RESEARCH ARTICLE

The Impact of a High School-Based Positive Youth Development Program on Sexual Health Outcomes: Results from a Randomized Controlled Trial

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ABSTRACT

BACKGROUND: Although positive youth development (PYD) programs have demonstrated effectiveness in improving adolescent reproductive health outcomes, there is a lack of evidence on effective school-based interventions designed especially for high school settings. This study examined the efficacy of Peer Group Connection (PGC-HS), a school-based PYD program, in improving sexual health outcomes for high school participants.

METHODS: A total of 1523 ninth-grade students at 18 schools were randomly assigned to be offered PGC-HS or a classes-as-usual control condition during 2016 to 2017 and 2017 to 2018 school years. Impacts were assessed on three confirmatory and 6 exploratory outcomes via self-reported participant questionnaire data collected at the beginning of 10th grade.

RESULTS: Although the offer of PGC-HS had no statistically detectable effect on confirmatory behavioral outcomes (sexual initiation, frequency of sex, and number of sexual partners) at 10th grade follow-up, causal impact estimates indicate that PGC-HS participants were less likely than control participants to ever have had vaginal sex. PGC-HS participants also scored higher on decision-making skills and perceived connection to peer connectedness.

CONCLUSIONS: Results suggest that by building social and emotional skills and helping students form supportive peer relationships, PGC-HS may encourage students to make healthier choices and avoid risky behaviors during a critical period in high school, thus, reducing the risk of pregnancy.

Keywords: child & adolescent health; evaluation; public health; reproductive health; research; risk behaviors.

Despite the promising overall reduction in teen births in the United States over the past 2 decades,

geographical, racial, and ethnic disparities endure.[1,2] Between 2007 and 2015, rural counties experienced

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the highest teen birth rates and slowest declines, when compared to more urban counties.[2] And as of 2018, birth rates of Hispanic and Black teens were over double the birth rate of White teens.[3] This is especially concerning as unintended teen pregnancy is linked to short- and long-term effects, such as increased high school dropout among teen parents and lower educational attainment for both teen parents and their children.[4,5]

To address the negative consequences associated with unplanned teen pregnancy, health officials and policymakers have prioritized the identification of effective teen pregnancy prevention (TPP) strategies.[6,7] The U.S. Department of Health and Human Services (HHS) began conducting a systematic review of evaluation studies in 2009 to identify programs shown to be effective at reducing teen pregnancy, STIs, and other related behavioral risk factors, as well as gaps in the existing evidence base.[8,9] Given the increase of risk behaviors in high school, the social and educational costs of unplanned teen pregnancy, and the amount of time teens spend in school, one of the most glaring gaps subsists in the lack of evidence on effective school-based interventions designed especially for high school settings.[10] Of the 88 programs reviewed, 26 were school-based; however, only 6 were designed to be implemented specifically in high schools.[9]

Although under-researched, school-based programs that help high school students form healthy and supportive peer relationships may be promising for preventing teen pregnancy.[11] Educational research has linked school involvement, attachment to school, and peer connectedness to reduced sexual risk-taking. In particular, reviews of peer-led interventions and positive youth development (PYD) programs suggest that offering such programs in schools can lead to the reduction of risky sexual behaviors, such as unprotected intercourse, frequency of intercourse, and number of sexual partners.[9,12-14] In addition, PYD programs have demonstrated effectiveness in increasing protective behaviors, such as contraceptive use, even in the absence of direct sexual health content.[15,16] Still, few of these studies focused exclusively on high school students.

This article presents short-term findings from a randomized controlled trial (RCT) examining the efficacy of Peer Group Connection-High School (PGC-HS), a school-based PYD program, in improving sexual health outcomes for high school participants. The PGC-HS theory of change is grounded in theories of social and emotional learning and the Social Development Model. Through facilitated interactions, discussions, and activities with cross-age peer leaders, PGC-HS promotes supportive relationships with older students who model positive social behaviors and promote safe and supportive school environments. PGC-HS is not explicitly a teen pregnancy prevention program.

Instead, it was designed to improve students' academic outcomes by targeting school attachment and social and emotional learning skills during the transition from middle to high school.

We aim to address gaps in the evidence base by investigating whether a program designed to improve educational outcomes can also serve to improve sexual health outcomes, within a high school setting. The hypothesis is that by increasing school engagement, building connectedness among peers, and fostering skills such as decision-making and goal-setting, PGC-HS will encourage students to make healthier decisions, including reducing sexual risk-taking behaviors and increasing protective behaviors.[11,16,17] If effective, such a program may be particularly appealing to schools that want to support student growth across multiple domains of well-being, but face local or state restrictions to providing programming that directly addresses sexual health.

PGC-HS was implemented in the ninth grade; for this article, we assess the program's effects on students at the beginning of 10th grade. Specifically, we investigate PGC-HS's impact on 3 short-term sexual health behaviors, which we pre-specified as our confirmatory outcomes and registered on clinicaltrials .gov with the ID NCT03240887. In addition, we assess program effects on 6 exploratory outcomes, which were also identified in the registered analysis plan. The confirmatory and exploratory outcomes are identified in the PGC-HS theory of change. In a separate and forthcoming study, we analyze program impacts on students at the beginning of 11th grade (registered on Open Science Framework: https://osf.io/dc4e3).

