Effects of the school environment on early sexual risk behavior: a longitudinal analysis of students in English secondary schools

Introduction[1]

Increasingly, policy approaches (such as the Health Promoting School model and Whole School, Whole Community, Whole Child initiative) promote the school environment as a key factor for improving student health and well-being (Langford et al., 2014; Lewallen et al., 2015). While commonly used as settings for interventions to promote sexual health, observational studies indicate that the school environment is itself likely to be a social determinant of young people's sexual health (Patton et al., 2016). Students with stronger attachment (Greene et al., 2018; Oman et al., 2013; Paul et al., 2000; Rink et al., 2007; Steiner et al., 2014), involvement (Lauritsen, 1994), pro-school attitude (Bonell et al., 2005; Henderson et al., 2008), and relationships (McNeely & Falci, 2004) in school report reduced sexual risk behaviors and outcomes in terms of early sexual debut, failure to use contraception, pregnancy and STIs. Further, school-level studies suggest that students who attend schools with higher aggregate levels of positive attitude towards school (Kim, 2015), expectations of higher education (White & Warner, 2015) and attendance (Resnick et al., 1997) report delayed sexual debut. These patterns extend to other risk behaviors (Bonell et al., 2013), suggesting that modifying school environments might be an effective public health strategy (Aveyard et al., 2004; Markham et al., 2008, 2012; Tobler et al., 2011).

Studies of school health effects are commonly informed by the theory of human functioning and school organization developed by Markham and Aveyard (2003) which proposes that schools can promote student health by increasing students' commitment to learning and sense of belonging in school through a focus on students' needs and engagement and the development of their ability for practical

[1] Abbreviations: free school meals (FSM); income deprivation affecting index (IDACI); value-added education (VAE)

reasoning and affiliation. These capacities are considered crucial for developing the self-esteem, support systems and skills needed to make pro-active and adaptive decisions about health and well-being in adolescence and later in life. Markham and Aveyard propose that schools may improve these capacities by improving student relationships with teachers and other students, providing opportunities for engaging in social and academic activities, and aligning the values of schools with the surrounding community. These strategies are theorized to work most effectively for students with low socio-economic status for whom engagement with school, which predominantly represents the values and goals of middle socioeconomic classes (Bernstein, 1975), cannot be assumed to be the default.

Previous empirical studies have assessed this theory using 'value-added education' (VAE), a proxy measure of school-level aggregate student commitment and belonging (Aveyard et al., 2004). VAE measures the degree to which schools achieve higher student attainment in public examinations and attendance than would be expected based on the socio-demographic characteristics of their students. Several studies have examined the relationship of VAE with health outcomes including smoking, substance use, bullying and misbehavior (Aveyard et al., 2004; Bisset et al., 2007; Bonell et al., 2017, 2019; Markham et al., 2008, 2012; Tobler et al., 2011). Higher levels of VAE were associated with reduced smoking in three studies (Markham et al., 2008, 2012; Tobler et al., 2011) and with reduced alcohol and misbehavior in one study (Tobler et al., 2011). Associations of VAE with sexual behaviors have not been examined to date.

VAE is a proxy measure for student engagement and relies on administrative data on attainment and attendance to assess belonging and commitment. It has been argued, however, that direct measures of school-level engagement with the school environment (i.e., aggregated student engagement) may more accurately reflect the extent to which schools are successfully engaging students as Markham and Aveyard suggest in their theory (Bonell et al., 2017, 2019). Using student reports, these studies have attempted to assess the theory with reliable direct measures of student engagement but have not examined sexual risk behavior. Previous school-level associations of school-related factors with sexual behavior

have been studied. However, these have primarily focused on the associations of school-level deprivation with sexual health (Henderson et al., 2008; Kim, 2015; Maticka-Tyndale & Tenkorang, 2010; Moore et al., 1998), rather than measures related to belonging in and commitment to school. An exception is a 1995 study from the western U.S. which found that school-level bonding – measured via aggregate self-reported belonging among 12th graders – was associated with lower rates of recent sexual activity among 9th grade boys (McBride et al., 1995). This study, however, did not account for known confounders of sexual behavior and could not establish temporality given its cross-sectional design. Further, previous school-level analyses used measures that were developed from available data rather than measures based on theory and established prior to data collection.

