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FEAR OF PREGNANCY OR FEAR OF STIGMA? ADOLESCENT ATTITUDES, KNOWLEDGE, AND THE TIMING AND SEQUENCING OF SEXUAL BEHAVIORS

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Fear of Pregnancy or Fear of Stigma? Adolescent Attitudes, Knowledge, and the Timing and Sequencing of Sexual Behaviors

Abstract

Teen girls may be influenced by stigmas around sex, the risk of pregnancy, and concerns about the acceptability of contraception. Additionally, many teens lack accurate knowledge and confidence about reproductive biology and contraception. Following a sample of female virgins aged 15-19 from Wave I through Wave IV of the National Longitudinal Study of Adolescent to Adult Health (N = 2,406), we test whether adolescent girls' attitudes and knowledge about sex, contraception, and reproduction influence the timing of coital debut and whether oral or anal sex precedes first vaginal sex. Results suggest that teen girls' worries about social stigma delay coital debut whereas fears of teen pregnancy increase the odds of oral and anal sex prior to vaginal sex.

The timing of first vaginal sex – and its sequencing relative to other sexual behaviors, particularly oral sex – has been linked to the risk of teen pregnancy (Reese, Haydon, Herring, & Halpern, 2013) and other indicators of sexual and reproductive health (Sandfort, Orr, Hirsch, &Santelli, 2008). A large literature documents socioeconomic and demographic variation in the timing of vaginal, oral, and anal sex (e.g., Caputo, 2009; Carlson, McNulty, Bellair, & Watts, 2014; Cavazos-Rehg et al., 2009; Holway, 2015), and a somewhat smaller body of research points to the importance of psychosocial factors such as religiosity, attachment to conventional institutions, and perceived or actual parental attitudes in predicting early sexual experiences (e.g., Halpern, Waller, Spriggs, & Hallfors, 2006; Laflin, Wang, & Barry, 2008; Reese, Choukas-Bradley, Herring, & Halpern, 2009). Far less attention has been paid to how teens' own views on sex, pregnancy, and contraception influence their sexual behaviors (Meier, 2003), especially beyond the early to mid-teen years. Yet ignoring teens' own attitudes and beliefs discounts teens' agency and voices (Mollborn, 2017).

Reproductive behavior is determined both by direct intentions to engage in specific behaviors and by broader attitudes toward and knowledge about longer term consequences (Bachrach & Morgan, 2013; Fishbein & Ajzen, 2010; Miller 1994, 1995; Miller, Severy, & Pasta, 2004; Philipov, Thévenon, Klobas, Bernardi, & Liefbroer, 2009). Because of the multiple meanings linked to sexual behavior, the set of attitudes related to coital debut and the sequencing of early sexual behaviors is likely to be complex. Sex brings benefits, like physical pleasure and closeness with partners but, especially for girls, it is often stigmatized as a cause for embarrassment, shame, or guilt. Fear of pregnancy, potentially compounded by moral and relational concerns over the acceptability of contraception, may spill over into negative attitudes about sex. Additionally, many teens lack accurate knowledge about reproductive biology and

contraception, further influencing sexual and reproductive decision-making. Previous research on the predictors of coital debut has shown that attitudes such as shame around sex, fear of pregnancy, and the pleasures of sex predict the timing of first sex (e.g., Cuffee, Hallfors, & Waller, 2007; Rostosky, Regnerus, & Wright, 2003; see Buhi & Goodson, 2007; Kirby, 2002 for reviews). However, research on the role of contraceptive knowledge and attitudes in predicting sexual debut is more limited, and the approach to including attitudes (which attitudes are included and how they are operationalized) has been rather piecemeal. Further, limited research has considered the attitudinal predictors of non-vaginal sex, yet many teens begin their sexual careers with oral (and sometimes anal) sex (Chandra, Mosher, Copen, & Sionean, 2011).

In this paper, we test how multiple dimensions of adolescent girls' attitudes and knowledge about sex, contraception, and reproduction are associated with coital debut and the sequencing of sexual behaviors among a sample of virgins in their mid-teen years. Rather than focus on 'early' sex (usually defined as sex prior ages 15 or 16) or sex before age 18, we adopt a longer time window than prior work has used in examining attitudes and sexual behavior, using Waves I and IV of the National Longitudinal Survey of Adolescent to Adult Health (Add Health). The analysis focuses on girls in explicit recognition of the gendered stigma surrounding sex (Hamilton & Armstrong, 2009) as well as recognition that the perceived responsibilities and burdens of contraception and pregnancy are borne primarily by girls and women (Fennell, 2011; Smith, Fenwick, Skinner, Merriman, & Hallett, 2011). We draw on research on gender and sexual activity as well as demographic work on reproductive behaviors to motivate our study, and we use factor analytic methods to establish the underlying dimensions of attitudes toward sex, reproductive knowledge, and reproductive attitudes.

Attitudes toward Sex and Sexual Behaviors

For teenage girls, sex carries a risk not only of pregnancy (and sexually transmitted infections) but potentially also of judgment, gossip, and social stigma. In fact, the risk of negative social consequences may be just as, or more important, than the risks of pregnancy for girls. Much has been written about the sexual double standard adolescent girls and adult women experience (e.g., Hamilton & Armstrong, 2009; Kreager & Staff, 2009; Lyons, Giordano, Manning, & Longmore, 2011; Tolman, 2002). Girls may face pressure to engage in sex from their partners (Morgan & Zurbriggen, 2007) but pressure to avoid sex from classmates (Kreager, Staff, Gauthier, Lefkowicz, & Feinberg, 2016) and parents (Schalet, 2011). Girls' own desires and views of sex as having benefits, such as intimacy and physical pleasure, have largely been ignored (for exceptions, see Tolman (2002) and Tolman and McClelland (2011)). Although research has examined how perceptions of social norms around sex are linked to sexual debut, teen girls' own evaluations and attitudes have received little attention (Mollborn, 2017). One exception is Cuffee, Hallfors, & Waller (2007), who used factor analysis to group attitudes about sex and pregnancy among virgins at Wave I of Add Health and used the resulting constructs to predict having had sex by Wave II. They found that attitudes about sex and pregnancy did indeed predict having vaginal sex. We view this work as important and foundational but somewhat limited in its implications. Their analysis did not include other types of sexual behaviors or measures of attitudes about contraception and was limited to only to changes in sexual behavior between Waves I and II. Nonetheless, the larger literature on teen sexuality as well as Cuffee, Hallfors, and Wallers' work leads us to the following hypothesis:

Hypothesis 1: Teen girls with the most negative attitudes toward sex will both delay having vaginal sex and avoid non-vaginal sexual behaviors.

Reproductive Knowledge and Attitudes and Sexual Behaviors

In addition to attitudes directly related to sex, a broader set of reproductive knowledge and attitudes – including knowledge about pregnancy and how to prevent it, perceptions of pregnancy and childbearing, and attitudes toward the ease and acceptability of contraception – shapes reproductive behavior in general and coital debut and the sequencing of sexual behaviors specifically. To conceptualize and measure the relevant domains of reproductive knowledge and attitudes, we build on previous research that identifies key underlying dimensions (AUTHORS, forthcoming). Reproductive knowledge includes understanding female reproductive biology (essentially, how pregnancy occurs), understanding how to use condoms (the most widely used method among teens; Abma & Martinez, 2017), and confidence about one's knowledge of contraception. Among teens, reproductive attitudes include general feelings about pregnancy, perceived life course consequences of a pregnancy, and attitudes toward birth control. All of these factors may be associated with the timing of first vaginal sex and with the sequencing of vaginal sex and other sexual behaviors.

There is wide variation in levels of reproductive knowledge in adolescence and early adulthood (Kaye, Suellentrop, & Sloup 2009). Adolescents' knowledge about the reproductive process, particularly contraception, has been linked to contraceptive behavior in the short- and long-term among those who are sexually active (Guzzo & Hayford, 2018; Rocca & Harper, 2012; Ryan et al., 2007). It is less clear whether and how adolescents' reproductive knowledge might affect the timing and sequencing of sexual behavior. Being confident about one's knowledge of contraceptive methods could lead to an earlier age at coital debut, perhaps because it allows one to feel confident that sex is unlikely to lead to pregnancy or contracting a sexually transmitted infection (STI). Additionally, girls with more knowledge about contraception and

reproduction may also hold more sex-positive views in general, increasing the odds they not only have vaginal sex earlier but also engage in other sexual activities. As such, we posit the following hypothesis:

Hypothesis 2: Girls with more accurate reproductive and contraceptive knowledge, and more confidence in their contraceptive knowledge, will have an earlier coital debut and may also be more likely to engage in non-vaginal sexual behaviors prior to vaginal sex.

Reproductive attitudes may be most closely linked to sexual behavior through fears about pregnancy. For teen and young adult women who have negative attitudes toward pregnancy and perceive that getting pregnant would have negative consequences, vaginal sex would likely be considered a risky behavior, and so we would expect these women to have a later coital debut. Evidence suggests that teens perceive oral sex as less risky than vaginal sex in terms of health, social, and emotional consequences (Halpern-Felsher et al., 2005). As such, those seeking to avoid pregnancy may engage in non-vaginal sex, particularly oral sex, precisely because these behaviors do not lead to pregnancy (Cornell & Halpern-Felsher, 2006). Half of women aged 15-24 report that their first oral sex experience occurred prior to their first vaginal intercourse (Chandra, Mosher, Copen, & Sionean, 2011). Among teens 15-19 who reported any sexual activity, a fifth have *only* had oral or anal sex (Uecker, Angotti, & Regnerus, 2008). Of these "technical virgins," 25% reported that the primary reason they had not had vaginal sex was the fear of pregnancy, with the most common reason (slightly higher, at 27%) being that vaginal sex was against their religion or moral code. We therefore propose:

Hypothesis 3: Girls with the most negative attitudes toward an early pregnancy will delay vaginal intercourse but would be more likely to engage in non-vaginal sexual behaviors prior to vaginal sex.

Attitudes about the acceptability of contraception, like knowledge about contraception, may make sex seem less risky. If adolescents have favorable views about taking precautions to avoid getting pregnant (i.e., accessing and using contraception), they may not delay vaginal intercourse. They may also not feel a need to engage in non-vaginal sexual behaviors as a way to avoid the risk of pregnancy, but favorable attitudes toward contraception may tap into an underlying sex-positive orientation which could increase the odds of engaging in oral or anal sex, similar to knowledge about contraception. Based on this reasoning, we hypothesize:

Hypothesis 4: Girls with more favorable attitudes toward contraception will have an earlier sexual debut and may also be more likely to engage in non-vaginal sexual behaviors prior to vaginal sex.

