RESEARCH ARTICLE

The School Contextual Effect of Sexual Debut on Sexual Risk-Taking: A Joint Parameter Approach

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──────────── ABSTRACT ────────────

BACKGROUND: Previous research has identified individual and school-level characteristics that are associated with sexual risk-taking, but the impact of school-level mechanisms on sexual risk-taking is not well understood. We examine the aggregated effects that early sex at the school level have on risky sexual behaviors.

METHODS: We use 3 waves of data from the National Longitudinal Study of Adolescent Health. An individual's first sexual intercourse before age 15 was recorded along with various risky sexual behaviors at debut. Two variables at respondent's later stage of life were also included: having sex in exchange for drugs or money, and contraction of sexually transmitted disease (STD). Longitudinal analysis was conducted using a joint parameter model that tested unobserved school effects on individual behaviors simultaneously.

RESULTS: An increase in early sexual initiation at the school level was associated with higher probability of sexual debut, along with increased involvement in sexual risk-taking controlling for student family background.

CONCLUSIONS: School behavioral mechanisms are directly related to sexual health behaviors among youth. Our findings have implications for school-based interventions, education programs, and the role of parents.

Keywords: sexual debut; sexual risk behavior; Add Health; contextual effect.

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Early initiation of sexual behaviors is widespread among adolescents in the United States. According to the US Centers for Disease Control and Prevention,[1] nearly half (47.4%) of all high school students have engaged in sexual intercourse. Although considered normative, early sexual initiation can severely affect the physical and psychological health of adolescents. Early sexual initiation is linked to an array of other sexual risk-taking behaviors, such as multiple sexual partners, sexual intercourse while under the influence of drugs or alcohol, unexpected pregnancy,[2] and lower rates of condom use.[2-4] As public policy has addressed, early sexual activity is also linked to poor educational outcomes,[5,6] depression,[7] and self-harm behaviors, such as self-cutting and suicide.[8,9]

Multiple efforts have been made to identify the individual characteristics of those who have engaged in sexual risky behaviors in the United States.[10] Researchers have also tried to pinpoint the school characteristics which might prompt such behaviors given that most youth today spend considerable amount of time inside school buildings. School, as a social institution, contains significant variations in social norms.[11] Such norms have been linked to an array of risk-taking behaviors, including sexual risk-taking. For instance, within disadvantaged schools,

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unique youth subcultures have been shown to increase the risk for early sexual debut, multiple sexual partners, and teenage pregnancy.[12] More recently, studies have demonstrated that students' attitudes within a school increase the likelihood for several sexual risk-taking behaviors, which are independent of the effects of school disadvantage and parenting.[13]

Although studies continually emphasize the influence of school structural effects such as racial composition with respect to youth sexual risk-taking, most of the research continually overlooks important behavioral mechanisms at the school level that have the potential to influence risky behavior. This study extends the current scholarship by considering the school-level influence on early sexual initiation and other sexual risk-taking behaviors. We utilized a novel contextual effects approach that allows for the consideration of unobserved behavioral effects at the school level on individual health-related outcomes.

We theorize that schools develop a set of norms, beliefs, and behaviors regarding sex that are manifested within its individual social systems. The youth who adopt the norms that promote early sexual initiation will often engage in other forms of sexual risk-taking, not only when they are in school, but also in the later stages of their lives. Specifically, we test the following hypothesis: Higher levels of early sexual initiation at the school level are associated with increased involvement in unprotected sex, joint occurrences of sex and alcohol or drugs, sex for money, and sexually transmitted disease (STD). Because early sex and sexual risky behaviors could occur simultaneously, they might be shaped by the same school contexts that are not easily captured by separate regression models. Studies that used aggregated school-level variables, usually as proxies, typically fail to capture specific unobserved school contexts, while educational surveys that focus on school environment do not typically contain sensitive information on sexual activities. We overcome these methodological limitations by employing a joint parameter model,[14] which allowed for testing the direct effect of unobserved school behavior on individual outcomes to investigate how the collective patterns of early sexual debut at the school-level influences involvement in risky sexual behaviors at the individual level.