This paper aims, for the first time, to assess the theory of human functioning and school organization as it relates to sexual behavior in early adolescence, using VAE, as well as direct measures of student engagement with the school environment aligned with the theory. In addition to exploring direct measures of commitment to learning and sense of belonging, this analysis also examines two variables which Markham and Aveyard theorized as ways to improve student engagement in school: relationships with teachers and participation in school activities. Using longitudinal data from control schools in the INCLUSIVE trial (Bonell et al., 2014), we examine the effect of these school- and student-level factors, in addition to the VAE proxy measure, on sexual behavior. Our analysis addresses the following questions: 1) Is value-added education at baseline associated with student-level sexual behavior at follow-up? 2) Are direct school- and student-level measures of engagement with school environment (i.e,. commitment, belonging, relationships and participation) at baseline associated with student-level sexual behavior at follow-up? 3) Do student-level measures of engagement with school environment mediate the relationship between VAE and sexual behavior? We hypothesize that VAE and direct measures of student- and school-level engagement with the school environment will be associated with reduced student sexual risk behavior. We also hypothesize that student-level measures of engagement with the school environment will mediate the relationship of VAE and student outcomes.

Methods

Design

The data for this paper come from English secondary schools enrolled in the control arm of the two-arm cluster randomized controlled trial (RCT) of a multi-component intervention to reduce bullying and aggression called INCLUSIVE. We limited our analysis to the 20 schools (3337 students at baseline) participating in the control arm of the RCT to avoid any confounding from intervention effects.

The INCLUSIVE trial was conducted from 2014 to 2017 by researchers from the London School of Hygiene and Tropical Medicine and the University College London (UCL) Institute of Child Health. State secondary schools were eligible to participate if they were within one-hour train ride from London and not evaluated as 'inadequate' by national school inspectors. There were no ineligibility criteria for students attending enrolled schools. Schools were allocated using computer-generated random numbers stratified by the following criteria: single- or mixed-sex enrollment; high or low rates of students receiving free school meals (FSM) (a proxy for government benefits entitlement); and school-level attainment in public examinations. Students provided written informed consent to participate in surveys with the option of parents withdrawing their children. Consenting students were surveyed prior to random allocation at baseline (age 11-12 years) and at 24-month and 36-month follow-up, when the students were aged 12-13 and 14-15, respectively. Trained field workers, blind to allocation, administered confidential, paper questionnaires to students in classrooms where teachers were present but unable to read student responses. Questionnaires were collected and entered by trained personnel into a password-protected system on a secure database. All student information was de-identified. The INCLUSIVE trial was approved by the UCL ethics committee (ref 5248/001). Full details of the trial are published elsewhere (Bonell et al., 2014, 2018).

Measures

To establish temporality, we examined exposure variables, including VAE and school-level and student-level commitment, belonging, relationships and participation, at baseline. Outcome variables, sexual debut and contraception use at first sex, were measured at 24- and 36-month follow-up. We also include student-level commitment, belonging, relationships and participation at 24-month follow-up to examine potential mediation between VAE and outcomes.

Value-added education: Exposure variable VAE was constructed as a continuous variable using administrative data as established in prior studies (Aveyard et al., 2004; Markham et al., 2008, 2012; Tobler et al., 2011). VAE is the difference between observed attainment and absence rates and those expected from a model based on the school's socio-demographic student profile. Attainment rates were five-year (2009-2013) averages of the proportion of students in year 11, passing at least five General Certificate of Secondary Education exams graded A*-C. Absence rates were five-year (2009-2013) averages of the proportion of half-days missed. Measures on ethnicity, sex, socio-economic status (area income deprivation, FSM eligibility and Family Affluence Scale), and English as an additional language were used to create a socio-demographic profile for each school. Ethnicity and Family Affluence Scale (Currie et al., 2008) data were derived from the study survey; all other socio-demographic data came from government websites. To calculate VAE, two logistic regression models using attainment and absence rates were created with the socio-demographic exposures. A single continuous variable was created using principal components analysis then standardized into a VAE score where +1 represented schools with performance one standard deviation above average and -1 indicated schools with one standard deviation below average.