Other Characteristics Linked to Sexual Behaviors

A number of socioeconomic and demographic characteristics have been linked to sexual debut and sexual behaviors. For instance, compared to whites, black women tend to have vaginal sex earlier, but both black and Hispanic women have oral sex later than their white peers (Holway, 2015). Growing up in a family structure other than two biological parents is associated with earlier vaginal and oral sex (Holway, 2015), and having a parent with a college degree predicts a later age at coital debut (Cuffee, Hallfors, &Waller, 2007). Psychosocial attributes other than attitudes have also been linked to coital debut, with religiosity one of the most frequently studied (e.g., Gold et al., 2010; Hull, Hennessy, Bleakley, Fishbein, & Jordan, 2010; Rostosky, Regnerus, & Wright, 2003). To the extent that young women have goals or characteristics that are perceived as being incompatible with early childbearing, such as being more school-oriented (as indicated by higher academic aptitude or expectations of attending college), we would expect those attributes to be linked to later coital debut (Wheeler, 2010) but perhaps a higher chance of

engaging in oral or anal sex prior to vaginal sex as a way to avoid the risk of pregnancy. Finally, an important component of many psychosocial theories of fertility is a degree of perceived control or self-efficacy – feeling as if one has the power to control reproductive behaviors and outcomes (Fishbein & Ajzen, 2010).

Data and Methods

We use data from the National Longitudinal Study of Adolescent to Adult Health (Add Health). Add Health is a nationally representative study that has been widely used to study sexual and reproductive behavior among adolescents and young adults. Add Health interviewed 20,743 adolescents in grades 7-12 (ages 12-20) in the United States in 1995, of whom 10,480 were female. Respondents were re-interviewed in 1996, 2001-2002, and 2007-2008. In the current analyses, we focus on the 8,352 women who participated in Wave IV (when respondents were aged 26-32) who had valid longitudinal survey weights (excluding 486) for an initial sample size of 7,866 women.

Questions that measure attitudes toward and knowledge about sex, pregnancy, and contraception were only asked of respondents aged 15 and older at Wave I; as such, we excluded 2,393 women below age 15 at Wave I as well as 71 women missing on all of the key attitudinal items (discussed in detail below). We excluded 18 women who reported having vaginal, oral, or anal sex younger than age 12 and excluded 77 women who did not provide valid answers about vaginal, oral, and anal sex experiences or ages at Wave IV.

There is an important caveat when studying the association between adolescent attitudes, knowledge, and sexual behaviors. Prior work has demonstrated that those who had already had sex by Wave I of Add Health had significantly different attitudes about sex and pregnancy than those who had not yet had sex (Deptula, Henry, Shoeny, & Slavick, 2006). It is impossible to

determine whether this difference is because those who were sexually active had more approving attitudes prior to sex or whether becoming sexually active changed attitudes. Thus, to establish temporal ordering, we restrict our analysis to those who were virgins at Wave I, as is common in previous research using this data. Specifically, we excluded women who reported having vaginal sex at Wave I (N = 2,632) or later reported an age at first sex that predated their age at the Wave I survey (N = 249)[1], giving us a final sample size of 2,497 female virgins over aged 15 Wave I. The restriction to virgins at Wave I introduces a new challenge – selection, particularly at older ages. On average, female teenagers in the mid-1990s had their coital debut at around age 17 (Finer & Philbin, 2014), and so female teenage virgins may be an increasingly select group at older ages. Due to concerns over greater sample selectivity at older ages at Wave I, we excluded 91 women aged 19 or older at Wave I (older than the normative age for high school students) and split the remaining sample into two groups for all analyses: 15-16 year olds (N = 1,610) and 17-18 year olds (N = 796).

Dependent Variables

We have two measures of sexual activity, drawn from Wave IV. First, we measure whether the respondent has ever had vaginal sexual intercourse and age at first intercourse. Second, we used the dates reported in Wave IV for first vaginal sex, first oral sex, and first anal sex to create a dichotomous indicator of whether the age at first oral sex or anal sex precedes the age at first vaginal sex; because respondents reported age of sexual experiences in whole years, this measure only captures those who had oral or anal sex at a younger age than vaginal sex.[2] For the indicator

[1] As discussed below, no questions were asked about oral or anal sexual activity at Wave I, so we could neither test for differences across our attitudinal and knowledge measures nor exclude those who had already engaged in either activity.

[2] This no doubt underestimates those who had oral or anal sex prior to vaginal sex but likely captures those who are most likely using non-vaginal sexual experiences as a way to delay vaginal sex and/or the risk of pregnancy.

of oral or anal sex prior to vaginal sex, respondents who reported vaginal sex at Wave IV but did not report either oral or anal sex and those who did not report any sexual activities were coded as 0, whereas those who reported either oral or anal sex but no vaginal sex were coded as 1. The large majority of those with oral or anal sex prior to vaginal sex (about 80%) reported only oral sex prior to vaginal sex; the results were substantively similar if we defined this indicator as having only oral sex prior to vaginal sex (not shown).

Independent Variables

The key independent variables are indicators of attitudes toward sex, reproductive knowledge, and reproductive attitudes. To measure these concepts, we first identified items potentially reflecting attitudes about sex (8 items), reproductive knowledge (13 items), and reproductive attitudes (16 items) at the Wave I survey. We then conducted both exploratory and confirmatory factor analyses (EFA and CFA, respectively) in Mplus 7 to identify the underlying constructs of the three sets of indicators. We compared the fit of models with different numbers of items and factors using two goodness-of-fit criteria, Root Mean Squared Error of Approximation (RSMEA) and Comparative Fit Index (CFI), and we conducted a chi-square test of model fit to determine significant differences in the improvement of model fit across models (Hu & Bentler, 1999). We used a cutoff of .05 or lower for RMSEA to indicate a good-fitting model (Brown & Cudeck, 1992; MacCallum, Browne, & Sugawara, 1996). The CFI values of a .90 or higher provide evidence for adequate model fit, with scores above .95 indicating excellent fit (Hu & Bentler, 1999). Note that for all three sets of factor analyses, we accounted for the correlation between items due to common question wording; see AUTHORS (forthcoming), for more details on this process.