The confirmatory research questions for this study ask whether the offer to participate in PGC-HS in ninth grade relative to the offer to participate in class-as-usual in ninth grade impacted participants' reported sexual initiation, frequency of sex, and number of sexual partners at the beginning of 10th grade. These outcomes reflect engagement in any type of sex (oral, vaginal, or anal) and were selected as comprehensive measures of adolescent sexual risk behaviors related to pregnancy and HIV/STIs. In addition to confirmatory research questions, we explored whether the offer to participate in PGC-HS impacted more specific pregnancy risk behaviors and potential mediators of sexual risk targeted by the program. Specifically, we investigated the potential impact on participants' reported initiation of vaginal sex, frequency of vaginal sex without a condom, decision-making skills, goal-setting skills, perceived connection with peers, and school engagement. Exploratory behavioral outcomes are more narrowly defined measures of pregnancy risk, focusing on vaginal sex. Examined mediators were targeted through program activities such as facilitated interactions, discussions, and activities with cross-age peer leaders.

METHODS

Participants

Recruitment and enrollment. The Center for Supportive Schools (CSS) recruited partner schools in rural North Carolina and New York City for the 2016-2017 (Cohort 1) and 2017-2018 (Cohort 2) school years. A total of 18 schools (11 from North Carolina and 7 from New York) participated in the study. In North Carolina, partner schools are located in rural areas, some with substantial Hispanic populations; in New York City, partner schools are located in urban areas and serve largely Hispanic, Black/African American, and other minority populations.

Recruitment began during the springs of 2016 and 2017, prior to students beginning high school, and continued through the first few weeks of students' ninth-grade year. To participate in the study, individuals had to meet the following inclusion criteria: provide parental consent and personal assent to participate; be entering ninth grade for the first time at a participating study school; and be able to complete the participant questionnaire in English or Spanish, unassisted, in a classroom setting, in 60 minutes or less. Eligible ninth graders were randomly selected to participate in PGC-HS or remain in their regularly scheduled classes or activities.

Randomization. Eligible participants were individually randomly assigned to conditions at an equal (1:1) assignment ratio. Random assignment was stratified by study school in blocks of varying sizes using the *ralloc* command (Stata 15.1).[18] The list of eligible students was alphabetized and then paired with the random assignment list; students were considered enrolled at the point of random assignment. A total of 1523 participants constituted the full intent-to-treat (ITT) sample,

with 755 participants assigned to the treatment group and 768 to the control group (Figure 1).

Treatment contrast. Students assigned to the treatment group were offered the opportunity to participate in PGC-HS. The intervention is designed to be delivered by 11th and 12th graders selected by PGC-HS faculty advisors to be peer leaders. Faculty advisors participate in a training course over an 18-month period to learn how to run the program and teach peer leaders in a daily leadership course. Peer leaders then work in pairs to co-lead groups of 10 to 14 ninth graders in regular, 45-minute outreach sessions during the school day. Peer groups participate in hands-on activities and discussions on a variety of youth development topics, such as school attachment, motivation, goal setting, and decision making. Outreach sessions can be implemented over the course of a semester or an entire school year. For the study, PGC-HS was considered implemented as intended if schools held at least 18 of the 26 outreaches designed for the program, and if at least three of the sessions offered were core outreaches (*Activity Day, Family Night*, and *Service-Learning*).

Students assigned to the control group received class as usual; that is, the classes or activities control participants were scheduled to receive during the period when PGC-HS outreach sessions occurred. No alternative program or additional activities were offered to the control participants; however, control group participants received more time in regularly scheduled classes than treatment participants.

Although normally scheduled classes or activities might include sexual or reproductive health information, school administrators confirmed that PGC-HS outreach sessions occurred in classes and on days only when no sexual or reproductive health components were taught. Thus, we believe exposure to sexual

Figure 1. **Flow Diagram of Randomization and Follow-Up**
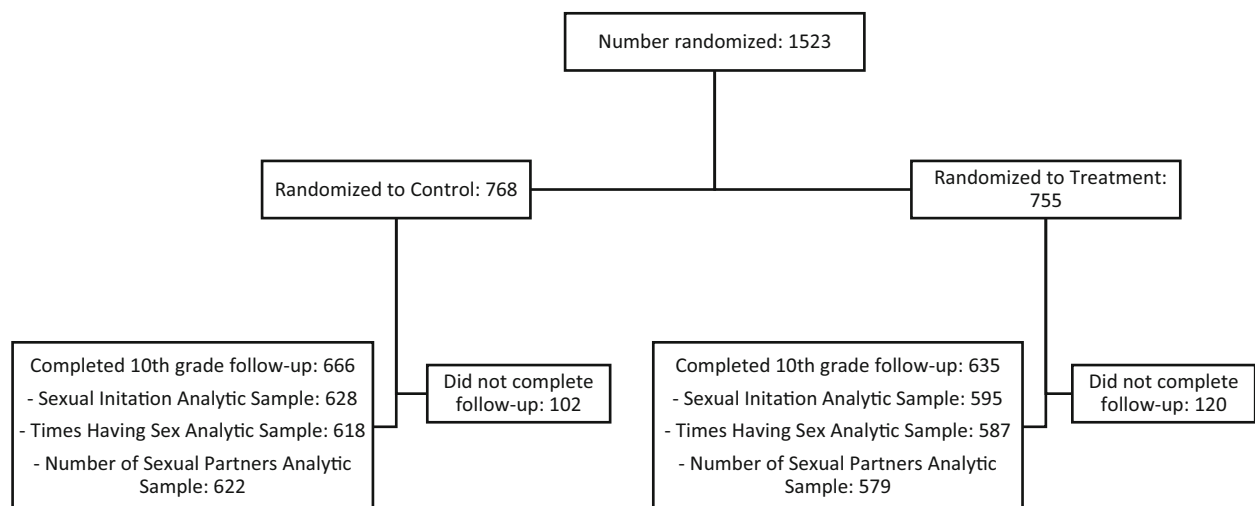
health content through school should have been similar for treatment and comparison group participants.