Engagement with school environment scales: School environment exposure variables were collected from students at baseline using multi-item scales from the BeyondBlue School Climate Questionnaire (Sawyer et al., 2010). These continuous measures included a four-item commitment to learning sub-scale (Cronbach's α=0.82), an eight-item sense of belonging sub-scale (α=0.85), a nine-item relationships with

teachers sub-scale (α=0.89) and a six-item participation in school sub-scale (α=0.81) (Table 1). Students were asked to rate each item with one of four possible responses between 0 ('totally disagree') and 3 ('yes, totally agree'). School-level variables were calculated as aggregates of student-level scores.

Early sexual risk behavior: Questions used to assess sexual risk behaviors at 24- and 36-month follow-up were derived from previous surveys (Stephenson et al., 2004). A dichotomous outcome *sexual debut* (i.e., ever had sex with man/boy or woman/girl) was measured among all students and is inclusive of heterosexual and same-sex sexual behaviors. Among those who answered yes to sexual debut questions, students were asked if they used any methods of contraception the first time they had sex (e.g., condom, the pill, emergency contraception, other, not sure). A dichotomous variable of *did not use contraception at first sex* was derived from this question, with an answer of 'yes' indicating risk.

Covariates: The following covariates were used in the adjusted regression models described below, pre-hypothesized as potential confounders and effect modifiers. School size, school-level income deprivation affecting index (IDACI) and proportion of students eligible for FSM were derived from data on government websites. Student-level factors from the baseline student surveys included sex, ethnicity, family structure, levels of household employment and housing tenure.

Analysis

Analysis was conducted in several stages using Stata 15 (StataCorp, 2017). Descriptive analyses assessed the proportion and means of baseline exposures and covariates, including VAE, school environment measures and socio-demographic characteristics. Intraclass correlations, which assess how similar individuals within schools respond to a variable, were calculated for outcomes at each time point. Unadjusted longitudinal associations were then calculated between VAE, school- and student-level school environment measures at baseline and outcomes at 24- and 36-month follow-up using logistic mixed-regression models. We then assessed for interactions with the covariates prior to running adjusted analysis for each model. Where interactions were present ($p \leq 0.01$), we report adjusted analyses by strata. We used multiple imputation by chained equations to account for missing participant data in regression models.

Complete case analysis was used to inform model building, then data were imputed by accounting for variables in final models. All associations were adjusted for clustering at the school level.

To assess whether associations between VAE and sexual behavior outcomes were mediated by student-level reports of school engagement (i.e., belonging, commitment, relationships and participation), we first explored associations between: 1) VAE and student-level school environment measures at 24-month follow-up using linear mixed-regression; and 2) student-level school environment measures at 24-month follow-up and sexual behavior at 36-month follow-up using logistic mixed-regression. As no associations were found between VAE and 24-month school environment variables, no further mediation analysis was conducted.

Results

Across control schools, 3347 students completed surveys at baseline (92.7% of students eligible). Of these, 3195 (90.4% of eligible) and 3087 (85.0% of eligible) completed surveys at 24- and 36-months respectively (Table 2). At baseline, half of students were female. Almost 60% of students reported their ethnicity as other than White British. The majority of students reported living with two parents (79%) with at least one parent working (75%). Just under half (44%) of all students reported living in a home owned by their family.

At 24-month follow-up, 4.5% of students reported sexual debut. Female students were less likely than male students to report ever having had sex (Supplementary Table 1). Of all students reporting sexual debut at 24-months, 30.3% reported not using contraception at first sex. Outcomes at 24-months varied by school from 0-15.5% for sexual debut and 0-60% for no contraception at first sex. The intraclass correlations at 24 months were 0.11 for sexual debut and 0.51 for contraception use.

At 36-month follow-up, 10.4% of students overall reported sexual debut with female students being less likely to report sexual debut than male students (Supplementary Table 1). Of those reporting sexual debut at 36-months, 23.9% reported not using contraception at first sex. Outcomes at 36 months varied by

school from 2.9-17.1% for sexual debut and 0-42.2% for no contraception at first sex. Outcome intraclass correlations at 36 months were 0.14 for sexual debut and 0.55 for contraception use.

