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Article in *American Journal of Public Health* · September 2016

DOI: 10.2105/AJPH.2016.303389

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Healthy Futures Program and Adolescent Sexual Behaviors in 3 Massachusetts Cities: A Randomized Controlled Trial

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Objectives. We evaluated the impact of the 3-year Healthy Futures program on reducing sexual behaviors among middle school students.

Methods. Fifteen public middle schools in Haverhill, Lowell, and Lynn, Massachusetts, participated in this longitudinal school-cluster randomized controlled trial (2011–2015), which included 1344 boys and girls. We collected student survey data at baseline, immediately after each Nu-CULTURE curriculum (classroom component of Healthy Futures) in the sixth, seventh, and eighth grades, and at a 1-year follow-up in the ninth grade (cohort 1 students only).

Results. Healthy Futures did not reduce the overall prevalence of eighth-grade students who reported ever having vaginal sex. In the eighth-grade follow-up, fewer girls in the treatment group than in the control group reported ever having vaginal sex ($P = .04$), and fewer Hispanic treatment students than Hispanic control students reported ever having vaginal sex ($P = .002$).

Conclusions. There was some evidence of delaying sexual initiation by the end of Nu-CULTURE, for girls and Hispanics, but not for boys. Future research should focus on improving implementation of the supplemental components intended to foster interpersonal and environmental protective factors associated with sustained delays in sexual activity. (*Am J Public Health.* 2016;106:S103–S109. doi:10.2105/AJPH.2016.303389)

 See editorials, p. S5–S31.

Despite declines in adolescent pregnancies and births in the United States, rates still remain higher than in other developed countries.^{1,2} Adolescents who engage in sexual activity are at risk for sexually transmitted infections and pregnancy. Moreover, adolescent pregnancy is often associated with negative consequences for young parents, their children, and society.³ Compared with children born to older parents, children of adolescent parents are more likely to have poorer educational, behavioral, and health outcomes throughout their lives. An estimated \$2.1 billion in public sector health care, \$3.1 billion in child welfare, and \$2 billion in incarceration costs in 2010 have been associated with adolescent pregnancy.⁴ To reduce adolescent pregnancy, in 2010, the US Department of Health and Human Services launched the Teen Pregnancy Prevention

initiative for developing, refining, and testing innovative strategies (TPP-Tier 2).^{5,6}

Although the adolescent pregnancy rate in Massachusetts was lower than the national average in 2009 (19.5 births per 1000 females vs 39.1 births per 1000 females, respectively, for ages 15–19 years),⁷ disparities existed across some communities, and certain subpopulations were at a greater risk. Haverhill, Lowell, and Lynn all ranked among the top 20 Massachusetts communities with the highest adolescent birth rates in 2009 (36.7, 53.0, and 55.8 births per 1000 females, respectively, for ages 15–19 years).⁸ In addition, compared with

non-Hispanic White youths, Black and Hispanic Massachusetts youths were more likely to report ever having sexual intercourse (44.1% vs 54.1% and 55.9%, respectively), which made them at higher risk for pregnancy.⁷

Studies have examined both risk (for example, peer alcohol use, gang involvement) and protective factors (for example, parent–youth communication, sports participation) associated with adolescent sex and pregnancy.⁹ Thus, interventions try to address these factors concurrently. Healthy Futures was originally designed as an abstinence-only program for middle and high school youths, and formative findings indicated the need to enhance knowledge and protective factors at an earlier age.¹⁰ Therefore, it was redesigned to be a school-based, 3-year relationship education program that targeted younger students in the sixth, seventh, and eighth grades, including a classroom-based curriculum and supplemental components intended to affect both individual and interpersonal level changes. It emphasizes delay of sexual initiation by developing adolescents' decision-making skills and promoting protective healthy relationships.

For many adolescents, school-based health education represents the only opportunity to learn medically accurate information about sexual and reproductive health. In 2009, only half (49%) of Massachusetts high school students reported speaking with their parents or another adult about sexual health topics during the past year.¹¹ Yet, state funding for school-based health programs was cut by \$5 million between 2009 and 2010.¹² Identifying

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This article was accepted July 13, 2016.

doi: 10.2105/AJPH.2016.303389

evidence-based programs that work in high-need communities is important for informing where to direct limited resources. In 2010, an agency (name removed for blinding) was awarded a TPP-Tier 2 grant to implement and evaluate the Healthy Futures program in Haverhill, Lowell, and Lynn, Massachusetts.

This article presents the findings of the 4-year (2011–2015) evaluation to determine the impact of the redesigned Healthy Futures. Because the program aim is to delay sexual initiation, the primary outcome is the prevalence of students who ever had vaginal sex by the eighth-grade follow-up. Secondary outcomes include prevalence of ever having sex by gender and race/ethnicity, sex in the past 3 months, and unprotected sex without effective contraception in the past 3 months by the eighth-grade follow-up. Prevalence of ever having vaginal sex by the ninth-grade follow-up was also explored.