The factor analyses identified three underlying factors, using all eight items, of attitudes toward sex: fewer physical benefits, more negative social consequences, and fewer positive social consequences. For reproductive knowledge, the factor analyses, which used nine of the 13 potential items, identified three factors: female reproductive biology knowledge, condom knowledge, and birth control confidence. For reproductive attitudes, the factor analyses used 12 of the 16 items and also had three factors: feelings toward pregnancy, birth control attitudes, and life course consequences. The component items are listed in Table 1. For attitudes toward sex, higher scores represent a more negative orientation towards sexual intercourse. Higher scores for reproductive knowledge factors mean more accurate knowledge and greater confidence. For the reproductive attitudes, items were recoded as necessary so that higher scores reflect less favorable attitudes toward pregnancy and/or more favorable attitudes toward birth control. We exported factor scores from Mplus into Stata 14 for use in regression models; Mplus does not handle categorical outcome variables well.

– Table 1 here –

In analyses, we controlled for a set of socioeconomic, demographic, and psychosocial background measures, all measured at Wave I. Socioeconomic and demographic control variables include: race-ethnicity, family structure, and maternal education. Psychosocial measures include a dichotomous indicator of whether the respondent highly expected to attend college, a measure of aptitude (adapted from the Peabody Picture Vocabulary Test), and religiosity (a scaled variable of four items about religious service attendance, prayer, and importance, $\alpha = 0.85$). We include two measures specifically linked to sex, sexual self-efficacy and self-reported pubertal timing. Sexual self-efficacy is a scale of three items about being able to plan ahead to use birth control or stopping sex to use birth control ($\alpha = 0.67$). Pubertal timing

is derived from the question "How advanced is your physical development compared to other girls your age?", with response categories of "I look younger than most," "I look younger than some," "I look average," "I look older than some," and "I look older than most." We grouped the first two in a category of "late", the middle response as "on-time," and the last two responses as "early." Finally, in the model predicting having oral or anal sex prior to vaginal sex, we included an indicator of age at first vaginal sex. This indicator has single years of age up to age 22, with a category for "age 23 or older" and a category for "never had vaginal sex."

Analytical Approach

We begin by describing our key independent and dependent variables. Then, we present two sets of analysis, both separately for 15-16 year olds and 17-18 year olds. First, we use discrete time event history models in which we predict the odds of having ever had vaginal sex, using logistic regression. We converted the data to person-years, and women enter at the Wave I survey and exit the year they first had sex or are censored at the year of the Wave IV survey. To account for the nonlinear association between age and sexual debut, we include a time-varying measure of age in years and age squared. Second, we present the odds ratios from logistic regression predicting having had oral or anal sex prior to vaginal sex (this model does not use event history methods). All analyses incorporate design effects using Stata 14's *svy* commands, and missing values are imputed using the *mi* commands; missing values occurred for 5% of the aptitude measures and less than 2% of maternal education, pubertal timing, and sexual self-efficacy.

Results

Descriptive Results

Table 2 shows the weighted descriptive statistics for the items in the sex attitudes, reproductive knowledge, and reproductive attitudes factors separately by age group. In general, for the sex

attitude factors, young women – all of whom had not had sex before Wave I – generally held fairly unfavorable attitudes, particularly in reference to the factors likely tapping into social stigma. (Recall that higher scores represent more negative attitudes about sex.) Young women perceived few positive social consequences and a fair degree of negative social consequences, with slightly less negative attitudes about the physical benefits of sex relative to the other two factors. In general, older and younger girls did not differ in their attitudes about sex, though younger girls had significantly higher scores on the item about sex being physically pleasurable, indicating that younger girls viewed sex as less pleasurable than their older counterparts. The young women in the sample had fairly negative views toward early childbearing and positive views toward birth control. Their knowledge about reproductive biology and condoms, however, was modest at best, and none of the young women were especially confident about their contraceptive knowledge. Although there were no significant differences across the age groups in reproductive attitudes, 15-16 year olds reported higher levels of birth control confidence than 17-18 year olds.

– Table 2 here –

Table 3 shows the weighted descriptives for the dependent variables and Wave I background factors by age group. Among female virgins aged 15 and older at Wave I, the vast majority of the young women had become sexually active by Wave IV (94% of those aged 15-16 and 91% of those aged 17-18). The average age at first vaginal sex was just under two years earlier for the younger age group (18.2 years) than the older age group (20.0 years), suggesting that 17-18 year olds who had not had sex by Wave I are distinct in some ways that carry over into later outcomes. About a fifth of the sample reported they had oral or anal sex prior to vaginal intercourse. In general, the sample characteristics were very similar for the two age

groups. The majority were non-Hispanic white, with 11-12% non-Hispanic black, and about 13-14% Hispanic. Slightly more than a quarter had a mother with a college degree or more, but just under a fifth reported their mother had no high school degree or reported no information for their mother. About two-thirds lived with both biological parents at Wave I. The respondents reported a fairly high degree of sexual self-efficacy (average of 5.16-5.18 on a scale of 1-6). Nearly 70% highly expected to attend college, and the sample was only moderately religious. The only significant difference across the two age groups occurred in self-reported pubertal timing; in the older age group (27%), significantly more reported being later than their peers compared to the younger age group (19%).