VAE and sexual behavior

In unadjusted (Table 3) and adjusted analyses (Table 4), students attending schools with higher levels of baseline VAE were more likely to report sexual debut at 24-month follow-up. Sexual debut at 36 months and contraception use at both time points was not associated with VAE in either unadjusted or adjusted analyses.

School-level school environment and sexual behavior

School-level associations indicate whether attending a school with higher levels of aggregate engagement with the school environment (i.e., commitment, belonging, relationships and participation) at baseline is associated with students' subsequent sexual behavior. In unadjusted analyses, direct school-level measures of the school environment at baseline did not appear to be associated with sexual behavior outcomes at 24 or 36 months. However, after identifying interactions and adjusting for school- and individual-level sociodemographic factors (Table 4), students who attended schools with low deprivation and higher levels of aggregate commitment to learning were less likely to report sexual debut at 24 months.

Further, in adjusted analyses, students who attended schools with higher levels of baseline school-level commitment to learning and belonging were less likely to report sexual debut at 36 months. Additionally, male students who attended schools with higher aggregate levels of relationships with teachers were less likely to report sexual debut at 36 months. School-level baseline variables were not associated with contraception use at 24 or 36 months, even after adjusting for sociodemographic factors.

Student-level school environment and sexual behavior

Student-level associations indicate whether a student's own engagement with school (i.e., commitment, sense of belonging, etc.) at baseline is associated with their subsequent sexual behavior. Several student-

level associations were identified at 24 and 36 months. Unadjusted and adjusted analyses showed that increased student-level commitment and good relationships with teachers were significantly associated with decreased odds of sexual debut at 24-months. After testing for interactions and adjusting for school- and individual-level sociodemographic factors, analyses suggested that, among students who attended schools with low deprivation, those who reported greater participation in school appeared less likely to report sexual debut at 24 months. None of the student-level measures of school engagement were associated with contraception use at 24 months.

At 36-month follow-up, baseline students who reported higher commitment to learning, in both unadjusted and adjusted analyses, were less likely to report sexual debut. After adjusting for sociodemographic factors, students with stronger relationships with teachers were less likely to report sexual debut at 36 months, as well as less likely to report a failure to use contraception if they were sexually active. Additionally, among students who attended small schools, students with higher levels of belonging appeared less likely to report sexual debut at 36 months.

Mediation of VAE and sexual behavior by student-level engagement with school environment

We found that VAE was not associated with any of the student-level measures of engagement with the school environment at 24-months (Supplementary Table 2) or sexual behavior outcomes at 36-months in unadjusted or adjusted analyses, and thus mediation analysis was not possible. We did find that student-level measures of increased commitment and relationships at 24 months were significantly associated with reduced odds of sexual debut at 36 months adjusting for previous sexual behavior (Supplementary Table 3). Additionally, students with stronger relationships with teachers were less likely to report not using contraception at first sex at 36 months. These relationships were maintained after adjusting for school- and individual-level sociodemographic variables.

Discussion

We found no evidence that attending schools with higher levels of VAE was associated with reduced sexual risk behavior among early adolescents. In fact, findings appear to show that increased VAE was associated with greater sexual risk at 24 months. However, based on direct measures of engaging school environments, we found some evidence that school-level commitment and belonging may reduce the likelihood of early sexual debut. Other school-level associations appear to be isolated to particular subgroups, such as male students and schools with low deprivation, and should be interpreted with caution given the large number of significance tests conducted and that interaction tests were underpowered. Student-level measures of engagement with the school environment were more strongly associated with reduced risk of sexual behavior. In particular, relationships with teachers appeared to be most consistently associated with reduced sexual risk behavior, across school- and student-levels, timepoints and outcomes.

This study is the first to assess the theory of human functioning and school organization (Markham & Aveyard, 2003) for sexual behaviors, contributing to the overall assessment of the theory on student health outcomes. Our findings indicate that having higher levels of personal engagement with the school environment, as well as attending schools with higher aggregate levels of commitment and belonging, are important for subsequent sexual decision-making in early adolescence. These findings add to the body of research on the school effects on sexual behavior by using a longitudinal design and theoretically-aligned variables of commitment, belonging, relationships and participation in school.

