ^b	2.93*	0.64	2.82	0.69	2.61	0.79	2.66	0.72
School Sports Participation ^c	0.77	0.95	0.82	1.04	1.10	1.03	1.07	1.04
Self-Esteem ^b	3.16*	0.57	3.07	0.51	3.31	0.48	3.23	0.48
Religiosity ^b	2.50*	0.84	2.23	0.95	2.61*	0.65	2.06	1.03
Percent with Pledge ^b	30.0				16.8			
N ^b	207		403		65		322	

^b Measured at time of wave 1, in-home interview

^c Measured at time of in-school interview

^e Time-varying co-variate, descriptive information for start of observation window

* Significant difference between pledgers and others (within group) in distribution (t-test for metric variables, χ^2 -test for dummy variables)

Table 3: Baseline Model for the Transition to First Intercourse

	Panel A			Panel B		
	White, Asian, Hispanic			Black		
	Rel. Risk	95% Conf. Interval		Rel. Risk	95% Conf. Interval	
12.5 up to 14	0.03**	0.01	0.07	0.07**	0.01	0.58
14 up to 14.5	0.05**	0.02	0.14			
14.5 up to 15	0.07**	0.02	0.18	0.09**	0.01	0.67
15 up to 15.5	0.05**	0.02	0.14			
15.5 up to 16	0.07**	0.02	0.18	0.11**	0.01	0.83
16 up to 16.5	0.08**	0.03	0.20			
16.5 up to 17	0.06**	0.02	0.16	0.14	0.02	1.06
17 up to 17.5	0.08**	0.03	0.22			
17.5 up to 18	0.10**	0.04	0.27	0.14	0.02	1.06
18 up to 18.5	0.11**	0.04	0.28			
18.5 and older	0.10**	0.04	0.27			
Female	1.18	0.99	1.41	0.83	0.56	1.23
Hispanic	0.97	0.79	1.19			
Asian	0.67**	0.46	0.96		-	
Single Parent Family	1.27**	1.04	1.55	1.30	0.88	1.91
Step or Foster Family	1.24**	1.02	1.50	1.28	0.81	2.02
Socio-economic Status (SES)	0.95**	0.92	0.99	0.98	0.91	1.05
Closeness to Parents	0.90	0.78	1.03	0.86	0.65	1.16
Perceived Parental Disapproval	0.80**	0.73	0.88	0.93	0.75	1.16
In Romantic Relationship	3.31**	2.36	4.63	3.69**	1.88	7.26
Number of Romantic Partners	1.16**	1.08	1.23	1.07	0.89	1.27
Emotional Commitment	1.14**	1.05	1.24	0.92	0.77	1.10
Embeddedness in Peer Group	0.92	0.82	1.04	1.01	0.77	1.31
School Attachment	0.83**	0.74	0.93	1.05	0.82	1.35
Unpopular in School Network	0.81**	0.66	0.99	0.71	0.49	1.05
Pubertal Development	1.16**	1.04	1.29	1.02	0.83	1.24
Add Health Verbal Test Score	1.00	0.99	1.00	0.99	0.98	1.01
GPA	0.89**	0.79	0.99	0.77**	0.60	0.99
School Sports Participation	0.93	0.86	1.01	1.08	0.93	1.25
Self-Esteem	1.06	0.90	1.25	0.96	0.66	1.40
Religiosity	0.84**	0.78	0.91	0.88	0.75	1.04
Pledge	0.66**	0.52	0.83	1.04	0.70	1.07
Number of Cases		5679			997	
Number of Events		690			152	
χ^2 (df)		455 (40)			48 (27)	

** p ≤ 0.05 (two-tailed test)

Coefficients for missing data flags omitted.

Table 4: Transition to First Intercourse: Gender Interaction Effects

Independent Variables	Panel A: White, Asian, Hispanic ^a						Panel B: Black ^a					
	Direct Effects			Gender Interaction			Direct Effects			Gender Interaction		
	Relative Risk	95% Confidence Interval		Relative Risk	95% Confidence Interval		Relative Risk	95% Confidence Interval		Relative Risk	95% Confidence Interval	
Female	14.70**	2.09	100.03	—	—	—	5.56	0.08	393.92	—	—	—
Hispanic	1.53*	1.12	2.09	0.47**	0.31	0.71	—	—	—	—	—	—
Asian	0.78	0.46	1.31	0.75	0.37	1.53	—	—	—	—	—	—
Single Parent Family	1.37	1.00	1.87	0.89	0.60	1.33	1.27	0.65	2.49	1.02	0.44	2.34
Step or Foster Family	1.45**	1.07	1.95	0.76	0.52	1.12	1.41	0.66	3.03	0.96	0.36	2.53
Socio-economic Status	1.00	0.95	1.06	0.92*	0.86	0.99	1.04	0.91	1.19	0.91	0.78	1.07
Closeness to Parents	1.00	0.79	1.26	0.86	0.75	1.00	1.19	0.62	2.29	0.64	0.31	1.33
Perceived Parental Disapproval	0.86	0.75	0.99	0.91	0.75	1.10	0.94	0.69	1.28	1.01	0.65	1.59
In Romantic Relationship	2.54**	1.51	4.28	1.51	0.76	3.01	8.80**	2.48	31.15	0.32	0.07	1.46
Number of Romantic Partners	1.24**	1.11	1.38	0.91	0.79	1.04	0.85	0.56	1.30	1.34	0.84	2.15
Emotional Commitment	1.17**	1.03	1.33	0.95	0.81	1.12	0.72**	0.52	0.99	1.43*	1.17 ^b	1.75 ^b
Embeddedness in Peer Group	0.86	0.71	1.05	1.12	0.87	1.43	1.03	0.64	1.65	0.91	0.51	1.63
School Attachment	0.74**	0.63	0.88	1.19	0.94	1.50	1.04	0.67	1.62	1.03	0.60	1.75
Unpopular in School Network	0.87	0.64	1.17	0.86	0.58	1.27	1.03	0.56	1.92	0.56	0.26	1.20
Pubertal Development	1.30**	1.08	1.57	0.86	0.69	1.08	1.42*	1.15 ^b	1.74 ^b	0.66*	0.52 ^b	0.84 ^b
Add Health Verbal Test Score	1.00	0.99	1.01	1.00	0.99	1.01	0.98*	0.96	1.00	1.02	0.99	1.04
GPA	0.86*	0.72	1.02	1.04	0.83	1.30	0.82	0.55	1.21	0.85	0.51	1.41
School Sports Participation	1.01	0.90	1.13	0.86*	0.79 ^b	0.93 ^b	1.37**	1.07	1.76	0.69**	0.50	0.95
Self-Esteem	1.28*	1.11 ^b	1.46 ^b	0.75*	0.63 ^b	0.89 ^b	0.75	0.40	1.44	1.53	0.69	3.38
Religiosity	0.81**	0.72	0.91	1.06	0.91	1.24	1.06	0.80	1.41	0.78	0.55	1.11
Pledge	0.50**	0.31	0.80	1.37	0.80	2.35	0.77	0.35	1.73	1.42	0.56	3.59
Number of Cases		5679			3054			997			610	
Number of Events		690			412			152			97	
χ^2 (df)					472 (60)						58 (45)	