Data collection

Research staff administered a baseline questionnaire to consenting students at the beginning of ninth grade, before PGC-HS programming was offered. Research staff collected outcome data through a follow-up questionnaire administered to these same students at the beginning of 10th grade. The instrument, which was identical for baseline and follow-up administration, contained 132 items adapted from previous research and took approximately 30 to 45 minutes to complete. The questionnaire collected self-reports of sexual behavior and experiences; intentions, thoughts, and feelings related to sexual behaviors; peer influence on sexual decision making; educational and career-related goals; intentions and feelings related to school; and social-emotional skills. The instrument was constructed by research staff and was reviewed by health and educational professionals. In addition, cognitive interviews and pilot-testing of the instrument were conducted with youth similar to the study target population.

Most participants (86.9%) completed the 10th-grade follow-up questionnaire through paper-based, in-person administrations led by research staff in a classroom setting within participating schools. If a student was not available during administration, participants were provided the option to complete the questionnaires online (10.8%), by mail (1.6%), or over the phone (0.69%) in a shortened interview format with research staff. Data collection procedures were identical for both the treatment and control groups. All participants received gift card incentives upon completing their questionnaires.

Measures

Behavioral outcomes. The three confirmatory outcomes for this study were assessed using self-reported data collected in the 10th-grade follow-up questionnaire. Sexual initiation was constructed as a dichotomous variable indicating whether a participant reported prior engagement in any type of sex (1) or no prior engagement (0). Frequency of sex in the past 3 months was operationalized as a count variable that quantified the total number of times a participant reported having any type of sex (vaginal, oral, or anal sex) in the past 3 months. Number of sexual partners in the past 3 months was constructed as a count that quantified a participant's self-reported number of sexual partners in the past 3 months.

Additional exploratory sexual risk behavior outcomes were assessed. This article presents the results of two exploratory sexual behavior outcomes—initiation of vaginal sex and frequency of vaginal sex with no condom in the past 3 months. Initiation of vaginal sex was constructed as a dichotomous variable where participants were coded as either having had vaginal sex (1) or not (0). Frequency of vaginal sex with no condom in the past 3 months was constructed as a count variable that quantified the number of times a participant reported not using condoms during vaginal sex over the past 3 months.

Behavioral antecedents. Behavioral antecedents were measured using multiple-item, 7-point scales adapted from prior research. For each measure, the score reflects the mean of all items; scores were not calculated if any items were skipped (Table 1). Decision-making skills were assessed with four items that asked participants to indicate on a unidirectional scale (α = 0.87; 1 = *never*, 7 = *all the time*) how often they stop and think before making a decision; higher scores are indicative of stronger decision-making skills.[19] Perceived connection with peers was assessed with five items that asked participants to indicate on a bidirectional scale (α = 0.92; 1 = *strongly disagree*, 7 = *strongly agree*) how much they agreed or disagreed with statements concerning their relationships with peers; higher scores are indicative of greater perceived connection with peers.[20] School engagement was assessed with nine items that asked participants to indicate on a bidirectional scale (α = 0.82; 1 = *strongly disagree*, 7 = *strongly agree*) how much they agreed or disagreed with statements concerning their relationships with faculty and their sense of school belonging; higher scores are indicative of greater school engagement and connection.[21,22] Goal-setting skills were assessed with five items that asked participants to indicate on a unidirectional scale (α = 0.88; 1 = *cannot do at all*; 7 = *highly certain can do*) how certain they are in their ability to set goals; higher scores are indicative of greater self-efficacy to set achievable goals.[23-25]

Data management

Prior to analysis, PRG staff systematically screened or reviewed analytic data to identify invalid, inconsistent, outlying, missing, and unreliable values. For our benchmark approach, data that were deemed unusable (ie, invalid or unreliable) were coded as missing and flagged according to missing data type; all other data were retained, unchanged. We determined if logical edits were possible for any variables missing a value due to item-specific nonresponse or a purposeful skip pattern and edited where appropriate. Missing covariate data were imputed using dummy variable adjustment, where we coded missing data to either zero or the mean of non-missing observations (for dichotomous and count/continuous variables, respectively). Dummy indicator variables indicating whether the covariate was imputed were created and coded as 1 if originally missing or 0 if not originally missing.