– Table 3 here –

Multivariate Results

Multivariate results from the event history logistic regressions predicting first vaginal sex are presented in Table 4. The odds ratios (ORs) shown here represents the odds of having sex for the first time in a given year, controlling for age and other covariates; an OR greater than 1 indicates an earlier debut whereas an OR less than 1 indicates a later debut. Hypothesis 1, which predicted that more negative attitudes about sex would lead to a later age at first sex, is partially supported. In particular, for both age groups, perceiving more negative social consequences delays becoming sexually active. Hypothesis 2 predicted that more reproductive knowledge and confidence could lead to earlier sex, and this, too, is partially supported. While reproductive knowledge is not predictive of becoming sexually active among 15-16 year olds, it is significant for 17-18 year olds. For this group, though, greater female reproductive biology knowledge actually reduces the odds of becoming sexually active in a given year (OR = 0.73), thus delaying coital debut. However, having more accurate condom knowledge and more confidence in one's

knowledge about birth control increases the odds of having sex (OR = 1.39 and OR = 1.49, respectively), leading to an earlier debut as hypothesized. We found no support for Hypotheses 3 or 4, as neither reproductive attitudes nor contraceptive attitudes predict coital debut for either age group. Virtually none of the control variables are significant for either age group, other than age. As expected, the risk of becoming sexually active increases sharply with each passing year but eventually tapers off. For the younger age group, living in a stepfamily at Wave I is associated with an earlier age at coital debut.

– Table 4 here –

Table 5 displays the odds ratios predicting having oral or anal sex prior to vaginal sex. There is no support for Hypothesis 1 regarding attitudes toward sex, as none of the factors tapping into various dimensions of attitudes are associated with having oral or anal sex prior to vaginal sex. As with coital debut, there is no association between adolescent reproductive knowledge and the odds of engaging in oral or anal sex prior to vaginal sex among 15-16 year olds. For 17-18 olds, more accurate condom knowledge increases the odds of oral or anal sex prior to vaginal sex by about 70%, although this association is only marginally statistically significant. Overall, though, there is little support for Hypothesis 2. There is more support for Hypotheses 3 and 4, especially for the older age group. Perceiving more life course consequences to an early pregnancy is significant for older teens; higher scores – indicative of greater concern about the negative consequences – more than double the odds of beginning one's sexual career via non-vaginal sex. Higher scores on birth control attitudes, which reflect greater approval, increase the odds of entering into sexual activity with oral or anal sex by about 60% among 17-18 year olds; among 15-16 year olds, the effect of birth control attitudes is in the same direction but smaller in magnitude and only marginally significant.

– Table 5 here –

Age at first vaginal sex (including whether they had sex at all) is an important predictor of having oral or anal sex prior to vaginal sex but only among younger teens. Among female virgins aged 15-16 at Wave I, those who had sex shortly after their Wave I interview – at ages 15 or 16 – are significantly less likely to have first had oral or anal sex prior to vaginal sex compared to those aged 18 at first sex, whereas those who waited several years to have vaginal intercourse (ages 22 or older) or who had not had vaginal intercourse by Wave IV are significantly more likely to have had oral or anal sex. Turning to the socioeconomic and demographic covariates, compared to Whites, both Black and Asian young women are about 70% less likely to experience oral/anal sex prior to first vaginal sex among those who are younger at Wave I. For those aged 17-18 at Wave I, foreign-born Hispanics and Asian women are less likely to have had oral/anal sex prior to vaginal sex. In addition, compared to young women whose mothers had less than a high school education, young women whose mothers had a college degree or more are more than twice as likely (OR = 2.44) to experience oral/anal prior to first vaginal sex by Wave IV, though this is true only the older teen virgins at Wave I. Among those aged 15-16 at Wave I, early pubertal development increases the odds of oral/anal sex relative to those who reported they developed on-time.

Discussion

Sexual activity becomes nearly universal over the teen and young adult years, but there is substantial variation in the timing and sequencing of sexual behaviors (Halpern-Felsher, Cornell, Kropp, & Tschann, 2005; Haydon, Herring, Prinstein, & Halpern, 2012; Holway, 2015), and the characteristics of sexual debut and sequencing have implications for early pregnancy and other potentially problematic reproductive health outcomes (Reese, Haydon, Herring, & Halpern,

2013; Sandfort, Orr, Hirsch, & Santelli, 2008). Although there is a large body of work documenting the socioeconomic and demographic factors linked to coital debut and sexual sequencing, identifying the psychosocial factors that influence sexual behaviors among teen girls is also an important component of larger efforts aimed at reducing sexual risk-taking and early childbearing in the U.S. Teens' beliefs and attitudes are arguably more easily modified through education, interventions, and programs than socioeconomic characteristics. Teen girls receive mixed messages about sex, pregnancy, and contraception, and so understanding how they filter and internalize these messages – and how they link to actual behavior – explicitly recognizes teens' own voices and agency. We hypothesized a complex set of associations between multidimensional measures of adolescent girls' attitudes and knowledge, the timing of first vaginal sex, and whether oral or anal sex precedes vaginal sex.

In general, our hypotheses were supported but in different ways across the measures of sexual initiation and sequencing behaviors and across the two age groups. Overall, adolescent attitudes and knowledge were more predictive of behaviors among older teens who were virgins at Wave I. Although there were relatively few differences in attitudes and knowledge (with the exception of older teens being less confident than younger teens in their birth control knowledge), or in background factors, it appears there is something unique about those who had already delayed vaginal intercourse to older ages at Wave I. Whatever is selective about this group (older teen virgins), in turn, seems to make their personal attitudes and knowledge more predictive of their subsequent sexual behavior than their younger counterparts. Perhaps younger teens have not yet fully had to resist opportunities and pressures to engage in sexual activity, and older teens – having stayed a virgin longer – experiencing a 'reinforcing' effect on their attitudes with age.