**p ≤ 0.05 (two-tailed test)

*p ≤ 0.05 (one-tailed test)

^aCoefficients for baseline rate omitted from table.

^b90 % confidence interval.

Table 5 a: Transition to First Intercourse: White, Asian and Hispanic Respondents

	Model 1			Model 2		
	Rel. Risk	95% Conf. Interval		Rel. Risk	95% Conf. Interval	
12.5 up to 14	0.01**	0.00	0.03	0.01**	0.00	0.03
14 up to 14.5	0.02**	0.01	0.07	0.02**	0.01	0.06
14.5 up to 15	0.03**	0.01	0.09	0.02**	0.01	0.08
15 up to 15.5	0.02**	0.01	0.07	0.02**	0.01	0.06
15.5 up to 16	0.03**	0.01	0.09	0.02**	0.01	0.08
16 up to 16.5	0.03**	0.01	0.10	0.03**	0.01	0.09
16.5 up to 17	0.02**	0.01	0.08	0.02**	0.01	0.07
17 up to 17.5	0.03**	0.01	0.11	0.03**	0.01	0.10
17.5 up to 18	0.04**	0.01	0.13	0.04**	0.01	0.13
18 up to 18.5	0.04**	0.01	0.14	0.04**	0.01	0.13
18.5 and older	0.04**	0.01	0.13	0.04**	0.01	0.13
Female	4.92**	1.83	13.26	5.06**	1.87	13.67
Hispanic	1.42**	1.05	1.92	1.44**	1.06	1.95
Hispanic Female	0.53**	0.36	0.77	0.51**	0.35	0.76
Asian	0.66**	0.46	0.96	0.66**	0.46	0.96
Single Parent Family	1.26**	1.03	1.53	1.27**	1.04	1.54
Step or Foster Family	1.22**	1.00	1.48	1.21*	0.99	1.47
Socio-economic Status (SES)	1.00	0.95	1.05	1.00	0.95	1.05
SES*Female	0.93**	0.87	0.99	0.93**	0.87	0.99
Closeness to Parents	0.90	0.78	1.03	0.89*	0.83 ^b	0.95 ^b
Perceived Parental Disapproval	0.82**	0.74	0.90	0.82**	0.74	0.90
In Romantic Relationship	3.26**	2.33	4.57	3.28**	2.34	4.60
Number of Romantic Partners	1.16**	1.09	1.24	1.16**	1.09	1.23
Emotional Commitment	1.14**	1.05	1.23	1.14**	1.05	1.23
Embeddedness in Peer Group	0.93	0.82	1.04	0.93	0.82	1.04
School Attachment	0.83**	0.74	0.93	0.83**	0.74	0.93
Unpopular in School Network	0.80**	0.65	0.99	0.81**	0.66	0.99
Pubertal Development	1.16**	1.05	1.29	1.16**	1.05	1.29
Add Health Verbal Test Score	0.99	0.99	1.00	1.00	0.99	1.00
GPA	0.88**	0.79	0.98	0.88**	0.79	0.98
School Sports Participation	0.99	0.89	1.11	0.99	0.89	1.11
Sports*Female	0.88	0.75	1.03	0.88*	0.81 ^b	0.95 ^b
Self-Esteem	1.25*	0.97	1.60	1.25*	1.10 ^b	1.42 ^b
Self-Esteem*Female	0.79	0.59	1.06	0.78*	0.67 ^b	0.91 ^b
Religiosity	0.84**	0.78	0.91	0.84**	0.78	0.91
Pledge	0.64**	0.51	0.81	1.00	0.59	1.68
Socially Closed School				1.09	0.82	1.44
Pledge in Socially Closed School				0.39**	0.17	0.90
%Pledgers (same sex)				1.00	0.99	1.02
% Pledgers*Closed School				1.00	0.98	1.02
Pledge*% Pledgers				0.98*	0.96 ^b	0.99 ^b
Pledge*% Pledgers*Closed School				1.05**	1.01	1.10
Number of Cases			5679			
Number of Events			690			
χ^2 (df)		464 (44)			468 (50)	

**p ≤ 0.05 (two-tailed test)

*p ≤ 0.05 (one-tailed test)