Table 1. Baseline Behavioral Antecedent Scale Reliability

Behavioral Antecedents	Example Item	N	Mean	SD	Cronbach's Alpha
Decision-making skills	I stop and think about my options before I make a decision.	1281	5.19	1.30	0.86
Goal-setting skills	How certain are you that you can set realistic goals for yourself?	1284	6.11	1.01	0.88
Perceived connection with peers	There are students at my school who care about me.	1263	5.70	1.31	0.91
School engagement	I feel proud of being part of my school.	1245	4.84	1.10	0.81

DATA ANALYSIS

We examined whether the offer of PGC-HS in ninth grade had an impact on confirmatory behaviors and select exploratory outcomes among students at the beginning of 10th grade within an intent-to-treat (ITT) framework. The ITT framework does not take into account participants' actual or measured exposure to the treatment itself, but, rather, the effect of the offer of the treatment (PGC) relative to the offer of receiving the control condition (class as usual). Students in the ITT analytic sample were analyzed according to their randomized treatment condition, irrespective of their level of program exposure. Baseline equivalence of the treatment and control samples was assessed with a model-based estimate of the standardized difference between the two groups on important demographic characteristics and the pre-intervention measures of our confirmatory outcomes.

We initially pre-specified the use of OLS regression to estimate the average treatment effect for all three confirmatory outcomes. OLS is analytically and interpretively straight-forward, robust to misspecification in large samples, and in most situations, tends to provide substantively similar results to models that are more appropriate for the distributional characteristics of the data (ie, count models).[26,27] However, for some of the analyses conducted in this study, we find that results are sensitive to model choice. As such, we present our findings using both OLS as our pre-specified, benchmark approach and the statistical model that better fits the distributional characteristic of the data (ie, negative binomial or logistic regression), based on diagnostics and log-likelihood statistics.

To increase the precision of our estimates and account for blocking procedures, we statistically adjusted for covariates pre-specified in our registered analysis plan.[26] We included the following individual-level covariates (measured at baseline): age, gender, race, Hispanic/Latino, and the following blocking variable: school. Baseline imputation indicators and the baseline measure of the outcome variable were also included. All covariates were mean-centered to facilitate interpretation. In accordance with our analysis plan, we adjusted for multiple comparisons in our confirmatory outcome analyses. We did not adjust for multiple comparisons in our exploratory analyses.

Sensitivity analyses were conducted to test the robustness and validity of our benchmark analytic and data management decisions, including: excluding outliers; excluding inconsistent values; not imputing or adjusting for missing baseline data; using alternative model specifications to estimate program effects; and adjusting for mode of questionnaire administration. Sensitivity study results that are substantively different from our benchmark approach are noted and discussed in the results section. All analyses were conducted in Stata 15.1.[18]

RESULTS

Between Fall 2016 and Fall 2017, a total of 1523 adolescents were randomized into the study, constituting the full ITT sample. A total of 1300 follow-up questionnaires were completed at the beginning of the 10th-grade. Due to item nonresponse in our outcome variables, there is slight variation in our confirmatory analytic samples: 1223 participants are included in the assessment of sexual initiation, 1205 in the assessment of frequency of sex, and 1201 in the assessment of number of sexual partners (Figure 1). Across all confirmatory outcome samples, the overall attrition rates for the study ranged from 19.7% to 21.1% and the differential attrition rates ranged from 2.8% to 4.3%.

Baseline characteristics of the analytic samples are presented in Table 2. On average, participants were 14 years old at baseline. Half of the participants identified as female, and approximately one-third of participants identified as Hispanic. Over a quarter of students (29%) identified as Black/African American, approximately 18% self-reported as another race (ie, American Indian or Alaskan Native, Asian, Native Hawaiian or Pacific Islander, or other), 16% identified as White, and 8% identified as more than one race; 29% did not specify a race. At the time of baseline administration, 16% reported sexual initiation, and on average, participants self-reported engaging in sex fewer than one time and having fewer than one sexual partner in the past 3 months. For each confirmatory and exploratory sample, baseline equivalence is convincing (see Supplementary Materials).

In Table 3, we present the estimated treatment effects, standard errors, and p-values produced by our

Table 2. Baseline Equivalence of Treatment and Control Groups, by Confirmatory Outcome Samples