Our first hypothesis addressed the role of direct attitudes about sex, and we expected that girls with more negative attitudes toward sex would delay vaginal sex and would be unlikely to engage in non-vaginal sexual behaviors as well. This was some support for Hypothesis 1, as girls who perceived that sex would have negative social consequences, such as guilt or upsetting one's mother, tended to have sex at later ages, and this was true for both younger and older teens. Attitudes towards sex were not predictive of sexual sequencing, though. Our second hypothesis was that greater reproductive/contraceptive knowledge and confidence could lead to both an earlier sexual debut and, to the extent that it is indicative of a sex-positive orientation, also increase the odds of having oral or anal sex prior to vaginal intercourse. Hypothesis 2 was partially supported. Older teens with more accurate condom knowledge and higher contraceptive confidence tended to have sex earlier, and greater condom knowledge also increased the odds of having oral/anal sex before coital debut. Conversely, those who better understood the physiological risks of pregnancy (in terms of when women were most likely to get pregnant during their menstrual cycle) had a later age at coital debut. Next, we hypothesized that having more negative attitudes toward having an early birth would delay vaginal sex but possibly increase the odds of engaging in non-vaginal sexual behaviors. We found no support for the first part of Hypothesis 3, as there was no link between coital debut and reproductive attitudes, suggesting that fears of teen pregnancy are not a primary influence when teen girls start having vaginal intercourse. However, greater concern over the consequences of an early birth (i.e., having to drop out of school or would be embarrassing to one's family) was associated with having oral or anal sex prior to vaginal sex among older teens. Thus, it appears that one way that fears about pregnancy manifest in sexual behaviors is to increase the chances that girls engage in sexual acts that do not carry a risk of pregnancy. Our final hypothesis was that more favorable

attitudes toward birth control would be associated with an earlier coital debut and increase the odds of having oral or anal sex prior to vaginal sex. Hypothesis 4, too, was partially supported. While birth control attitudes in adolescence did not predict coital debut, attitudes indicative of greater acceptance of contraception increased the odds of having oral or anal sex prior to vaginal sex, although the association was strongest for older teens.

Overall, then, it seems that older teen girls delay vaginal sex primarily due to concerns about the social costs of engaging in sex rather than concerns over pregnancy. However, girls with greater concerns about the consequences of pregnancy are more likely to enter into sexual activity with oral or anal (primarily oral) sex first, perhaps functioning as a delaying mechanism. That is, they may be facing pressure to engage in vaginal sex even earlier, and use oral (or anal) sex as a way to delay to more normative ages. Girls with more favorable attitudes toward contraception are also more likely to first engage in a nonvaginal sexual behavior, perhaps because these attitudes tap into a broader openness about sex. The results linking reproductive knowledge to coital debut are interesting and somewhat provocative, given the larger discourse about sex ed programs for adolescents (Hall, Sales, Komro, & Santelli, 2016). While more accurate information about female reproductive biology was associated with delayed coital debut, accurate condom knowledge and more general confidence in contraceptive knowledge was linked to an earlier debut; it is possible that adolescents who feel prepared to manage the risks of vaginal sex (both pregnancy and STI transmission) may engage in sex earlier because it seems less risky given their familiarity with contraceptive methods. Again, though, we note that the associations between reproductive knowledge and sexual behaviors were present only for those who were virgins at ages 17-18 at Wave I, a select group.

Limitations

A primary limitation of the analyses is the selectivity of the sample. To establish causal linkages between attitudes and sexual behavior, we restricted our sample those who had not yet had sex by Wave I; this is a selective group of individuals, especially those who were older during the initial wave. We also note that the attitudinal and knowledge items are somewhat limited; it is likely that there are other dimensions of reproductive knowledge, reproductive attitudes, and attitudes toward sex that are not captured by these surveys, such as knowledge about which sex acts actually lead to pregnancy (Wynn, Foster, & Trussell, 2009) or questions about other methods of contraception. We were also unable to discern giving versus receiving oral sex, nor did we know anything about the women's partners. Ideally, we would have been able to examine contraceptive use at first sex, but this question was only asked at Waves I and II of Add Health. A fifth of the analytical sample was not interviewed in Wave II (which was restricted to those still enrolled in school), and only 20% of Wave I virgins who had sex by Wave IV had done so by Wave II. Finally, we excluded males, as the questions about attitudes toward sex seemed to tap into a stigma that is uniquely gendered.

Conclusion

Although the United States' teen pregnancy rates have declined over the past two decades, teen pregnancy rates continue to be higher for the U.S. relative to other industrialized countries, and STI rates have been increasing among teens and young adults in recent years (Centers for Disease Control and Prevention, 2018; Sedgh, Finer, Bankole, Eilers, & Singh, 2015). The current political milieu is shifting away from comprehensive sex ed (Lindberg, Maddow-Zimet, & Boonstra, 2016), threatening to reverse the improvements in teens' and young adults' sexual and reproductive health. The movement away from comprehensive sex ed, in some ways, makes

continued research into the drivers of early sexual behaviors increasingly important so as to build a solid evidence base for what programs should include and why comprehensive sex ed programs are preferable to abstinence-only or sexual risk avoidance programs (Santelli et al., 2017). For instance, the results imply that teen girls' worries about the emotional and social consequences of sex, rather than concerns about the risk of pregnancy, are major drivers of the timing of coital debut. This suggests that sex ed programs must do more than just discuss the physiological aspects of reproduction but also consider the relational and social aspects of sexual activity. Our findings about the link between knowledge and timing also suggest the field should be prepared to acknowledge that some aspects of sex ed may indeed lead to earlier sex. It remains to be seen, however, if earlier sex is also accompanied by safer sex, which is an important future research question.