METHODS

Participants

This study is based on the National Longitudinal Study of Adolescent Health (Add Health), a longitudinal study of a nationally representative sample of adolescents in grades 7 to 12 in the United States during the 1994 to 1995 school years.[15] Schools were selected using a stratified cluster design. Adolescents and their parents were subsequently randomly selected within schools. Baseline in-home interviews with participants were followed by 3 additional in-home interviews in 1996 (Wave II), 2002 to 2003 (Wave III), and 2008 to 2009 (Wave IV) and incorporated an array of individual, school, family, and behavioral measures. Over 70% of chosen schools participated. The adolescent participation rates ranged from 78% to 88% from Wave I to Wave IV, with parent participation being more than 85%.

Our analytical sample is based on adolescents from Wave I to Wave III. We did not include Asian and other racial categories in the analysis because of low frequency. Cases with missing values on independent variables or information on time of sexual debut were also deleted, leaving a sample size of 13,322 unique individuals.

Instruments

Dependent Variables. Respondents were asked to provide information regarding the timing of sexual debut. The initiation of sexual intercourse was defined as having sex for the very first time before age 13.

We included 5 sexual risk-taking behaviors that have been shown to be correlated with early sexual debut and poor health and life course outcomes among youth. These behaviors include: (1) drinking alcohol at the first sexual intercourse, (2) using drugs at the first sexual intercourse, (3) having sex in exchange for drugs or money, (4) becoming infected by STDs, and (5) having regretted sex under the influence. All 5 sexual risk-taking behaviors were measured as dummy variables, with 1 representing the presence of the indicated behavior.

The sex debut variable was constructed using responses to the question of age of first sexual intercourse from Wave I to Wave IV; sexual risk behaviors variables were measured at Wave I-III of Add Health, conditional on the time of sexual debut.

Independent Variables. Individual background including age, sex, race, family structure (whether lives with 2 bio-parents), religiosity (average of 3 5-point scales on church attendance, importance of religion, and frequency of prayer) were included. Parents' nativity (whether parents were foreign born), economic status (whether receiving welfare), education, and smoking habits[16] were also included as additional controls. An array of parenting information is also used in our models, including parental connectedness, parental monitoring, parent-child communication, and parent-child communication on sexual issues. Details are listed in Table 1.

Data Analysis

Our main interest is to investigate the effect the early sexual debut at the school level has on the involvement in other sexual risk-taking behaviors

Table 1. Descriptive Statistics for Variables Included in the Study

	N	Mean (SD)	Minimum	Maximum
Female	13,222	0.51 (0.50)	0	1
Age	13,222	15.53 (1.71)***	11	21
Race				
White	13,222	0.58 (0.49)***	0	1
Black	13,222	0.23 (0.42)***	0	1
Hispanic	13,222	0.19 (0.39)***	0	1
Two biological parents	13,222	0.52 (0.50)*	0	1
Smoking parent	13,222	0.45 (0.50)***	0	1
Foreign born	13,222	0.14 (0.35)***	0	1
Parental education				
Less than high school	13,222	0.13 (0.33)†	0	1
High school	13,222	0.25 (0.43)	0	1
College †	13,222	0.62 (0.48)*	0	1
Welfare	13,222	0.09 (0.28)***	0	1
Religiosity	13,222	3.41 (0.85)	1	5
Conflict	13,222	0.39 (0.49)	0	1
Parental connectedness				
Perceived caring	13,222	4.78 (0.48)***	1	5
Closeness	13,222	4.44 (0.77)*	1	5
Parental monitoring				
Monitoring	13,222	0.73 (0.22)**	0	1
Daily meal	13,222	0.40 (0.49)**	0	1
Parental beliefs				
Disapproval sex	13,222	4.28 (1.17)	1	5
Approval steady sex	13,222	4.15 (1.22)*	1	5
Parent-child communication				
Intenseness of talk	13,222	2.86 (0.93)*	1	4
Recommend birth control	13,222	2.84 (1.44)	1	5
Attitude on sexual topics	13,222	4.18 (0.73)***	1	5
Early sexual initiation at 11	13,222	0.04 (0.20)	0	1
Early sexual initiation at 12	13,222	0.08 (0.27)	0	1
Early sexual initiation at 13	13,222	0.15 (0.36)	0	1
Early sexual initiation at 14	13,222	0.25 (0.44)	0	1
Early sexual initiation at 15	13,222	0.39 (0.49)	0	1
Sexual risk-taking at wave I-III		Wave I	Wave II	Wave III
Drink at the first sex	Mean (SD) N	0.09 (0.29)† 7482	0.01 (0.10) 5917	
Drug at the first sex	Mean (SD) N	0.03 (0.19) 7482	0.003 (0.06) 5917	
Sex for drug/money	Mean (SD) N	0.03 (0.16) 7583	0.02 (0.13) 11,210	0.04 (0.17) 18,277
Sexually transmitted disease	Mean (SD) N	0.08 (0.26)† 7482	0.06 (0.24) 5917	0.09 (0.28) 13,324
Regretted sex under influence	Mean (SD) N	0.15 (0.35) 4943	0.07 (0.25) 7616	0.12 (0.32)** 12,607