Characteristic	Sexual Initiation*			Times Having Any Sex*			Number of Sexual Partners*		
	Treatment	Control	Standardized Difference†	Treatment	Control	Standardized Difference†	Treatment	Control	Standardized Difference†
Age	(n = 586)	(n = 623)		(n = 579)	(n = 614)		(n = 571)	(n = 617)	
Mean age at baseline	14.55	14.52	0.042	14.55	14.51	0.059	14.54	14.52	0.043
Gender	(n = 586)	(n = 623)		(n = 579)	(n = 614)		(n = 571)	(n = 617)	
Female	49%	51%	0.005	49%	51%	0.005	49%	51%	0.005
Male	50%	48%	−0.009	50%	48%	−0.009	50%	48%	−0.009
Other	1%	1%	0.150	1%	1%	0.150	1%	1%	0.150
Race10F	(n = 595)	(n = 627)		(n = 587)	(n = 617)		(n = 579)	(n = 621)	
White	16%	18%	−0.098	17%	19%	−0.098	17%	18%	−0.098
Black/African American	28%	28%	−0.002	27%	27%	−0.002	27%	28%	−0.002
Other	19%	18%	0.009	19%	18%	0.009	20%	18%	0.009
More than one race	9%	8%	0.024	10%	8%	0.024	9%	8%	0.024
Race not reported	28%	27%	0.054	28%	28%	0.054	27%	27%	0.054
Ethnicity	(n = 595)	(n = 627)		(n = 587)	(n = 617)		(n = 579)	(n = 621)	
Hispanic	32%	33%	0.002	33%	33%	0.002	32%	33%	0.002
Sexual initiation	(n = 556)	(n = 592)		—	—	—	—	—	—
	15%	15%	0.026						
Mean times having any sex in past 3 months	—	—	—	(n = 546)	(n = 577)		—	—	—
				0.37	0.24	−0.038			
Number of sexual partners in past 3 months	—	—	—	—	—	—	(n = 535)	(n = 580)	
							0.21	0.14	0.037

*We assess baseline equivalence on non-imputed baseline covariates as our benchmark approach, as presented in this table. In addition, we tested the robustness of this approach by running sensitivity tests using dummy variable adjusted baseline covariates. No substantive differences in equivalence statistics were evident.

†The p-values of the differences between than control and treatment group are >.05 for each presented characteristic.

Table 3. Confirmatory and Exploratory 10th Grade Outcomes, by Benchmark and Alternative Models

Variable	n	Model 1: Benchmark Approach		Model 2: Negative Binomial or Logistic		
		Effect Estimate (Standard Error)*	p-Value	Effect Estimate (Standard Error)*	p-Value	Marginal Effect
Behavioral Outcomes						
Sexual initiation	1223	−0.033 (0.022)	.140	−0.224 (0.151)	.138	−0.044
Times having any sex in past 3 months	1205	0.010 (0.155)	.947	0.052 (0.169)	.760	0.027
Number of sexual partners in past 3 months	1201	−0.026 (0.040)	.518	−0.109 (0.130)	.401	−0.028
Ever had vaginal sex	**1210**	**−0.043 (0.021)**	**.042**	**−0.348 (0.165)**	**.035**	**−0.053**
Times having vaginal sex without condom in past 3 months	1205	**−0.522 (0.234)**	**.026**	−0.426 (0.271)	.115	−0.035
Behavioral antecedents						
Decision-making skills	**1281**	**0.170 (0.064)**	**.009**	—	—	—
Goal-setting skills	1284	0.026 (0.048)	.587	—	—	—
Perceived connection with peers	**1263**	**0.126 (0.068)**	**.062**	—	—	—
School engagement	1245	0.074 (0.055)	.180	—	—	—

*Effect estimates listed are the coefficients produced by the analytic models. Ordinary least squares produced the coefficients for model 1. In model 2, logistic regression models produced the coefficients for sexual initiation and ever had vaginal sex. A negative binomial model using the glm command in Stata with the log link and the binomial family produced the coefficient for times having any sex in the past 3 months, number of sexual partners in the past 3 months, and times having vaginal sex without a condom in the past 3 months. The p-values are included as separate columns in bold.

benchmark model (OLS) and an alternative nonlinear specification whose parametric form better fits the conditional distributional characteristics of the data (either logistic or negative binomial regression). In addition, since the magnitude of the treatment effect is not easily decipherable through the coefficients produced in these alternative models, we also report the marginal effects at the mean. Marginal effects represent the conditional predicted change in probability for binary outcomes and change in count for count outcomes associated with being assigned to the treatment group (versus the control group). Impact estimates from the benchmark model indicate that the offer of PGC-HS has no statistically detectable effect on the three confirmatory behavioral outcomes (participants' sexual initiation, frequency of sex, or number of sexual partners) at 10th grade follow-up. Sensitivity analyses corroborate these findings.

Results do suggest that PGC-HS has a significant detectable effect on the initiation of vaginal sex at the beginning of 10th grade. According to benchmark model estimates, 25% of the control group reported having vaginal sex by 10th grade, as compared to 21% in the treatment group (p = .042). Sensitivity analyses support these findings. Likewise, benchmark estimates appear to evince a significant reduction in the number of times having vaginal sex without a condom (p = .026); however, estimates produced by the alternative negative binomial model undermine our confidence in this finding. Further scrutiny suggests that the significant finding in the benchmark linear model is likely an artifact of an outlying value (Table 3).

Additional analyses find that, at the beginning of 10th grade, PGC-HS appears to be having a positive effect on several behavioral antecedents that are integral to the program's theory of change. Estimates reported in the second panel of Table 3 indicate a

significant and positive effect on participants' decision-making skills (p = .009) *and* a borderline significant effect on perceived connection to peers (p = .062). No significant effects were observed in school engagement or goal-setting skills.

DISCUSSION

Findings from this study suggest that PGC-HS is having a short-term impact on specific behaviors and select theoretical antecedents to those behaviors. No statistically significant differences between PGC-HS participants and control participants are observed with regards to sexual initiation, frequency of sex, or number of sexual partners at the beginning of 10th grade. However, the program appears to be influencing at least one narrowly defined behavior related to vaginal sex. At the beginning of 10th grade, causal estimates indicate that PGC-HS participants are less likely than control participants to ever have had vaginal sex. Though modest, the observed behavioral effects are noteworthy because the intervention does not address sexual health behaviors or sexual decision-making directly; thus, even modest reduction of sexual initiation is notable.