^b90 % confidence interval

Table 5 b: Transition to First Intercourse: Black Respondents

	Model 1			Model 2		
	Rel. Risk	95% Conf. Interval		Rel. Risk	95% Conf. Interval	
12.5 up to 14.5	0.04**	0.00	0.36	0.04**	0.00	0.40
14.5 up to 15.5	0.05**	0.01	0.41	0.05**	0.01	0.46
15.5 up to 16.5	0.06**	0.01	0.51	0.06**	0.01	0.55
16.5 and older	0.08**	0.01	0.67	0.07**	0.01	0.68
Female	1.98	0.53	7.40	2.14	0.55	8.34
Single Parent Family	1.27	0.87	1.87	1.28	0.87	1.89
Step or Foster Family	1.30	0.82	2.05	1.28	0.80	2.02
Socio-economic Status (SES)	0.98	0.91	1.05	0.97	0.91	1.04
Closeness to Parents	0.87	0.65	1.16	0.86	0.64	1.16
Perceived Parental Disapproval	0.94	0.75	1.18	0.93	0.75	1.17
In Romantic Relationship	3.84**	1.93	7.61	3.82**	1.92	7.63
Number of Romantic Partners	1.06	0.89	1.27	1.05	0.88	1.27
Emotional Commitment	0.81*	0.73 ^b	0.91 ^b	0.81*	0.73 ^b	0.91 ^b
Emotional Commitment*Female	1.20**	1.00	1.44	1.20**	1.00	1.44
Embeddedness in Peer Group	0.98	0.75	1.29	0.99	0.75	1.30
School Attachment	1.06	0.83	1.35	1.04	0.81	1.33
Unpopular in School Network	0.72*	0.59 ^b	0.88 ^b	0.71*	0.58 ^b	0.86 ^b
Pubertal Development	1.31	0.89	1.94	1.34	0.90	2.00
Pubertal Development*Female	0.73	0.47	1.14	0.70	0.45	1.11
Add Health Verbal Test Score	0.99	0.98	1.01	0.99	0.98	1.01
GPA	0.77**	0.60	0.99	0.77**	0.60	0.99
School Sports Participation	1.31**	1.03	1.66	1.31**	1.03	1.66
Sports*Female	0.74**	0.55	1.01	0.76*	0.65 ^b	0.89 ^b
Self-Esteem	0.96	0.66	1.39	0.96	0.66	1.39
Religiosity	0.89	0.76	1.05	0.90	0.76	1.06
Pledge	1.02	0.69	1.52	1.51	0.57	4.00
Socially Closed School				1.79	0.74	4.32
Pledge in Socially Closed School				0.21*	0.09 ^b	0.51 ^b
%Pledgers (same sex)				1.01	0.98	1.05
% Pledgers*Closed School				0.94*	0.88	1.01
Pledge*% Pledgers				0.98	0.92	1.04
Pledge*% Pledgers*Closed School				1.10*	1.05 ^b	1.16 ^b
Number of Cases	997					
Number of Events	152					
χ^2 (df)	52 (30)			55 (36)		

**p ≤ 0.05 (two-tailed test)

*p ≤ 0.05 (one-tailed test)

^b90 % confidence interval

Table 6 a: Transition to First Intercourse, White, Asian and Hispanic Respondents, Model with Period-Specific Effects

Stage of Adolescence	Relative Risks			Effect Size Tendency
	Early (12½ -15½)	Middle (15½ -17½)	Late (17½ +)	
Female	1.07	3.83*	15.96**	Increasing with age (catch-up)
Hispanic	0.99	1.30	2.02**	Increasing with age
Hispanic Female	1.19	0.54**	0.33**	Increasing with age
Asian	0.85	0.30**	1.06	Middle adolescence
Single Parent Family	1.37	1.08	1.34	Ns
Step or Foster Family	1.18	1.29*	1.06	Stronger early
Socio-economic Status (SES)	0.93	0.99	1.05	Ns
SES*Female	0.97	0.95	0.88**	Late adolescence
Closeness to Parents	0.67**	1.05	0.87	Early adolescence
Perceived Parental Disapproval	0.78**	0.84**	0.81**	Always
In Romantic Relationship	2.09**	3.18**	4.17**	Increasing
Number of Romantic Partners	1.31**	1.18**	1.09	Decreasing
Emotional Commitment	1.08	1.20**	1.11	Middle adolescence
Embeddedness in Peer Group	1.01	0.85*	1.02	Middle adolescence
School Attachment	0.80*	0.80**	0.87	Early and mid-adolescence
Unpopular in School Network	0.91	0.88	0.77	Increasing
Pubertal Development	1.41**	1.12	1.10	Decreasing, early
Add Health Verbal Test Score	1.00	0.99	1.00	Ns
GPA	0.75**	0.91	0.98	Decreasing, early
School Sports Participation	1.00	1.07	0.91	Ns
Sports*Female	0.80	0.81*	1.05	Middle adolescence
Self-Esteem	1.17	1.05	1.66**	Late adolescence
Self-Esteem*Female	1.28	0.84	0.55**	Late adolescence
Religiosity	1.00	0.80**	0.80**	Middle and late adolescence
Pledge	3.73	0.65*	1.09	middle adolescence
Socially Closed School	1.33	1.08	0.94	Ns
Pledge in Socially Closed School	0.12**	0.50	0.37	Early adolescence
%Pledgers (same sex)	0.99	1.01	1.00	Ns
% Pledgers*Closed School	0.99	1.00	1.02	Ns
Pledge*% Pledgers	0.92*	0.98	0.98	decreasing
Pledge*% Pledgers*Closed School	1.12*	1.05	1.04	decreasing
Number of Events	166	321	203	
Number of Cases		5679		
χ^2 (df)		490 (96)		

** p ≤ 0.05 (two-tailed test)

* p ≤ 0.05 (one-tailed test)

Ns: estimate fluctuates around 0

Note: Coefficients for baseline rate omitted from table

Table 6 b: Black Respondents, Model with Period-Specific Effects

Stage of Adolescence	Relative Risks			Effect Size Tendency
	Early (12½ -15)	Middle (15 -17)	Late (17 +)	
Female	7.80	1.83	2.20	(Decreasing with age)
Single Parent Family	2.17*	1.07	1.01	Early Adolescence
Step or Foster Family	3.36**	0.84	0.89	Early Adolescence
Socio-economic Status (SES)	1.06	0.96	0.99	Ns
Closeness to Parents	0.85	1.00	0.89	Ns
Perceived Parental Disapproval	0.83	0.99	1.02	(Decreasing)
In Romantic Relationship	4.98**	3.26**	6.18**	Increasing
Number of Romantic Partners	1.16	1.13	0.76	Ns
Emotional Commitment	0.94	0.90	0.72	(Increasing)
Emotional Commitment*Female	1.28	1.05	1.20	Ns
Embeddedness in Peer Group	0.72	0.98	1.24	Ns
School Attachment	1.07	1.37	0.66*	Late Adolescence
Unpopular in School Network	0.62	0.70	1.40	Ns
Pubertal Development	1.83*	0.99	1.49	Early adolescence
Pubertal Development*Female	0.44*	0.90	0.75	Early adolescence
Add Health Verbal Test Score	1.01	1.00	0.97**	Late adolescence
GPA	0.90	0.74	0.85	(Middle adolescence)
School Sports Participation	1.32	1.35	1.82*	Increasing
Sports*Female	0.61	0.70	0.66	Ns
Self-Esteem	0.71	0.91	1.32	Ns
Religiosity	1.06	0.84	0.90	(Middle adolescence)
Pledge	1.29	0.69	0.97	(Middle adolescence)
Number of Events	38	66	48	
Number of Cases		997		
χ^2 (df)		68 (69)		