In contrast to our hypothesis and previous studies that reported positive or null associations between VAE and risk behaviors (Aveyard et al., 2004; Bisset et al., 2007; Bonell et al., 2017, 2019; Markham et al., 2008; Tobler et al., 2011), our findings suggest a possible harmful effect of VAE on sexual risk behavior at 24-month follow-up. This is consistent with a single, previous study from Scotland that reported an association between higher VAE and increased substance use behavior (Markham et al., 2012). VAE is based on the assumption that achieving higher academic attainment and attendance rates

than would be expected from the school's demographic profile represents a school's broader ability to support its students' social development and, thus, influence their behavior. It has been argued, however, that recent changes to U.K. education policy focus too narrowly on achieving traditional academic success, and thus, academic metrics have become less associated with a school's ability to engage and support students' broader development (Bonell et al., 2017). Our analysis appears to support this line of thinking as VAE was not associated with any of our direct measures of students' engagement with the school environment at 24 months. It is possible that a school with higher VAE may be effective at improving academic outcomes but not effective at supporting its students' development in ways that would lead to lower risk behavior.

Our findings that school-level commitment, belonging and relationships were associated with reduced sexual risk behavior suggests that school environment factors are important for student health above and beyond personal disposition towards school. Further, while it is possible that factors such as commitment and belonging may be proxy measures of more general prosocial behavior, our school-level findings indicate that these variables measure something about the school climate above any individual-level mechanism. This is consistent with previous reports of direct school-level measures of the school environment on other risk behaviors (Bonell et al., 2017, 2019) and provides support for the theory of human functioning and school organization, in that attending schools with other students who have positive associations with school, may delay sexual debut in early adolescence. More associations were present at 36-month follow-up than at 24-months, indicating early school environment experiences are important for shaping behavior over time.

This research confirms that, at the individual level, students who engage with school are less likely to report early sexual behaviors. These findings align with the theory of human functioning and school organization in that students who are unable to meet the academic demands or feel alienated from the school community are more likely to engage in risk behaviors. Higher levels of student-level belonging and participation were associated with delayed sexual debut at 24-months only among students attending

schools with low deprivation, perhaps aligning with Markham and Aveyard's assumption that students with higher socioeconomic backgrounds are more likely to be aligned with school values. Having stronger relationships with teachers, however, was associated with sexual debut at 24-months for students who attended schools with either low or high deprivation, suggesting teacher relationships potentially mitigate the effects of socioeconomic status on early initiation of sex.

Indeed, across school-level and student-level exposures, relationships appeared to be an important determinant of sexual behavior, which the theory of human functioning and school organization theorizes are critical for improving student commitment to school. Attending a school with higher levels of good teacher-student relationships appeared to be associated with lower risk of early sexual debut among male students. Further, personally having good relationships with teachers appears to reduce the risk of early sexual debut and failure to use contraception when initiating sex. Qualitative research supports this finding in that adolescent mothers reported negative experiences with teachers and school staff, resulting in a disconnection from school prior to pregnancy (Peterson & Bonell, 2018). At the school-level, students may be responding to how teachers connect with others in the classroom. The finding that school-level relationships may be associated with sexual debut only for boys might result from the higher proportion of boys having sex. However, it may also reflect gendered experiences in school; for example, students may bond with teachers differently based on teachers' characteristics or observations of how teachers interact with other students, depending on their gender.

Our findings are subject to several limitations. While the analysis used a longitudinal design with a relatively large sample, some analyses were underpowered, such as interaction tests. Further, the sample for contraception use was very small due to the low prevalence of students reporting sexual debut, likely making associations difficult to detect. Additionally, we could not assess differences by subgroups related to heterosexual or same-sex behaviors, nor could we assess behaviors of students who identified as having a nonbinary gender. It is also possible that we did not account for all school- or individual-level confounders; however, the inclusion of our covariates was based on known influences on sexual behavior.

We did not adjust for age but students were enrolled in the same year at school and were primarily within the same age range (e.g., 11-12 years at baseline). Despite adequate retention, multiple imputation was used to account for missing outcome data. We did not adjust for multiple testing but instead were cautious in our interpretation of significance tests. Given the UK setting, our findings may not be generalizable to other settings. For example, calculation of VAE may be based on other measures of attainment and attendance in other country settings (Markham et al., 2012), potentially producing a different relationship between VAE and risk behaviors.