Findings also suggest that at the beginning of 10th grade, PGC-HS appears to have had some positive influence on students' social and emotional skills and in building peer connectedness. In accordance with the theory of change, we observed positive and significant change in decision-making skills and borderline significant change in peer connection. Beyond the contemporaneous improvements in decision-making skills, peer connectedness, and comparative reduction in sexual initiation, we are unable to causally investigate the relationships between improvements in social emotional skills and supportive relationships

and the reduction in sexual risk behaviors. However, because these results are consistent with PGC-HS's theory of change, we hypothesize that through building social and emotional skills and helping students form healthy and supportive peer relationships, the program may encourage participants to make healthier choices and avoid risk behaviors. Subsequent research could investigate this directly.

In a separate study of outcomes measured at the beginning of 11th grade, we find that significant impacts observed in the short-term study do not endure two full academic years after the initial offer of PGC-HS. A full discussion of these null 11th-grade findings lies outside the scope of this study; nevertheless, the short-term impacts of the intervention are meaningful, as even a short-term delay in sexual initiation has been shown to be positively associated with a number of health outcomes. Notably, research has found a 1-year delay in sexual initiation to be associated with significantly lower likelihood of poor health or obesity in adulthood.[28] In addition, initiating vaginal sex prior to the age of 15 has been linked to a higher likelihood of STIs and multiple sexual partners in early adulthood.[29,30] Previous studies have also explored the relationship between delayed sexual initiation and educational outcomes; initiating sexual activity before 10th grade is correlated with a lower likelihood of graduating high school by early adulthood, as well as a reduced likelihood of enrolling in post-secondary education.[31]

While promising, the findings in this short-term study raise the question of how PYD programs such as PGC-HS may work to encourage less risky and more protective behaviors, even without the inclusion of sexual health information.[15,16] Leading theories in health-risk behaviors maintain that information is a necessary (but insufficient) condition to motivate risk reduction, however, our data do not provide a simple and unqualified empirical examination of this mechanism.[32-34] Although a complex question, it bears consideration that the behavioral outcome in which change was observed in this study (initiation of vaginal sex) may require lower levels of information or knowledge than other sexual health outcomes, such as condom use. Namely, the former involves the basic understanding that vaginal sex involves risk, while the latter may require additional knowledge, such as where to access and how to use condoms. Outcomes with a higher threshold of knowledge requirements may be harder to affect. Regardless, the type and quantity of information required for programs like this to affect behavior remains an open and important query to investigate in future research.

There are several limitations to the study. First, our findings are based on data obtained from adolescent students' self-reported data; as participants' responses may be influenced by social approval and desirability,

reliability, and self-reporting bias may occur. Second, since random assignment was at the individual level within schools, there remains a possibility that students assigned to PGC-HS interacted with control students in the same school in a way that affected outcomes. We were not able to measure the level of spillover effects; however, since control students would not have been exposed to the deliberate relationship-building activities and experience with the peer mentors and between peers, we remain skeptical of this possibility. In addition, interpreting findings for theoretical antecedents of behavior presents a challenge in this study, as PGC-HS is a complex program comprised of several components. Further investigation into effective program components, as well as the relationships between the targeted, correlates in the logic model and sexual outcomes, may further improve the efficacy of future school-based PYD programs.

Despite the limitations, this study addresses gaps in the evidence base on high school-focused programs using a rigorous study design with a robust sample size. Baseline equivalence analysis indicates the RCT was well executed, and high questionnaire response rates suggest the successful limitation of potential bias in our impact estimates stemming from attrition.[35]

IMPLICATIONS FOR SCHOOL HEALTH

Unintended teen pregnancies are a leading cause of high school dropout and decreased academic achievement.[36] As such, reaching high school students with programming that may decrease unintended pregnancy is critical. Moreover, identifying programs that impact teen sexual health but do not explicitly focus on sex education may have important practical and policy implications. Cultural and religious norms around adolescent sexuality have shaped federal and state policies and practices, driving restrictions on comprehensive reproductive health information and service delivery in schools and elsewhere.[37] This is especially of concern in rural areas, which have disproportionately high rates of teen pregnancy, but have seen a drop in formal sex education delivery over the last decade.[38,39]

The favorable short-term impacts observed in this study are promising, even if findings do not persist in the 11th grade, especially for schools and communities with restrictions around sexual health education. Findings from this study expand upon previous research by providing causal evidence that a PYD program implemented in a school setting and designed specifically for a high school population can lead to improved sexual health outcomes, even in the absence of reproductive health information.[8,14] Furthermore, a recent HHS report suggests that delayed sexual initiation (a finding in this study) may promise a range of

benefits related to students' health and well-being. For example, studies suggest that delaying sexual activity may reduce the chance of pregnancy in early adolescence and reduce STI transmission.[29,40] Delayed sexual activity is also linked to improved educational outcomes, such as high school performance and increased high school graduations among girls.[41] In addition, some studies have found evidence that delayed sexual initiation may improve mental health and well-being, including self-esteem and depression.[41-44]

In addition to the potential of improved outcomes, programs such as PGC are designed to be flexible, can be tailored to a school's needs, and leverage already existing resources (such as school staff and student leaders). These program characteristics may be particularly meaningful to schools when considering the selection and implementation of new programming in the face of limited resources and reproductive health education constraints.