**p ≤ 0.05 (two-tailed test)

*p ≤ 0.05 (one-tailed test)

Ns: estimate fluctuates around zero

Note: Coefficients for baseline rate omitted from table

Table 7: Logistic Regression of Contraceptive Use at First Intercourse, for Whites, Hispanics, and Asians^e

	Odds Ratio	95 % Conf. Interval	
Age ^a	1.05	0.91	1.21
Age at first intercourse ^c	1.00	0.99	1.01
Female ^a	1.10	0.77	1.58
Hispanic ^a	0.68*	0.46	1.00
Asian ^a	0.34**	0.14	0.84
Single Parent Family ^a	0.76	0.49	1.17
Step Family ^a	0.68**	0.50	0.91
Socio-economic Status ^a	0.95	0.89	1.02
Parental Closeness ^a	1.01	0.75	1.34
Parental Disapproval ^a	1.04	0.84	1.28
School Integration ^a	1.09	0.87	1.38
Unpopular in School Network ^b	0.88	0.59	1.32
Add Health Verbal Test Score ^a	1.01	0.99	1.02
GPA ^a	1.34**	1.10	1.64
Self-Esteem ^a	1.05	0.77	1.42
Religiosity ^a	0.96	0.81	1.14
Pledge ^a	0.65**	0.43	0.99
χ^2 (df)		56.11** (17)	
N		1329	

**p ≤ 0.01 (two-tailed test) *p ≤ 0.05 (two-tailed test)

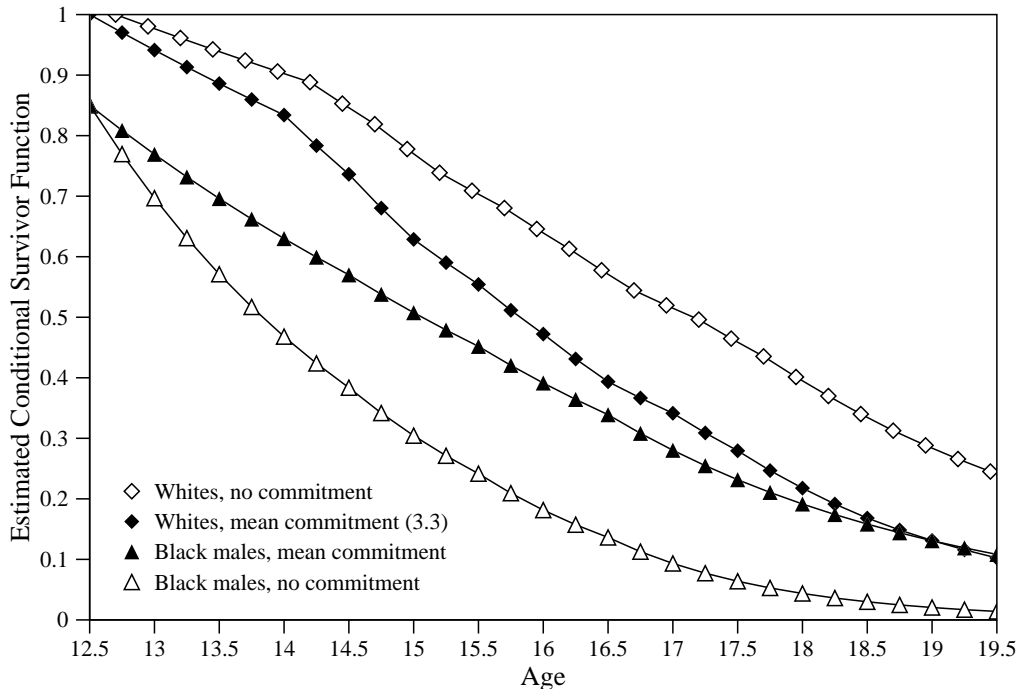
^a Measured at time of wave 1, in-home interview

^b Measured at time of in-school interview

^c Measured at time of wave 2, in-home interview

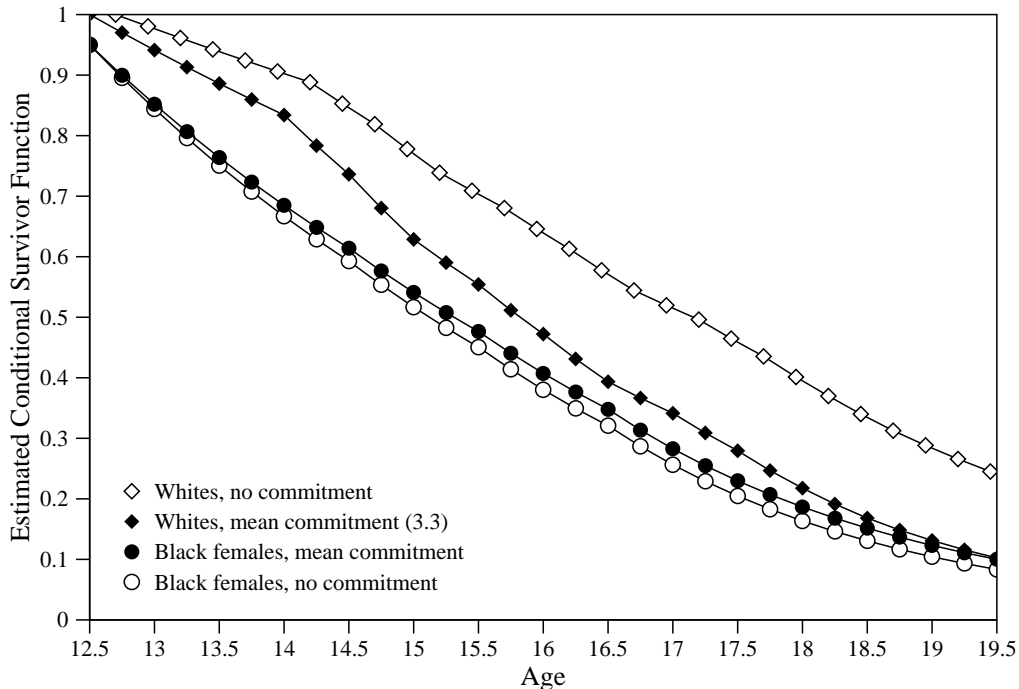
^e Standard Errors adjusted for clustering, weighted data.