Despite these limitations, our research indicates that engagement with the school environment is an important social determinant of sexual health in early adolescence. New research is needed on interventions that address the school environment, such as those following Health Promoting School and Whole School, Whole Community, Whole Child frameworks. Results from a recent meta-analysis indicate that programs addressing the school environment can be effective at promoting young people's sexual health (Peterson et al., 2019). Given the findings on VAE in this study and others, interventions should be careful in solely focusing on academic attainment and attendance as indicators of commitment and belonging. More research is also needed on the mechanisms by which the school environment influences sexual behaviors. These mechanisms may differ from other risk behaviors, as engagement in sexual behavior becomes more biologically and developmentally appropriate with age. As this study examined data from schools representative of southeast England, replication of this analysis in other settings would be useful for understanding the extent to which school-related factors influence sexual health, especially in low- or middle-income country settings and in schools with higher levels of deprivation in high-income countries. These studies may also include, in addition to aggregated student data, observations by researchers of the physical and social environment or self-reported data from other members of the student community, including teachers and staff, on the ability of schools to engage students effectively.

References

Aveyard, P., Markham, W. A., Lancashire, E., Bullock, A., Macarthur, C., Cheng, K. K., & Daniels, H. (2004). The influence of school culture on smoking among pupils. *Social Science & Medicine*, *58*(9), 1767–1780. https://doi.org/10.1016/S0277-9536(03)00396-4

Bernstein, B. (1975). *Class, codes and controls, Vol. 3: Towards a theory of educational transmission*. Routledge.

Bisset, S., Markham, W. A., & Aveyard, P. (2007). School culture as an influencing factor on youth substance use. *Journal of Epidemiology and Community Health*, *61*(6), 485–490. https://doi.org/10.1136/jech.2006.048157

Bonell, C., Allen, E., Christie, D., Elbourne, D., Fletcher, A., Grieve, R., LeGood, R., Mathiot, A., Scott, S., Wiggins, M., & Viner, R. M. (2014). Initiating change locally in bullying and aggression through the school environment (INCLUSIVE): Study protocol for a cluster randomised controlled trial. *Trials*, *15*. https://doi.org/10.1186/1745-6215-15-381

Bonell, C., Allen, E., Strange, V., Copas, A., Oakley, A., Stephenson, J., & Johnson, A. (2005). The effect of dislike of school on risk of teenage pregnancy: Testing of hypotheses using longitudinal data from a randomised trial of sex education. *Journal of Epidemiology and Community Health*, *59*(3), 223–230. https://doi.org/10.1136/jech.2004.023374

Bonell, C., Allen, E., Warren, E., McGowan, J., Bevilacqua, L., Jamal, F., Legood, R., Wiggins, M., Opondo, C., Mathiot, A., Sturgess, J., Fletcher, A., Sadique, Z., Elbourne, D., Christie, D., Bond, L., Scott, S., & Viner, R. M. (2018). Effects of the Learning Together intervention on bullying and aggression in English secondary schools (INCLUSIVE): A cluster randomised controlled trial. *The Lancet*, *392*(10163), 2452–2464. https://doi.org/10.1016/S0140-6736(18)31782-3

Bonell, C., Beaumont, E., Dodd, M., Elbourne, D. R., Bevilacqua, L., Mathiot, A., McGowan, J., Sturgess, J., Warren, E., Viner, R. M., & Allen, E. (2019). Effects of school environments on student risk-behaviours: Evidence from a longitudinal study of secondary schools in England.