Human Subjects Approval Statement

This study received approval from both Sterling and New York City Department of Education IRB prior to the start of implementation and maintained approval through each phase of the study.

Conflict of Interest

No potential competing interest to report.

REFERENCES

1. Centers for Disease Control and Prevention. About Teen Pregnancy. 2019. Available at: https://www.cdc.gov/teenpregnancy/about/index.htm. Accessed January 15, 2021.
2. Hamilton BE, Rossen LM, Branum AM. Teen Birth Rates for Urban and Rural Areas in the United States, 2007-2015; 2007.
3. Martin JA, Hamilton BE, Osterman MJK. Births in the United States, 2018; NCHS Data Brief No. 346. 2019;346, 7.
4. Youth.gov. The Adverse Effects of Teen Pregnancy. 2022. Available at: https://youth.gov/youth-topics/pregnancy-prevention/adverse-effects-teen-pregnancy. Accessed March 21, 2022
5. Centers for Disease Control. *Prevention. About Teen Pregnancy*. Atlanta, GA: Centers for Disease Control; 2019. https://www.cdc.gov/teenpregnancy/about/index.htm.
6. Maynard RA. *Kids Having Kids: Economic Costs and Social Consequences of Teen Pregnancy*. London: Routledge; 2018. doi:https://doi.org/10.4324/9780429452635
7. Perper K, Peterson K, Manlove J. *Diploma Attainment Among Teen Mothers. Child Trends Fact Sheet*. Washington, DC: Child Trends; 2010:1-4.
8. Mathematica policy research. Identifying programs that impact teen pregnancy, sexually transmitted infections, and associated sexual risk behaviors: *Review Protocol Published online* 2016. https://tppevidencereview.youth.gov/
9. Goesling B, Colman S, Trenholm C, Terzian M, Moore K. Programs to reduce teen pregnancy, sexually transmitted infections, and associated sexual risk behaviors: a systematic review. *Journal of Adolescent Health Published online*. 2014;54:499-507. https://doi.org/10.1016/j.jadohealth.2013.12.004.
10. Redfield RR, Bunnell R, Greenspan A, et al. Youth risk behavior surveillance- United States, 2019. *Morbidity and Morality Weekly Report*. 2020;69(1):1-83. https://www.cdc.gov/healthyyouth/data/yrbs/index.htm.
11. Kirby D. The impact of schools and school programs upon adolescent sexual behavior. *J Sex Res*. 2002;39(1):27-33. https://doi.org/10.1080/00224490209552116.
12. O'Hara P, Messick BJ, Fichtner RR, Parris D. A peer-led AIDS prevention program for students in an alternative school. *Journal of School Health*. 1996;66(5):176-182. https://doi.org/10.1111/j.1746-1561.1996.tb06271.x.
13. Pearlman DN, Camberg L, Wallace LJ, Symons P, Finison L. Tapping youth as agents for change: evaluation of a peer leadership HIV/AIDS intervention. *J Adolesc Health*. 2002;31(1):31-39. https://doi.org/10.1016/S1054-139X(02)00379-8.
14. Smith MU, Dane FC, Archer ME, Devereaux RS, Katner HP. Students together against negative decisions (STAND): evaluation of a school-based sexual risk reduction intervention in the rural south. *AIDS Educ Prev*. 2000;12(1):49-70.
15. Gavin LE, Catalano RF, David-Ferdon C, Gloppen KM, Markham CM. A review of positive youth development programs that promote adolescent sexual and reproductive health. *J Adolesc Health*. 2010;46(3 SUPPL):S75-S91. https://doi.org/10.1016/j.jadohealth.2009.11.215.
16. Taylor RD, Oberle E, Durlak JA, Weissberg RP. Promoting positive youth development through school-based social and emotional learning interventions: a meta-analysis of follow-up effects. *Child Dev*. 2017;88(4):1156-1171. https://doi.org/10.1111/cdev.12864.
17. Hawkins JD, Catalano RF, Kosterman R, Abbott R, Hill KG. Preventing adolescent health-risk behaviors by strengthening protection during childhood. *Arch Pediatr Adolescent Med*. 1999;153(3):226-234. https://doi.org/10.1001/archpedi.153.3.226.
18. Statacorp. *StataCorp*.; 2017.
19. McNeal RB, Hansen WB. Developmental patterns associated with the onset of drug use: changes in postulated mediators during adolescence. *J Drug Issues*. 1999;29(2):381-400. https://doi.org/10.1177/002204269902900214.
20. Appleton JJ, Christenson SL, Kim D, Reschly AL. Measuring cognitive and psychological engagement: validation of the student engagement instrument. *J Sch Psychol*. 2006;44(5):427-445. https://doi.org/10.1016/j.jsp.2006.04.002.
21. Fredricks J, McColskey W, Meli J, Mordica J, Montrosse B, Mooney K. *Measuring Student Engagement in Upper Elementary through High School: A Description of 21 Instruments*, Vol. 098. Washington, DC: REL; 2011.
22. Radziwon CD. The effects of peers' beliefs on 8th-grade students' identification with school? *J Res Childhood Educ*. 2003;17(2):236-249. https://doi.org/10.1080/02568540309595013.
23. Martino LR. A goal-setting model for young adolescent at risk students. *Middle School J*. 1993;24(5):19-22. https://doi.org/10.1080/00940771.1993.11496086.
24. White F. A cognitive-behavioural measure of student goal setting in a tertiary educational context. *Educ Psychol*. 2002;22(3):285-304. https://doi.org/10.1080/01443410220138520.
25. Bandura A. *Multidimensional Scales of Perceived Academic Efficacy*. Stanford: Stanford University; 1990.
26. Angrist JD, Pischke JS. Mostly *Harmless Econometrics: An Empiricist's Companion*. Willough by, NSW, Australia: The Economic Society of Australia; 2008. https://doi.org/10.1111/j.1475-4932.2011.00742.x.
27. Lumley T, Diehr P, Emerson S, Chen L. The importance of the normality assumption in large public health data sets. *Annu Rev Public Health*. 2002;23:151-169. https://doi.org/10.1146/annurev.publhealth.23.100901.140546.
28. Epstein M, Furlong M, Kosterman R, et al. Adolescent age of sexual initiation and subsequent adult health outcomes. *Am J Public Health*. 2018;108(6):822-828. https://doi.org/10.2105/AJPH.2018.304372.