Figure 1a: Estimated Effect of Emotional Commitment on Black Males



Notes: Based on results reported in table 4. Other covariates evaluated at means/modes

Figure 1b: Estimated Effect of Emotional Commitment on Black Females



Notes: Based on results reported in table 4. Other covariates evaluated at means/modes

Figure 2: Transition Rate for Pledgers and Context, by School Type

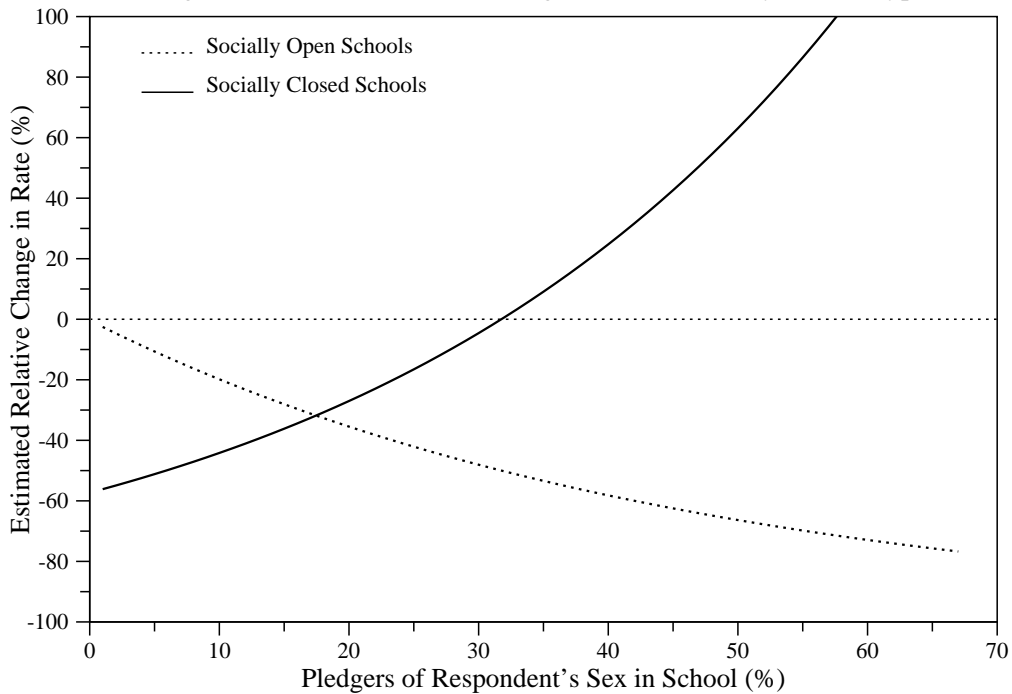
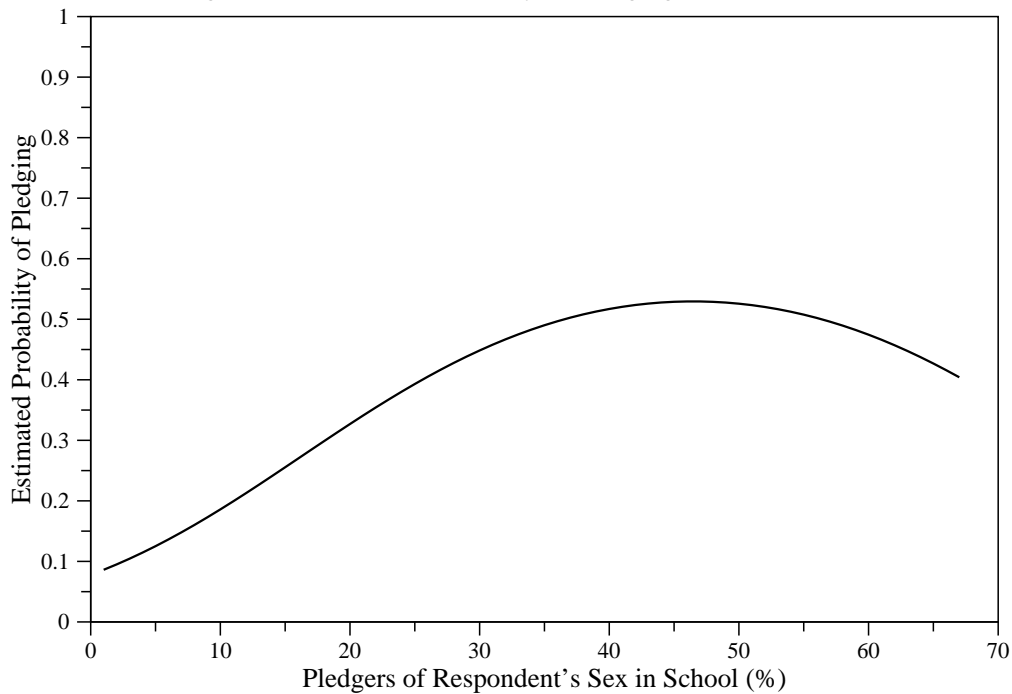


Figure 3: Estimated Probability of Pledging and School Context



Appendix A: Sample Selectivity

As part of the ACASI section of the in-home interviews, adolescents were asked whether they had ever had sexual intercourse. Those who reported intercourse were asked when they had intercourse for the very first time (year and month). Figure 1 shows the survivor function for the transition to first intercourse, combining data from both waves⁴⁸, for the full sample, by gender and race (all adolescents with valid data on month and year). In contrast to earlier research, among non-blacks we find gender differences only at early ages. Later, girls ‘catch up’ and the two functions converge.⁴⁹ For blacks, gender differences are pronounced until late adolescence, when the survivor functions for girls and boys converge. The median transition age for non-black teenagers is slightly below 18, for blacks slightly over 16. These figures are comparable to other national estimates (Alan Guttmacher Institute 1994, Moore et al. 1998).