*p < .05; **p < .01; ***p < .001; †p < .1 in 2-tailed test.

at the individual level. We use a random-effect-dependent model,[14] which models early sexual initiation at the individual level, along with other sexual risk-taking behaviors as a joint process. The joint estimation approach is critical to obtaining an unbiased inference because the longitudinal nature of outcome markers, such as risky sexual behavior, is correlated with the timing of sexual initiation.

We define early sexual initiation as a dummy variable, eg, the occurrence of first-time intercourse before a certain age, and age threshold. We fit a multilevel logistic model to account for the data clustering at the school level. The same approach

is used to model 5 sexual risk-taking variables. We practically estimate 5 sets of models. Within each set, 2 simultaneous regression equations are estimated for the likelihood of (1) early sexual debut and (2) a specific sexual risky behavior, controlling for the same individual characteristics, parent characteristics, and parenting information.

Although the 2 equations within each set are estimated with the same independent variables, they are connected by a shared random effect u_{1i} (see Appendix for more details). Since the dependent variable in the first equation is early sexual initiation, the random effect u_{1i} represents the unobserved effect

of distinct school context on early sexual initiation. In the second equation, the dependent variable is a risky sexual behavior, and in addition to the same set of independent variables from the first equation, the early sexual initiation as well as the school-level random effect are also included. Its random effects contain 2 parts. The first part is the joint random effect u_{1i}, which represents the effect of aggregated sexual initiation at the school level on individual risky sexual behavior. The second part, u_{2i}, accounts for the clustering effect of the involvement of risky sexual behavior at the school level. Statistical models are described in the Appendix. The model was implemented using SAS PROC NLMIXED.[17]

RESULTS

Descriptive Results

Table 1 presents descriptive statistics for our analytic sample. The analysis was limited to respondents who reported information regarding the timing of sexual debut and non-Asian/other. At Wave I, respondents were on average 15.53 years (SD = 1.71) with slightly more than half being female (51%). More than half were white (58%), followed by 23% African American, and 19% Hispanic. When looking at the progression of early sexual debut by age, few respondents engaged in sexual intercourse at ages 11 (4%) and 12 (8%), with a slight increase at age 13 (15%). The percentage of adolescents engaging in sexual intercourse for the first time increased substantially at ages 14 and 15, representing almost two thirds of all sexual debut cases (25% and 39%, respectively). Approximately 9% reported using alcohol (SD = 0.29) and 3% reported using drugs (SD = 0.19) at debut at Wave 1. Judging by the information reported 8 years later in Wave III, 4% reported having sex in exchange for drugs or money (SD = 0.17), 9% reported an STD (SD = 0.28), and 12% reported having feelings of regret after engaging in sex under the influence (SD = 0.32).