Journal of Epidemiology & Community Health, jech-2018-211866. https://doi.org/10.1136/jech-2018-211866

Bonell, C., Parry, W., Wells, H., Jamal, F., Fletcher, A., Harden, A., Thomas, J., Campbell, R., Petticrew, M., Murphy, S., Whitehead, M., & Moore, L. (2013). The effects of the school environment on student health: A systematic review of multi-level studies. *Health & Place*, *21*, 180–191. https://doi.org/10.1016/j.healthplace.2012.12.001

Bonell, C., Shackleton, N., Fletcher, A., Jamal, F., Allen, E., Mathiot, A., Markham, W., Aveyard, P., & Viner, R. (2017). Student- and school-level belonging and commitment and student smoking, drinking and misbehaviour. *Health Education Journal*, *76*(2), 206–220. https://doi.org/10.1177/0017896916657843

Currie, C., Molcho, M., Boyce, W., Holstein, B., Torsheim, T., & Richter, M. (2008). Researching health inequalities in adolescents: The development of the Health Behaviour in School-Aged Children (HBSC) Family Affluence Scale. *Social Science & Medicine*, *66*(6), 1429–1436. https://doi.org/10.1016/j.socscimed.2007.11.024

Greene, K. M., Eitle, D., & Eitle, T. M. (2018). Developmental Assets and Risky Sexual Behaviors among American Indian Youth. *The Journal of Early Adolescence*, *38*(1), 50–73. https://doi.org/10.1177/0272431615596427

Henderson, M., Butcher, I., Wight, D., Williamson, L., & Raab, G. (2008). What explains between-school differences in rates of sexual experience? *BMC Public Health*, *8*, 53. https://doi.org/10.1186/1471-2458-8-53

Kim, J. (2015). School socioeconomic composition and adolescent sexual initiation in Malawi. *Studies in Family Planning*, *46*(3), 263–279. https://doi.org/10.1111/j.1728-4465.2015.00029.x

Langford, R., Bonell, C., Jones, H. E., Pouliou, T., Murphy, S. M., Waters, E., Komro, K. A., Gibbs, L. F., Magnus, D., & Campbell, R. (2014). The WHO Health Promoting School framework for improving the health and well-being of students and their academic achievement. *Cochrane Database of Systematic Reviews*.

Lauritsen, J. (1994). Explaining race and gender differences in adolescent sexual-behavior. *Social Forces*, *72*(3), 859–884. https://doi.org/10.1093/sf/72.3.859

Lewallen, T. C., Hunt, H., Potts-Datema, W., Zaza, S., & Giles, W. (2015). The Whole School, Whole Community, Whole Child Model: A New Approach for Improving Educational Attainment and Healthy Development for Students. *Journal of School Health*, *85*(11), 729–739. https://doi.org/10.1111/josh.12310

Markham, W. A., & Aveyard, P. (2003). A new theory of health promoting schools based on human functioning, school organisation and pedagogic practice. *Social Science & Medicine*, *56*(6), 1209–1220.

Markham, W. A., Aveyard, P., Bisset, S. L., Lancashire, E. R., Bridle, C., & Deakin, S. (2008). Value-added education and smoking uptake in schools: A cohort study. *Addiction*, *103*(1), 155–161. https://doi.org/10.1111/j.1360-0443.2007.02020.x

Markham, W. A., Young, R., Sweeting, H., West, P., & Aveyard, P. (2012). Does school ethos explain the relationship between value-added education and teenage substance use? A cohort study. *Social Science & Medicine*, *75*(1), 69–76. https://doi.org/10.1016/j.socscimed.2012.02.045

Maticka-Tyndale, E., & Tenkorang, E. Y. (2010). A multi-level model of condom use among male and female upper primary school students in Nyanza, Kenya. *Social Science & Medicine*, *71*(3), 616–625. https://doi.org/10.1016/j.socscimed.2010.03.049

McBride, C. M., Curry, S. J., Cheadle, A., Anderman, C., Wagner, E. H., Diehr, P., & Psaty, B. (1995). School-level application of a social bonding model to adolescent risk-taking behavior. *Journal of School Health*, *65*(2), 63–68.

McNeely, C., & Falci, C. (2004). School connectedness and the transition into and out of health-risk behavior among adolescents: A comparison of social belonging and teacher support. *Journal of School Health*, *74*(7), 284–292.