Figure A 1 about here

The great advantage of longitudinal data lays in the possibility to order presumed causes and effects in time. Since most of our explanatory factors, including whether adolescents had taken a pledge, are measured in the first in-home interview, causal inferences for adolescents who by that time already had experienced first sexual intercourse are limited. Excluding these adolescents from the sample means that our sample is selective for later transitions to first intercourse. We now explore the impact of this selectivity. In our analyses, we consider only adolescents who

⁴⁸Adolescents participating in both waves were asked twice about the date they had intercourse for the first time. In some of these cases, there is a inconsistency between the data collected in the two waves. The solution we adopted was to chose the date given in the first wave on the grounds that recollection of the timing of salient events in the life course declines in accuracy over time – the longer the time between the survey and the event in question, the more likely are recall errors (Brückner 1995). Since in the case of sexual debut under-reporting is more likely than over-reporting, we adopted this strategy also for teens who reported sexual debut in the first wave but claimed to be virgins in the second wave. A comparison of the survivor functions resulting from choosing either wave 1 *or* wave 2 data shows that the differences are minimal and have no impact whatsoever on the estimates of median transition age or the proportion of virgins at any other age.

⁴⁹In contrast to other studies, *Add Health* data do not show gender differences in the timing of first intercourse for white adolescents. This is likely the result of ACASI technology. Because interviewers were not privy to adolescent responses, girls may have felt freer to report earlier transitions. Boys may have felt freer to admit to a later transition. Turner et al. (1998) report similar changes for abortion arising from ACASI interviews.

“survived” as virgins until their first in-home interview.⁵⁰ 44 % of teens in the in-home sample had already experienced sexual debut by the time they were interviewed. Although the internal validity of causal inferences is strengthened by concentrating the analysis on adolescents who were still at risk for initiating sexual activity when data on explanatory variables were collected, we have to be concerned with the external validity of the resulting restricted sample. Specifically, the effects of factors influencing the age of sexual initiation can be underestimated in a sample from which part of the population at risk has already dropped out. Figure 2 shows a comparison between the full *Add Health* sample and the restricted sample that we described above.

Figure A 2 about here

For non-black respondents, who on average are older at sexual initiation, the survivor functions for the full and restricted samples are identical until age 15, after which they diverge somewhat. At the end of the observation period, the estimated proportion with intercourse is very similar. For black adolescents, the restricted sample is far more selective towards late transitions. The estimated median transition age from the restricted sample is almost one year higher than that estimated from the full sample for black adolescents.

In the intercourse models, adolescent pledge status is the key independent variable we focus on. Adolescents who were not married at the time of the first in-home interview were asked whether they had “ever taken a public or written pledge to remain a virgin until marriage”. Table 2 reports the median transition age for pledgers and others, by race and gender. Here, the median transition age for eight groups is calculated from the full sample for descriptive purposes. For non-black females, pledgers transitioned to first intercourse on average more than three years later than non-pledgers (38 months). Because less than half of non-black male pledgers had experienced sexual initiation, we compare the transition for pledgers and non-pledgers in the lowest quartile. Here, pledgers transitioned to first intercourse on average 2.5 years later than their non-pledging counterparts. For both black females and males, the difference in median transition age between pledgers and others is slightly above 2 years (27 months). For all groups, we observe a substantial delay in sexual debut for pledgers.

⁵⁰We also exclude a few adolescents who report to have had intercourse before age 10 (age 9 for black males).

For the restricted sample, selected on late intercourse, the difference in median age for non-black girls is still at 1 ¼ years. For non-black males, pledgers transition to first sex 20 months later than non-pledgers. For both male and female blacks, there is no difference in median transition age between pledgers and others. Compared to the full sample, pledgers are over-represented in this sample, especially among black girls. Pledgers make up 30 % of the black female restricted sample compared to 19 % of the full sample (for black boys, the respective numbers are 9 % versus 17 %, for non-black boys 9% versus 17 %, and non-black females 16 % versus 23 %). Thus, with our restricted sample for black adolescents we cannot show a pledge effect – however, pledging is associated with being in our sample (since pledgers have intercourse later, their chances to be part of our sample are greater).

Sample selectivity also results from missing data. Like all surveys, *Add Health* data suffers from missing data. Throughout, we have replaced missing values with the means for the associated race/sex group. In all cases we control for measurement error that may be introduced by mean imputation. None of the dummy variables were significant in the models reported below.⁵¹ Unfortunately, mean substitution was not always possible. A key requirement for our models involved timing relationships with respect to intercourse. We therefore excluded all respondents who had missing data either on the occurrence or date of first intercourse or on starting and ending times of romantic relationships. In addition, we lost a few respondents who had either missing data on the pledge question, or were not linked to any of the schools in the sample. Of the 8150 respondents who were still under risk to experience first intercourse at the time of the first in-school interview and participated in the second, we were able to retain 6776 cases in the event history models reported below. Most of these losses are due to missing start and end dates in the relationship data. We found no indication that respondents with missing dates were different from others in terms of their transition behavior or in terms of the distribution of independent variables used in this analysis. The results of these analyses are available from the authors.

⁵¹Missing data problems are especially great for popularity. For the popularity measure, we need full information on the entire friendship network in the school. In the 24 schools where the response rate was too low, this measure was set to missing. We tested models both by including only cases with valid data on these variables and by excluding these two variables and found that the results are stable across all specifications.

Problems of selectivity are certainly present for black adolescents in our sample. For blacks, selectivity on the dependent variable all but wipes out the effect of our key independent variable, pledging. Given these problems, we cannot draw inferences about race differences from our sample. Rather, we focus on gender differences among black teenagers, asking the reader to keep in mind that the results presented below for black adolescents should not be taken to be representative for the population. For white adolescents, a delay of sexual debut associated with pledging observed in the full sample is somewhat reduced but still substantial.⁵² In sum, we are more likely to under- than overestimate a delaying effect of pledging on sexual debut.