To evaluate potential selection bias due to missing information on the timing of sexual debut, we conducted a *t* test to compare the sample used with the entire Wave I sample. Although all the statistics were similar, according to the test results, the sample we used was slightly younger (15.53 vs 15.70; p < .01), had a higher percentage of white (58% vs 50%; p < .01), black (23% vs 21%; p < .01), and Hispanic (19% vs 17%; p < .01), a lower percentage of smoking parents (45% vs 47%; p < .01), foreign-born parents (14% vs 20%; p < .01), parents receiving welfare (9% vs 10%; p < .01) parents with less than a high school degree of education (13% vs 14%; p < .10), and a higher percentage of parents who have a college degree of education (62% vs 61%; p < .05), living with 2 biological parents (52% vs 51%; p < .05), higher

level of parent-child closeness (4.46 vs 4.42; p < .01), perceived caring (4.78 vs 4.75; p < .01), intenseness of talk on sexual topics (2.86 vs 2.84; p < .05), disapproval of sex (4.18 vs 4.15; p < .01), and approval of steady sex (4.15 vs 4.11; p < .05); as well as a higher percentage of daily meals (40% vs 39%; p < .01), and a lower level of parental monitoring (0.73 vs 0.74; p < .01). For the risky sexual behaviors, the sample showed a slightly lower percentage of using alcohol at debut (3% vs 4%; p < .10) at the Wave I, and a higher percentage of regretted sex while under the influence (12% vs 11%; p < .01) at the Wave III. In short, our analytical samples did not appear to deviate substantially from the full Wave I sample. There is some self-selection bias, but the distribution of the covariates is similar between the missing and nonmissing samples. We conclude that the missing data are at random and use case-wise deletion to provide unbiased estimates in the following section, though with reduced statistical power.

Multivariate Results

Individual and school effect of early sex. Since adolescent's sexual debut could take place at varying time points, we utilize various age thresholds for early sexual initiation. In Table 2, we show the results of the joint model, examining the effect that an individual's early sexual initiation had on other forms of sexual risk-taking alongside the coefficient of school random effect, b1, which captures the unobserved school contextual effects on the same sexual risky behaviors. The estimated coefficients for debut and school context in Table 2 are tied to each of the risk-taking behaviors included in the study. Therefore, 5 columns are provided for sexual debut that correspond to each of the sexual risk-taking behaviors.

In all the specifications, individual early sex initiation is positively correlated with the 5 risky sexual behaviors. For alcohol and drug use, the estimated effects are only significant for the age 14 threshold group. The pattern is more consistent between sexual debut and the rest of the 3 risky behaviors. Specifically, individual effect on sex for money/drugs ranges from 0.5 to 0.8, representing an increase of 65.5% to 138.2% when the person had early sex. The effect on STD ranges from 0.2 to 0.4, representing an increase of 25% to 45%. This finding is consistent with prior studies that link early sexual debut to inconsistent use of birth control and an increased risk of having STDs.[18] The effect on regretted sex under the influence ranges from 0.3 to 0.4, representing an increase of 40% to 52%. There seems to be no clear pattern on how different age of initiation affects risky sexual behaviors occurrences.

Another important result is that school effect is salient in most of our specifications: 14 out of 25

Table 2. Individual and School Effects of Sex Debut on Risky Sexual Behaviors

Sexual Debut	Risky Sexual Behavior				
	Alcohol Use at Debut	Drug Use at Debut	Sex for Money/Drug	Sexually Transmitted Disease	Regretted Sex Under Influence
Individual, age = 11	0.223 (0.176)	0.224 (0.244)	0.504 (0.113)***	0.225 (0.112)*	0.120 (0.090)
School (b1)	0.521 (0.279)†	0.367 (0.273)	0.206 (0.082)*	0.100 (0.070)	−0.150 (0.052)**
Individual, age = 12	0.105 (0.134)	0.115 (0.196)	0.652 (0.091)***	0.303 (0.082)***	0.339 (0.063)***
School (b1)	0.555 (0.194)**	0.412 (0.242)†	0.252 (0.092)**	0.043 (0.074)	−0.219 (0.053)***
Individual, age = 13	0.089 (0.108)	0.202 (0.164)	0.754 (0.081)***	0.357 (0.065)***	0.365 (0.050)***
School (b1)	0.662 (0.228)**	0.137 (0.298)	0.155 (0.109)	0.038 (0.084)	−0.255 (0.058)***
Individual, age = 14	0.167 (0.100)†	0.373 (0.160)*	0.832 (0.080)***	0.372 (0.059)***	0.355 (0.044)***
School (b1)	0.986 (0.288)***	0.562 (0.378)	0.234 (0.134)†	0.053 (0.104)	−0.276 (0.072)***
Individual, age = 15	0.031 (0.106)	0.109 (0.177)	0.868 (0.087)***	0.368 (0.061)***	0.421 (0.043)***
School (b1)	1.898 (0.671)**	0.797 (0.650)	0.121 (0.152)	0.085 (0.121)	−0.279 (0.083)**