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Table 1. Items in the Sex Attitudes, Reproductive Knowledge, and Reproductive Attitudes Factors

Sex Attitudes[A]	Variable name	Reproductive Knowledge	Variable name	Reproductive Attitudes[A]	Variable name
(Fewer) Physical Benefits		*Female Reproductive Biology Knowledge*[B]		*Feelings toward Pregnancy*	
If you had sexual intercourse, it would give you a great deal of physical pleasure	sex pleasure	The most likely time for a woman to get pregnant is right before her period starts. *(false)*	before period	Getting pregnant at this time is one of worst things that could happen. [D]	preg worst
If you had sexual intercourse, it would relax you	sex relax	In general, a woman is most likely to get pregnant if she has sex during her period, as compared with other times of the month. *(false)*	during period	Wouldn't be all that bad if got pregnant now.	preg not bad
(Fewer) Positive Consequences		*Condom Knowledge*[B]		*Life Course Consequences*	
If you had sexual intercourse, your friends would respect you more.	sex respect more, friends	Even if the man pulls out before he ejaculates, even if ejaculation occurs outside of the woman's body, it is still possible for the woman to become pregnant. *(true)*	withdraw, get preg	If you got pregnant, it would be embarrassing for your family.[D]	preg embarrass family
If you had sexual intercourse, it would make you more attractive to men (women).	sex attractive	When putting on a condom, it is important to have it fit tightly, leaving no space at the tip. *(false)*	fit tight	If you got pregnant, it would be embarrassing for you.[D]	preg embarrass self
If you had sexual intercourse, you would feel less lonely.	sex less lonely	Vaseline can be used with condoms, and they work just as well. *(false)*	vaseline	If pregnant now, would have to grow up too fast.[D]	preg grow up fast
		As long at the condom fit over the tip of the penis, it doesn't matter how far down it is unrolled. (*false)*	fully unroll	If pregnant now, would have to quit school.[D]	preg quit school
(More) Negative Consequences		*Birth Control Confidence*[C]		*Birth Control Attitudes*	
If you had sexual intercourse, your partner would lose respect for you.[D]	sex lose respect, partner	You are quite knowledgeable about the rhythm method of birth control and when it is a "safe" time during the	rhythm confidence	It takes too much planning ahead of time to have birth control on hand when you're going to have sex.	BC planning

		month for a woman to have sex and not get pregnant.			
If you had sexual intercourse, afterward, you would feel guilty.[D]	sex feel quilty	You are quite knowledgeable about how to use a condom correctly.	condom confidence	Using birth control is morally wrong.	BC morally wrong
If you had sexual intercourse, it would upset {MOTHER}.[D]	sex upset mom	You are quite knowledgeable about the withdrawal method of birth control.	withdrawal confidence	Too much of a hassle to use birth control.	BC hassle
				Birth control interferes with enjoyment.	BC less pleasure
				In general, birth control is too expensive to buy.	BC expensive
				It {IS/WOULD BE} too hard to get a {GIRL/ BOY} to use birth control with you.	BC hard partner

[A] Unless otherwise indicated, all items measured on a scale of 1=strongly agree to 5=strongly disagree.
[B] Items were recoded so that 1 equals the correct answer, and 0 equals the incorrect answer.
[C] Originally measured on a scale of 1=strongly agree to 5=strongly disagree. Recoded as a dichotomous variable: 1=strongly agree/agree and 0=all other responses.
[D] Reverse coded.

Table 2. Weighted Descriptive Statistics for Items in the Sex Attitudes, Reproductive Knowledge, Reproductive Attitudes Factors

	15-16 (N = 1,610)	17-18 (N = 796)	
Panel A: Sex Attitudes (mean, SD; range 1-5)			
(Fewer) Physical Benefits			
Sex pleasure	3.17 (0.99)	3.01 (1.04)	*
Sex relax	3.47 (0.88)	3.37 (0.90)	
(Fewer) Positive Consequences			
Sex respect more, friends	4.12 (0.87)	4.14 (0.89)	
Sex attractive	3.90 (0.93)	3.99 (0.91)	
Sex less lonely	3.89 (0.94)	3.92 (0.97)	
(More) Negative Consequences			
Sex lose respect, partner	2.98 (1.14)	2.85 (1.21)	
Sex feel guilty	3.79 (1.14)	3.90 (1.17)	
Sex upset mom	4.49 (0.86)	4.40 (0.93)	
Panel B: Reproductive Knowledge (% correct or agreeing)			
Female Reproductive Biology Knowledge			
Before period	38.9%	37.7%	
During period	62.3%	64.3%	
Condom Knowledge			
Withdraw, get pregnant	81.5%	84.0%	
Fit tight	47.2%	46.2%	
Vaseline	67.8%	67.5%	
Fully unroll	89.9%	92.7%	
Birth Control Confidence			
Rhythm confidence	49.8%	41.9%	**
Condom confidence	72.2%	64.3%	*
Withdrawal confidence	55.8%	47.8%	**
Panel C: Reproductive Attitudes (mean, SD; range 1-5)			
Feelings toward Pregnancy			
Preg worst	4.61 (0.72)	4.56 (0.84)	
Preg not bad	4.47 (0.80)	4.48 (0.79)	
Life Course Consequences			
Preg embarrass family	3.95 (1.14)	4.05 (1.20)	
Preg embarrass self	4.19 (1.12)	4.21 (1.18)	
Preg grow up fast	4.28 (0.92)	4.20 (1.05)	
Preg quit school	2.58 (1.18)	2.56 (1.28)	
Birth Control Attitudes			
BC planning	4.11 (1.04)	4.16 (1.10)	
BC morally wrong	4.19 (1.04)	4.15 (1.07)	
BC hassle	4.24 (1.05)	4.29 (1.08)	
BC less pleasure	4.06 (0.99)	4.13 (0.98)	
BC expensive	3.95 (0.99)	4.02 (1.03)	
BC hard partner	3.78 (1.08)	3.89 (1.12)	

Significant differences between 15-16 and 17-18 year olds using Pearson chi-square
* $p \leq .05$; ** $p \leq .01$; *** $p \leq .001$