29. Kugler KC, Vasilenko SA, Butera NM, Coffman DL. Long-term consequences of early sexual initiation on young adult health: a causal inference approach. *J Early Adolesc*. 2017;37(5):662-676. https://doi.org/10.1177/0272431615620666.

30. Epstein M, Bailey JA, Manhart LE, et al. Understanding the link between early sexual initiation and later sexually transmitted infection: test and replication in two longitudinal studies. *J Adolesc Health*. 2014;54(4):435-441.e2. https://doi.org/10.1016/j.jadohealth.2013.09.016.

31. Pham C, Keenan T, Han B. Evaluating impacts of early adolescent romance in high school on academic outcomes. *J Appl Econo Business Res JAEBR*. 2013;3(1):14-33.

32. Bandura A. Self-efficacy mechanism in human agency. *Am Psychologist*. 1982;37(2):122-147. https://doi.org/10.1037/0003-066X.37.2.122.

33. Bandura A. In: Di Clemente RJ, Peterson JL, eds. *Preventing AIDS: Theories and Methods of Behavioral Interventions*, Vol. 26. New York: Plenum Press; 1994.

34. Ajzen I. The theory of planned behaviour: reactions and reflections. *Psychol Health*. 2011;26(9):1113-1127. https://doi.org/10.1080/08870446.2011.613995.

35. Policy Research M. Identifying Programs That Impact Teen Pregnancy, Sexually Transmitted Infections, and Associated Sexual Risk Behaviors Review Protocol Version 5.0 This page left blank for double-sided printing.

36. Shuger L. Teen pregnancy and high school dropout: what communities can do to address these issues. In: *The National Campaign to Prevent Teen and Unplanned Pregnancy and America's Promise Alliance*. Washington, DC: The National Campaign to Prevent Teen and Unplanned Pregnancy and America's Promise Alliance; 2012:1-15.

37. Hall KS, McDermott Sales J, Komro KA, Santelli J. The state of sex education in the United States. *J Adolesc Health*. 2016;58(6):595-597. https://doi.org/10.1016/j.jadohealth.2016.03.032.

38. Hamilton BE, Rossen LM, Branum AM. Teen birth rates for urban and rural areas in the United States, 2007-2015. *NCHS Data Brief*. 2016;264:1.

39. Lindberg LD, Maddow-Zimet I, Boonstra H. Changes in adolescents' receipt of sex education, 2006-2013. *J Adolesc Health*. 2016;58(6):621-627. https://doi.org/10.1016/j.jadohealth.2016.02.004.

40. Forhan SE, Gottlieb SL, Sternberg MR, et al. Prevalence of sexually transmitted infections among female adolescents aged 14 to 19 in the United States. *Pediatrics*. 2009;124(6):1505-1512. https://doi.org/10.1542/peds.2009-0674.

41. Assessing the benefits of delayed sexual activity: a synthesis of the literature.

42. McCarthy B, Grodsky E. Sex and school: adolescent sexual intercourse and education. *Soc Probl*. 2011;58(2):213-234. https://doi.org/10.1525/sp.2011.58.2.213.

43. Jamieson LK, Wade TJ. Early age of first sexual intercourse and depressive symptomatology among adolescents. *J Sex Res*. 2011;48(5):450-460. https://doi.org/10.1080/00224499.2010.509892.

44. Meier AM. Adolescent first sex and subsequent mental health. *Am J Sociol*. 2007;112(6):1811-1847. https://doi.org/10.1086/512708.

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The following Supporting Information is available for this article:

Table S1: Supporting Information

Additional supporting information may be found online in the Supporting Information section at the end of the article.