⁵²We explored the extent of sample selectivity by running a multivariate hazard model for both samples and comparing the estimated effects across samples, including only explanatory variables that do not change over time and are not affected by sexual initiation. With the exception of the early gender difference (see Figure A 1) that we cannot show with the restricted sample, the models for non-black teenagers look very similar in terms of effect sizes and direction (results not shown, tables available on request). Again, for black teenagers, the restricted sample is clearly selective.

Figure A 1: Transition to Sexual Intercourse by Race and Gender, Full Sample

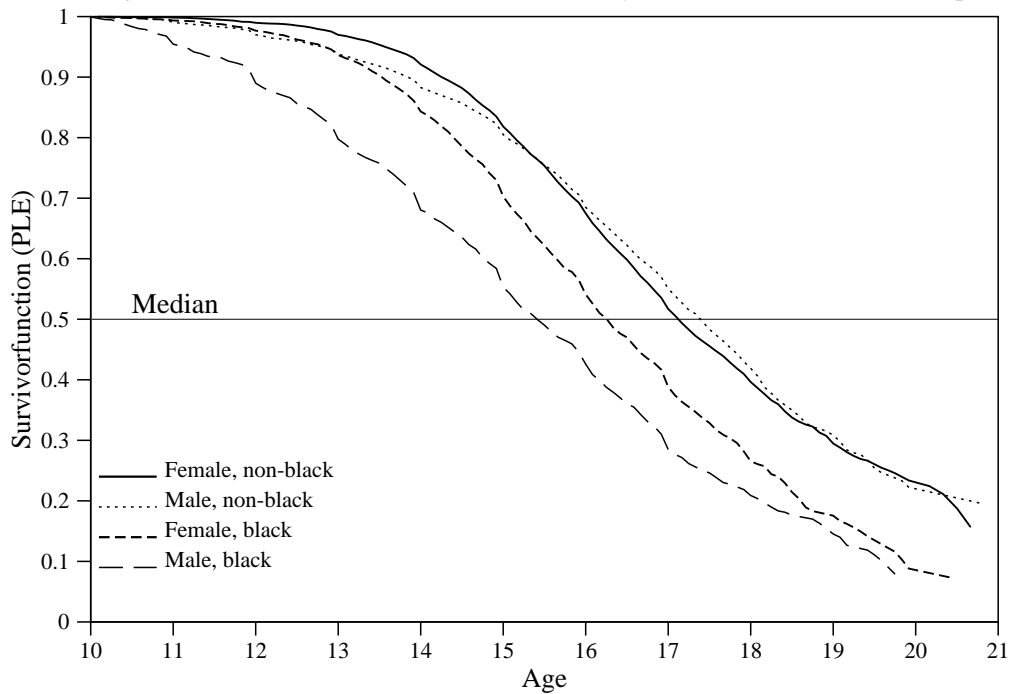
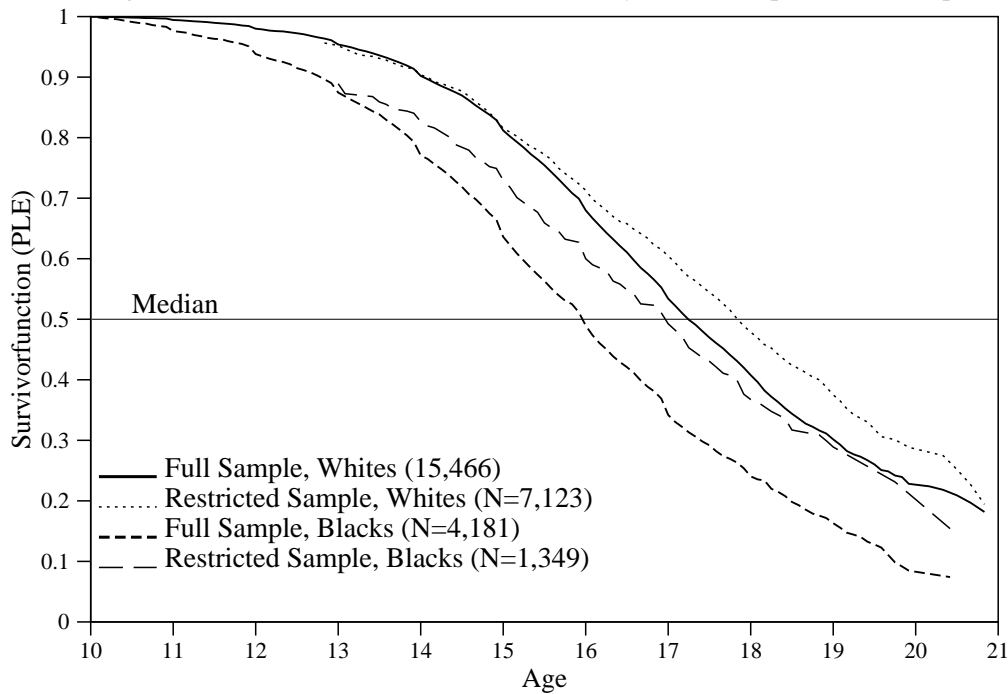


Figure A 2: Transition to Sexual Intercourse by Race, Comparison of Samples



Appendix B: Who Pledges?

In this section, we present a multivariate model of pledging with the goal of further exploring what differentiates pledgers from others. Because the differences we observe might be due to selection, we model the probability of pledging between the two waves of in-home interviews. This necessitates the use of a different sample than the sample we use in our transition models. First, we need to exclude all adolescents who said they had taken a pledge in the first wave. Adolescents who had already experienced sexual initiation at Wave 1 are excluded from the present analysis as well since adolescents who have had sex are very unlikely to pledge. This yields a sample of 6849 persons, of which 699 (9.41%) report that they have taken a pledge between waves.⁵³ Compared to the *Wave 1* pledgers included in subsequent analyses of sexual debut, the pledgers in this sample have joined the pledge movement later in its history.