Table 3. Weighted Descriptive Statistics among Adolescent Female Virgins Aged 15-18 at Wave I of the National Longitudinal Survey of Adolescent to Adult Health

	15-16	17-18	
Wave IV Sexual Activity			
Vaginal intercourse	93.7%	91.3%	
Age at 1st experience (range 15-30)	18.2 years	20.0 years	***
Had oral/anal prior to first vaginal sex	20.0%	23.3%	
Wave I Background Characteristics			
Age	15.4 years	17.4 years	***
Race-ethnicity-nativity			
White	70.9%	66.3%	
Black	11.5%	11.1%	
Foreign-born Hispanic	4.2%	6.2%	
Native-born Hispanic	9.1%	8.4%	
Asian	2.9%	6.3%	
Other	1.4%	1.8%	
Family structure			
Both biological parents	65.3%	70.5%	
Stepfamily	13.3%	8.5%	
Single parent	19.2%	17.7%	
Other	2.1%	3.3%	
Mother's education			
Less than HS	16.6%	18.4%	
HS/GED	31.9%	27.0%	
Some college	26.0%	25.2%	
College or more	25.5%	29.4%	
W1 Sexual Self-efficacy (range 1-6)	5.18	5.16	
W1 Pubertal timing			
On time	39.6%	31.2%	
Early	41.6%	42.3%	
Late	18.8%	26.5%	**
High college expectations	66.4%	75.3%	
Aptitude score (range 16-131)	103.13	103.35	
Religiosity (range 1-7)	3.53	3.56	
N	1,610	796	

Significant differences between 15-16 and 17-18 year olds using Pearson chi-square
* $p \leq .05$; ** $p \leq .01$; *** $p \leq .001$

Table 4. Odds Ratios from Weighted Logistic Regression Event History Models Predicting Vaginal Sexual Debut, by Age Group

	15-16		17-18	
Wave I Attitudes				
Attitudes toward Sex				
More negative social consequences	0.80	***	0.75	**
Fewer positive social consequences	0.99		1.07	
Fewer physical benefits	0.90		0.92	
Reproductive Knowledge				
Female reproductive biology knowledge	0.90		0.73	*
Condom knowledge	1.07		1.39	*
Birth control confidence	1.12		1.49	***
Reproductive Attitudes				
Feelings toward pregnancy	1.12		0.97	
Birth control attitudes	1.08		1.07	
Life course consequences	0.95		1.05	
Wave I Background Characteristics				
Age (time-varying)	4.60	***	2.90	***
Age squared (time-varying)	0.96	***	0.98	***
Race-ethnicity-nativity (omitted = White)				
Black	1.21		1.09	
Foreign-born Hispanic	0.94		0.76	
Native-born Hispanic	0.95		0.77	
Asian	0.96		1.17	
Other	1.11		1.96	
Family Structure (omitted = both bio parents)				
Stepfamily	1.67	***	1.13	
Single-parent family	1.19		1.16	
Other-family	0.81		0.89	
Mother's Education (omitted = High School/GED)				
Less than HS	1.10		0.97	
Trade School/Some College	1.20		0.80	
Bachelor's or more	0.92		0.99	
Sexual Self-efficacy	1.08		0.99	
Pubertal timing (omitted = on time)				
Early	1.20		1.09	
Late	1.14		0.79	
High college expectations	0.96		0.86	
Aptitude score	1.00		1.00	
Religiosity	1.00		0.96	
Constant	0.00	***	0.00	***
N	1,610		796	
Person-months	7271		3538	

* $p \leq .05$; ** $p \leq .01$; *** $p \leq .001$

Table 5. Odds Ratios from Weighted Logistic Regression Event History Models Predicting Oral/Anal Sex Prior to Vaginal Sex, by Age Group

	15-16		17-18	
Wave I Attitudes				
Attitudes toward Sex				
More negative social consequences	0.96		0.94	
Fewer positive social consequences	0.88		0.90	
Fewer physical benefits	0.70		0.74	
Reproductive Knowledge				
Female reproductive biology knowledge	0.96		1.31	
Condom knowledge	1.39		1.69	+
Birth control confidence	0.86		0.86	
Reproductive Attitudes				
Feelings toward pregnancy	1.11		0.61	
Birth control attitudes	1.28	+	1.62	**
Life course consequences	1.29		2.26	*
Age at 1st Vaginal Sex (omitted = 18)				
15	0.18	**	---	
16	0.31	*	---	
17	0.57		1.19	
19	1.31		1.33	
20	3.15		0.94	
21	0.93		0.89	
22	2.89	*	2.02	
23 or older	2.42	*	1.79	
Never had sex	5.74	***	1.69	
Wave I Background Characteristics				
Race-ethnicity-nativity (omitted = White)				
Black	0.27	***	0.77	
Foreign-born Hispanic	0.95		0.07	**
Native-born Hispanic	0.71		0.77	
Asian	0.32	*	0.21	*
Other	0.55		0.61	
Family Structure (omitted = Both bio parents)				
Stepfamily	0.97		0.78	
Single-parent family	1.38		0.61	
Other-family	0.73		0.30	
Mother's Education (omitted = High School/GED)				
Less than HS	0.56		0.72	
Trade School/Some College	1.18		1.71	
Bachelor's or more	1.56		2.44	*
Sexual Self-efficacy	1.03		1.25	
Pubertal timing (omitted = on time)				
Early	1.53	*	0.71	
Late	1.38		1.13	
High college expectations	1.44		1.60	
Aptitude score	1.01		1.00	
Religiosity	1.05		0.92	
Constant	0.03	**	0.07	+
N	1,610		796	

* $p \leq .05$; ** $p \leq .01$; *** $p \leq .001$