*$p < .05$; **$p < .01$; ***$p < .001$; †$p < .1$ in two-tailed test.

coefficients associated with b1 were significant at least at the 0.1 level in Table 2. Interestingly, school context is negatively correlated with the probability of an individual regretting having had sex under the influence, a direct contrast to the individual effect, which is positive. This shows that when there were more students who have had early sexual initiation inside schools, individuals are less remorseful to having sex under the influence. Overall, the direction of the effect also fits with what one would expect. An increase in school-level early sex, regardless of age level, leads to riskier sexual behaviors at the same time, and to risky behaviors later in life. The school effects diminish in an individual's later life risky sexual behaviors, such as sex for money or drugs or contracting an STD.

Furthermore, our exploratory analysis indicated that among the other 5 risky sexual behaviors included in this study, 2 out of the 5 did not yield valid estimates for the variance of school random effect, although the process of estimation was terminated normally. This speaks to the fact that when the participants recorded their sexual debut information, they were still in the same high schools. Most of the risky sexual behavior data were collected after they left the schools; therefore, to cluster data at the initial school level made little practical sense. Thus, we only present the results where the random effect was left out for the risky sexual behavior in the joint model.

Effects of the covariates. Table 3 presents the coefficient estimates for the effect of parenting and other covariates on sexual debut at age 13 or equation A1 of the joint model. The remaining tables are qualitatively similar and available upon request. Overall, females are less likely than males to engage in risky sexual behaviors. Higher levels of religiosity are also negatively correlated with risky sexual behaviors. Higher levels of perceived caring by parents along with having a daily family meal both reduced the chances of risky sexual behaviors. Consistent with prior studies, female, older age, living with 2 biological parents, and foreign-born parents decreased the odds for early sexual debut. Parental smoking and parental-child conflict increased the likelihood of early sexual debut.[16] At the school level, results demonstrated that there was significant variation between schools regarding early sexual debut at age 12.

We also note that parenting strategies do not display a universal relationship with risky sexual behaviors when taking into account sexual debut. For instance, when parents recommend birth control methods, adolescents are more likely to report feeling regret after having sex under influence, as well as show an increase in STD. But this variable does not have any impact on the reported alcohol or drug use, neither does it have any impact on sex for money/drugs. This finding suggests that parenting advice on risky sexual behaviors needs to be strategized on specific behavioral targets.

Previous studies have acknowledged the complexity of the relationship between parent-child communication and early sexual debut.[19] Various factors have been proposed to explain the positive association, such as timing of parent-child communication,[19] and the parental communication styles. In our case, although the variables have effects with expected direction, we lack the information to determine the chronological order of sexual initiation and parent-child communication. It is possible that parent-child communication is a response to their perception of their child's sexual readiness or sexual initiation.[19]

DISCUSSION

Schools play a substantial role in the socialization of youth. Affected by their parent's choices in location, youth are geographically constrained within schools with varying resources, beliefs, behaviors, and traditions. Beliefs systems and traditions embedded within a school have the potential to create unique youth cultures that encourages early sexual debut.[12] Numerous studies show that early sexual initiation is linked to several other sexual risk behaviors that lead to poor health and life course outcomes.[6-9] Building

Table 3. Estimated Effect of School Sexual Debut on Other Forms of Sexual Risk-Taking at Age 13