We estimate a logistic regression model with the same covariates we use in the transition rate models, including age as an additional co-variate⁵⁴. Relationship information cannot be treated as time-varying co-variate in this type of model. We therefore include the relationship status as measured at the time of the first in-home interview, the number of partners an adolescent had up to that date, and the mean characteristics of those relationships. The results are reported in Table B1.⁵⁵

Table B 1 about here

While pledgers are more likely to be female once we control for other factors, the gender effect disappears. All variables associated with parents and family background have virtually no effect on pledging. Although we find

⁵³We lose fewer cases due to missing data here because we do not need to know the exact dates of relationship start and end. Adolescents were asked whether a relationship was still on going and that information was used to extract the relationship status at the time of the first in-home interview. Cases where the relationship status was unclear were included, together with a variable flagging them.

⁵⁴Questions on attitudes about sex were only asked of respondents that were either older than 14 or reported that they had experienced sexual debut. For this reason, we could not use these data in the models presented in this paper.

⁵⁵Because pledging may effect some of the variables described in table 1, for example self-esteem and one's relationship to parents, and because we look at a different sample, the means of independent variables for both groups are reported in columns one and two of table 2.

a bivariate difference with respect to parental disapproval of sexual initiation and parental closeness, these differences disappear in the multivariate model, when controlling for religiosity and school context. School integration, as well as academic achievement and sports participation are also not associated with a greater propensity to pledge. Pubertal development and cognitive ability, however, both decrease the likelihood of pledging substantially. Pubertal development here may indicate increased motivation to engage in sexuality (Udry 1988), which in turn decreases motivation for pledging. Cognitively more able adolescents probably have access to multiple strategies for saying “no thank you” to sex, and so are less likely to be attracted to the pledge movement. Being in a relationship increases the odds of pledging. This is consistent with a recruitment strategy of the pledge movement that constructs pledging as a token of ‘true love’ between teenagers. There was no interaction effect between being in a relationship and number of prior partners. Thus, adolescents who have experience in the dating game are less likely to pledge, regardless of their current relationship status. The nature of the relationship does not play a role for pledging.⁵⁶

The results of this analysis suggest that pledgers tend to be more religious, from more normative backgrounds, and less physically developed than their non-pledging peers. We control for these, and other characteristics, in all of the intercourse models that assess a pledge effect.

⁵⁶Restricting the sample only to adolescents that had had at least one relationship by the time of Wave 1 does not change these results.

Table B1: Determinants of Pledging ^c					
	Mean: Pledgers	Mean: Others	Odds Ratio	95% Conf. Interval	
Age ^a	15.43	15.43	0.96	0.90	1.02
Female	0.60 [†]	0.49	0.98	0.77	1.25
Black	0.18	0.16	0.85	0.64	1.13
Hispanic	0.18	0.16	0.85	0.60	1.22
Asian	0.12 [†]	0.07	1.71 ^{**}	1.09	2.69
Single Parent Family ^a	0.21	0.21	1.09	0.81	1.49
Step or Foster Family ^a	0.17	0.17	1.15	0.86	1.54
Socio-economic Status (SES) ^a	5.89	6.15	0.97	0.93	1.01
Closeness to Parents ^a	4.47 [†]	4.40	1.12	0.89	1.43
Perceived Parental Disapproval ^a	3.67 [†]	3.52	1.08	0.84	1.39
In Romantic Relationship ^a	0.19	0.22	1.51 ^{**}	1.09	2.10
Number of Romantic Partners ^a	0.54 [†]	0.72	0.78 ^{**}	0.64	0.96
Mean Emotional Commitment ^a	1.85	2.22	1.08	0.97	1.19
Mean Embeddedness ^a	0.83 [†]	1.05	0.84	0.67	1.07
School Attachment ^a	2.87	2.78	1.09	0.90	1.33
Unpopular in School Network ^b	0.27	0.24	1.18	0.91	1.55
Pubertal Development ^a	2.85	2.96	0.83 ^{**}	0.70	0.99
Add Health Verbal Test Score ^a	97.12 [†]	102.30	0.98 ^{**}	0.97	0.99
GPA ^a	2.93	2.88	1.14	0.97	1.34
School Sports Participation ^b	1.16	1.15	1.08	0.98	1.19
Self-Esteem ^a	3.07	3.06	0.89	0.70	1.14
Religiosity ^a	2.28 [†]	1.81	1.51 ^{**}	1.31	1.74
% Same-Sex Pledgers ^a	16.77 [†]	10.90	1.12 ^{**}	1.09	1.15
% Same-Sex Pledgers squared ^{a,d}	404.17 [†]	359.02	0.99 ^{**}	0.98	0.99
Number of Cases ^c	699	6150	6849		
χ^2 (df)			602 (37)		

[†]Significant bivariate differences

^{**}p ≤ 0.05 (two-tailed test)

^a Measured at time of wave 1, in-home interview

^b Measured at time of in-school interview

^c Measured at time of wave 2, in-home interview

^d Coefficient multiplied with 10

^e Coefficients not shown: 6 denomination categories, 8 missing value flags (none significant at $\alpha=.05$). Standard Errors adjusted for clustering, weighted data.

Appendix C: Items used in Index Construction

Items for Self-Esteem Index:

You have a lot of energy.
You seldom get sick.
When you do get sick, you get better quickly.
You are well coordinated.
You have a lot of good qualities.
You are physically fit.
You have a lot to be proud of.
You like yourself just the way you are.
You feel like you are doing everything just about right.
You feel socially accepted.
You feel loved and wanted.

Items for School Integration Index:

You feel close to people at your school.
You feel like you are part of your school.
You are happy to be at your school.
The teachers at your school treat students fairly.
You feel safe in your school.

Closeness to Parents

Most of the time, your mother (father) is warm and loving towards you.
You are satisfied with the way your mother (father) and you communicate with each other.
Overall, you are satisfied with your relationship with your mother (father).

Religiosity

How often do you go to church?
How often do you pray?
How important is religion to you?

Social Embeddedness of Romantic Relationship

You went out together in a group.
You met your partner's parents.
You told other people that you were a couple.

Emotional Commitment

You saw less of other friends so you could spend more time with your partner.
You and your partner went out together alone.
You gave each other presents.
You told each other that you loved each other.
You thought of yourselves as a couple.