Moore, K. A., Manlove, J., Glei, D. A., & Morrison, D. R. (1998). Nonmarital School-Age Motherhood Family, Individual, and School Characteristics. *Journal of Adolescent Research*, *13*(4), 433–457. https://doi.org/10.1177/0743554898134004

Oman, R. F., Vesely, S. K., Aspy, C. B., Tolma, E. L., Gavin, L., Bensyl, D. M., Mueller, T., & Fluhr, J. D. (2013). A longitudinal study of youth assets, neighborhood conditions, and youth sexual behaviors. *Journal of Adolescent Health*, *52*(6), 779–785. https://doi.org/10.1016/j.jadohealth.2012.12.005

Patton, G. C., Sawyer, S. M., Santelli, J. S., Ross, D. A., Afifi, R., Allen, N. B., Arora, M., Azzopardi, P., Baldwin, W., Bonell, C., Kakuma, R., Kennedy, E., Mahon, J., McGovern, T., Mokdad, A. H., Patel, V., Petroni, S., Reavley, N., Taiwo, K., … Viner, R. M. (2016). Our future: A Lancet commission on adolescent health and wellbeing. *The Lancet*, *387*(10036), 2423–2478. https://doi.org/10.1016/S0140-6736(16)00579-1

Paul, C., Fitzjohn, J., Herbison, P., & Dickson, N. (2000). The determinants of sexual intercourse before age 16. *Journal of Adolescent Health*, *27*(2), 136–147. https://doi.org/10.1016/S1054-139X(99)00095-6

Peterson, A. J., & Bonell, C. (2018). School experiences and young women's pregnancy and parenthood decisions: A systematic review and synthesis of qualitative research. *Health & Place*, *53*, 52–61. https://doi.org/10.1016/j.healthplace.2018.07.003

Peterson, A. J., Donze, M., Allen, E., & Bonell, C. (2019). Effects of interventions addressing school environments or educational assets on adolescent sexual health: Systematic review and meta-analysis. *Perspectives on Sexual and Reproductive Health*, *51*(2), 91–107.

Resnick, M. D., Bearman, P. S., Blum, R. W., Bauman, K. E., Harris, K. M., Jones, J., Tabor, J., Beuhring, T., Sieving, R. E., Shew, M., Ireland, M., Bearinger, L. H., & Udry, J. R. (1997). Protecting adolescents from harm. Findings from the National Longitudinal Study on Adolescent Health. *JAMA*, *278*(10), 823–832.

Rink, E., Tricker, R., & Harvey, S. M. (2007). Onset of sexual intercourse among female adolescents: The influence of perceptions, depression, and ecological factors. *Journal of Adolescent Health*, *41*(4), 398–406. https://doi.org/10.1016/j.jadohealth.2007.04.017

Sawyer, M. G., Pfeiffer, S., Spence, S. H., Bond, L., Graetz, B., Kay, D., Patton, G. C., & Sheffield, J. (2010). School-based prevention of depression: A randomised controlled study of the beyondblue schools research initiative. *Journal of Child Psychology and Psychiatry*, *51*(2), 199–209. https://doi.org/10.1111/j.1469-7610.2009.02136.x

StataCorp. (2017). *Stata Statistical Software: Release 15*. StataCorp LP.

Steiner, R. J., Michael, S. L., Hall, J. E., Barrios, L. C., & Robin, L. (2014). Youth violence and connectedness in adolescence: What are the implications for later sexually transmitted infections? *Journal of Adolescent Health*, *54*(3), 312-318.e1. https://doi.org/10.1016/j.jadohealth.2013.09.008

Stephenson, J. M., Strange, V., Forrest, S., Oakley, A., Copas, A., Allen, E., Babiker, A., Black, S., Ali, M., Monteiro, H., Johnson, A. M., & RIPPLE study team. (2004). Pupil-led sex education in England (RIPPLE study): Cluster-randomised intervention trial. *The Lancet*, *364*(9431), 338–346. https://doi.org/10.1016/S0140-6736(04)16722-6

Tobler, A. L., Komro, K. A., Dabroski, A., Aveyard, P., & Markham, W. A. (2011). Preventing the Link Between SES and High-Risk Behaviors: "Value-Added" Education, Drug Use and Delinquency in High-Risk, Urban Schools. *Prevention Science*, *12*(2), 211–221. https://doi.org/10.1007/s11121-011-0206-9

White, C. N., & Warner, L. A. (2015). Influence of family and school-level factors on age of sexual initiation. *Journal of Adolescent Health*, *56*(2), 231–237. https://doi.org/10.1016/j.jadohealth.2014.09.017