Variables	Alcohol Use at Debut	Drug Use at Debut	Sex for Money/Drug	STD	Regretted Sex Under Influence
Intercept	−5.399 (0.851)***	−3.679 (1.304)**	−2.230 (0.598)***	−2.974 (0.457)***	−0.647 (0.341)†
Female	0.072 (0.097)	−0.453 (0.156)**	−0.813 (0.084)***	1.210 (0.065)***	−0.225 (0.041)***
Welfare	0.068 (0.165)	0.070 (0.250)	0.143 (0.116)	−0.005 (0.089)	−0.202 (0.082)*
Religiosity	−0.121 (0.055)*	−0.195 (0.085)*	0.004 (0.046)	−0.033 (0.036)	−0.052 (0.024)*
Conflict	0.147 (0.094)	0.153 (0.147)	0.258 (0.075)***	0.097 (0.056)†	0.321 (0.040)***
Perceived caring	−0.158 (0.094)†	−0.010 (0.149)	−0.244 (0.073)**	−0.075 (0.057)	−0.042 (0.044)
Monitoring	0.726 (0.252)**	0.641 (0.384)†	−0.196 (0.169)	0.001 (0.132)	0.245 (0.101)*
Daily meal	−0.185 (0.109)†	−0.248 (0.173)	−0.078 (0.081)	−0.153 (0.061)*	−0.231 (0.044)***
Closeness	0.013 (0.066)	−0.117 (0.099)	0.005 (0.054)	−0.043 (0.038)	−0.041 (0.029)
Attitude on sexual topics	0.019 (0.077)	−0.169 (0.113)	−0.068 (0.057)	−0.025 (0.044)	−0.017 (0.034)
Disapproval of sex	−0.015 (0.040)	0.071 (0.067)	0.007 (0.032)	−0.026 (0.023)	0.006 (0.018)
Approval of steady sex	−0.057 (0.039)	0.068 (0.066)	−0.034 (0.030)	−0.048 (0.023)*	−0.001 (0.017)
Age	0.192 (0.038)***	0.022 (0.057)	0.001 (0.025)	0.009 (0.019)	−0.074 (0.014)***
Intenseness of talk	0.032 (0.065)	0.138 (0.100)	−0.016 (0.048)	−0.026 (0.036)	0.006 (0.027)
Recommend birth control	−0.003 (0.037)	−0.024 (0.058)	0.041 (0.029)	0.075 (0.022)***	0.032 (0.016)*
Sexual debut at age 13	0.089 (0.108)	0.202 (0.164)	0.754 (0.081)***	0.357 (0.065)***	0.365 (0.050)***
School sexual debut b1	0.662 (0.228)**	0.137 (0.298)	0.155 (0.109)	0.038 (0.084)	−0.255 (0.058)***
Race (White as reference group)					
Black	−0.996 (0.149)***	−0.553 (0.212)*	0.503 (0.093)***	0.777 (0.067)***	−0.864 (0.064)***
Hispanic	0.193 (0.140)	0.292 (0.214)	0.175 (0.122)	0.228 (0.094)*	−0.161 (0.066)*
Two biological parents	0.093 (0.097)	−0.128 (0.154)	0.003 (0.079)	−0.100 (0.059)†	0.129 (0.042)**
Foreign born	−0.609 (0.169)***	−0.312 (0.249)	−0.006 (0.123)	−0.203 (0.099)*	−0.446 (0.071)***
Smoking parent	0.097 (0.097)	0.136 (0.153)	0.068 (0.077)	0.175 (0.057)**	0.073 (0.042)†
Less than high school	−0.075 (0.167)	−0.087 (0.267)	0.038 (0.123)	0.170 (0.092)†	−0.022 (0.080)
College and above	0.105 (0.109)	0.206 (0.174)	−0.025 (0.088)	0.064 (0.066)	0.169 (0.049)***
σ^2	0.138 (0.034)***	0.146 (0.035)***	0.238 (0.041)***	0.221 (0.040)***	0.251 (0.043)***
−2 LL	14,793.51	12,801.42	32,360.58	30,097.21	43,276.36
AIC	14,887.51	12,895.42	32,454.58	30,191.21	43,370.36
AICC	14,887.96	12,895.88	32,454.74	30,191.42	43,370.52
BIC	15,026.1	13,034.02	32,594.81	30,331.11	43,510.59
N (no. of individuals)	6221	6221	13,213	11,578	12,809

LL, Log Likelihood; AIC, Akaike information criterion; AICC, Small-sample size corrected AIC; BIC, Bayesian information criterion.

Number of adolescents included in the 5 models vary due to number of measurements each participant gave. For each individual, alcohol and drug use were measured 2 times at Wave I and Wave II, respectively. For sex for money, sexually transmitted disease (STD), and regretted for sex variables, each individual was measured 3 times throughout 3 waves. Multiple responses were used in the modeling, which resulted in a larger sample.

σ^2 is the estimates of variance component of the random effect.

*p < .05; **p < .01; ***p < .001; †p < .1 in two-tailed test.

on this work, we used data from Wave I to Wave III of the Add Health to examine the effect of school early sexual debut on other forms of sexual risk-taking that are linked to poor health and life course outcomes. We hypothesized that increased early sexual initiation within the school would increase the involvement in unprotected sex, joint occurrences of sex and alcohol or drugs, sex for money, and reporting an STD.

Our findings suggest that behavioral processes at the school level are directly related to individual sexual risk-taking, even when accounting for various dimensions of parenting and critical demographic characteristics. As expected, an increase in school early sexual initiation at age 13 increased the likelihood of using alcohol at debut, using drugs at debut, having sex for money or drugs, contracting an STD, and reporting regretted sex under the influence. Overall, the results provide evidence that school behavioral norms can play a meaningful role in shaping individual behaviors regarding sexual health among adolescents.

The current study extends research in this area in several ways. First, we utilized a novel contextual effects approach to consider the influences of early sexual initiation at the school level on an array of other sexual risk-taking behaviors. Using this approach allowed us: (1) to capture the unobserved effect of early sexual initiation at the school level on sexual risk-taking conditional on parenting and other relevant covariates; (2) to obtain unbiased estimates from a joint process of sexual initiation and sexual risk-taking. Second, the substantive finding that early sexual debut at the school level has a significant impact on other sexual risk-taking behaviors affirms the relevance of school context in influencing healthy behaviors. Finally, although not central to our analysis, this study reinforced the importance of parenting on sexual risk-taking behaviors.

Although family-, peer-, school-, and neighborhood-level disadvantage are associated with obesity in both adolescence and young adulthood,

when all levels of disadvantage were considered simultaneously, only school-level disadvantage was associated with obesity in adolescence, and only family-level disadvantage was associated with obesity in young adulthood. There has been a recent emphasis on the school context for reducing obesity risks by limiting the availability of snacks and drinks with high sugar and salt content (eg, soda), but critics have argued that returning to a family context that promotes poor diet and other behaviors associated with obesity risk undermines such policies.

Limitations

There are a few notable limitations to this study. First, we did not include other measures of school disadvantage that have been used in previous work, eg, the level of concentrated poverty[20] and proportion of Black adolescents in census tract.[21] Our preliminary analyses indicated that including those measures created numerical instability in estimating the random effects at the school level. Therefore, we were forced to leave the measures out of the final analyses. In addition, we only investigated a very limited scope of risky behaviors. There are other risky behaviors available in the Add Health study, such as anal sex, and unintended pregnancy. Future research would benefit from including other measures of sexual risk-taking and assessing how parenting and other important demographic characteristic mediate the relationship between early school sexual initiation and sexual risk-taking.

IMPLICATIONS FOR SCHOOL HEALTH

Our research shows that attending a school with higher levels of early sexual initiation can play a powerful role in individual sexual risk-taking in adolescence and young adulthood. When considering our findings, important directives for school health practice and policy emerge. First, we strongly encourage school administrators to work with data scientists to better understand the specific challenges that individual schools face concerning early sexual initiation at the school level. Second, our findings point to the importance of assembling a school health council that can advise school administrators and clinicians on effective intervention and prevention programs focused on the sexual-risk taking, as well as other types of health behaviors. We encourage school administrators to assemble a council that is broad, diverse and, can speak to the needs of different segments of the school population. Third, our findings indicate that no matter at what age, school-level early sexual initiation was linked to individual sexual-risk taking. Thus, we encourage school administrators to implement intervention and preventions programs for all grade levels (5-12). These programs should be embedded within the school environment and promote healthy behaviors and informed decisions.[22] These programs should also include a range of topics including the linkage between early sex and sexual risk behaviors. Positive peer-to-peer interactions can play an important role in positive behavioral changes.[23,24] Thus, programs should also not exclusively focus on youth who have previously engaged in sexual-risk taking or are ''at-risk'' of engaging in these behaviors. Fourth, school administrators, faculty, staff, and parents/guardians should be trained on how to educate youth on the potential health impacts of early sexual initiation in multiple settings. Finally, addressing sexual risk-taking norms at the school level requires the support and participation of community stakeholders. We encourage school administrators to invite community members, parents/guardians, school health council members, and state and local agencies into the process of building interventions as early as possible.

Human Subjects Approval Statement

Willamette University's Institutional Review Board reviewed and exempted this study (FWA00014292). All data sources used in this study are secondary and de-identified. There is no requirement to obtain informed consent from any participant.

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Appendix

We use a random-effect-dependent model,[14] which models early sexual initiation at the individual level, along with other sexual risk-taking behaviors as a joint process. Using this approach, we estimate 2 simultaneous regression equations that account for (1) early sexual debut and (2) the remaining sexual risk-taking behaviors.

Since early sexual initiation at a specified age threshold was defined as dummy variables, a multilevel logistic model was used to account for the clustering at the neighborhood level. The model has the following form where i and j indicate the neighborhood and individual, respectively, for i = 1 to n; j = 1 to n_i

$$\log\left(\frac{\pi_{ij}}{1 - \pi_{ij}}\right) = C_{ij}\alpha_C + L_{ij}\alpha_L + D_{ij}\alpha_D$$

$$+ F_{ij}\alpha_f + x_{ij}\gamma_1 + u_{1i} \qquad (A1)$$

Here, the probability π_{ij} that a respondent engaged in sexual debut depends on parental connectedness C_{ij}, parental monitoring L_{ij}, parental communication D_{ij}, and parental beliefs F_{ij}, as well as other control variables x_{ij}. The vectors of coefficients α_C, α_L, α_D, and α_F capture the effect of parental connectedness, parental monitoring, parental communication, and parental beliefs, respectively. The vector of coefficients γ_1 summarizes the effects of the demographic and behavioral variables. The random effect u_{1i} represents the unobserved neighborhood effect that influences early sexual initiation.

The model for risky sexual behaviors is similar to that of early sexual debut except for two additional terms—early sexual debut at the individual level, and the random effect u_{1i} from the previous model:

$$\log\left(\frac{p_{ij}}{1 - p_{ij}}\right) = C_{ij}\beta_C + L_{ij}\beta_L + D_{ij}\beta_D$$

$$+ F_{ij}\beta_F + x_{ij}\gamma_2 + a_1 \times \text{Earlysex}_{ij} + b_1 u_{1i} + u_{2i}$$

$$(A2)$$

The joint model is defined by equations (A1) and (A2). Basically, the joint model includes 2 models, each representing an outcome—early sexual debut and risky sexual behavior—which are connected by the shared random effect u_{1i}. Since the dependent variable in the first equation is early sexual initiation, the random effect u_{1i} represents the unobserved effect of distinct neighborhood subcultures on early sexual initiation. In the second equation, the dependent variable is a risky sexual behavior. Therefore, the probability that a respondent is involved in other forms of sexual risk-taking depends on early sexual initiation, conditional on parental connectedness C_{ij}, parental monitoring L_{ij}, parental communication D_{ij}, parental beliefs F_{ij}, and other covariates x_{ij}. The coefficient a_1 captures the effect of early sexual initiation at the individual level. Conceptually, the random effect u_{1i} represents the effect of aggregate neighborhood subcultures, in this case, early sexual initiation. Therefore, the coefficient b_1 depicts the influence of neighborhood subcultures through early sexual debut on the involvement of the risky sexual behaviors. The random effect u_{2i} accounts for the clustering effect of the involvement of risky sexual behavior at the neighborhood level. The vectors β_C, β_L, β_D, and β_F collect the effects of measures on parental connectedness, parental monitoring, parental communication, and parental beliefs accordingly, and the vector γ_2 summarizes the effects of other covariates. If we drop u_{1i} in the second equation, the joint model becomes a regular separated analysis. The model was implemented using SAS PROC NLMIXED.[17]