METHODS

Fifteen public middle schools in the 3 Massachusetts cities were enrolled in this school cluster, randomized controlled trial. Schools were rank-ordered by the percentage of students eligible for free/reduced price lunch, matched in pairs, and randomized after school principals signed memoranda of understanding and before parent consent and student assent. Each school had a 50% probability of being assigned to either the treatment or the control group. All sixth-grade students in targeted schools were eligible for inclusion. Cohort 1 schools ($n = 14$) were randomized during the 2011–2012 school year and followed for 4 years (2011–2015). Cohort 2 consisted of a single school that agreed to the study later. It was randomized to condition outside of a pair in 2012 and followed for 3 years (2012–2015). Students and parents were blinded and unaware of the school's group assignment, because treatment and control interventions were referred to as Healthy Futures during program delivery.

Treatment Intervention

Healthy Futures is informed by the social ecological model framework¹³ and social learning theory,^{14,15} and was designed to target

individual- and interpersonal-level change through several interacting components:

1. Nu-CULTURE, a classroom-based relationship curriculum with parent connection forms;
2. age-appropriate virtual classroom Web sites;
3. Rhymin' it Write afterschool program;
4. Code A peer leadership summer program; and
5. parent Web site and True Connections parent workshops.

Table 1 shows the target population, setting, duration, and dosage for each component.

We recruited health educators from the study communities and trained them to implement Nu-CULTURE. Eight 50-minute sessions, offered during consecutive school days for boys and girls, in each of the sixth, seventh, and eighth grades addressed 3 key areas: (1) human anatomy and physiology, (2) life skills, and (3) relationships. The sixth-grade sessions built a foundation for a healthy adolescent and covered such topics as puberty and reproduction (boys and girls were taught separately), gender reflection, identifying emotional needs, assertiveness and refusal skills, conflict resolution, qualities of a good friend, sexual abuse, and cyber assault. The seventh-grade sessions expanded on these topics by discussing puberty and pregnancy, STIs, identifying and achieving dreams, basic human needs, consequences of choices, handling stress in healthy ways, overcoming peer pressure by enhancing refusal skills, and exploring levels of friendship, positive character traits, and sexual harassment. The eighth-grade sessions reviewed previous topics and aimed to enhance students' skills to identify goals, dreams, and emotional needs, identify effective contraception, and set personal limits in relationships.

Sessions were offered during regularly scheduled health or physical education classes and used interactive teaching strategies to engage youths, including lectures, discussions, role play, skits, and multimedia. Classes emphasized the connection between adolescents' choices and their ability to achieve goals and dreams, specifically related to educational and career achievement. Students received parent connection forms after each

class to complete with their parent and returned them the next session (the eighth session form was not collected). Fifty-six percent of students who attended at least 1 session in the sixth, 36% in the seventh, and 42% in the eighth grades returned at least 1 form (33%, 22%, and 29% returned 4 or more forms in each grade, respectively). Less than 15% returned all 7 forms each year, which suggested less success in fostering student-parent interactions. However, it is possible that completed forms were not returned.

Other supporting program components included the virtual classrooms for reinforcing the curriculum (<http://www.onmylevel.org> for sixth and seventh, <http://www.doinitright.org> for eighth, and <http://www.ontheirlevel.org> for parents), which were available to Nu-CULTURE students, their parents, and to the public. Rhymin' it Write, Code A, and True Connections, which target interpersonal-level change by cultivating peer leaders and protective peer-to-peer and parent-child relationships, recruited participants from those who returned any parent connection forms. Participation in these additional activities was low, so they will not be discussed further. (See the final report on the Office of Adolescent Health Web site for details on these other components.¹⁶)

Control Intervention and Study Participants

The control intervention was a 2-session, classroom-based program offered each year on health topics and implemented during regularly scheduled health or physical education classes. The sixth-grade curriculum included 1 class on puberty and reproduction and 1 class on bullying prevention; the 2 seventh-grade classes covered dating violence prevention; and the 2 eighth-grade classes covered mental health promotion and suicide prevention. A pair of non-Nu-CULTURE health educators led each session.

Students were eligible if they were (1) enrolled in sixth grade in 1 of the 15 participating public middle schools in the 2011–2012 (cohort 1) or 2012–2013 (cohort 2) school year; and (2) were not withdrawn from the program by themselves, a parent, or school administrator(s) before the consent or assent process. Students who enrolled in the

TABLE 1—Intended Healthy Futures Components: Healthy Futures Program and Adolescent Sexual Behaviors, Massachusetts, 2011–2015

Component	Target Population	Setting	Duration	Dosage
Nu-CULTURE	Sixth grade (aged 10–15 y) Seventh grade (aged 11–16 y) Eighth grade (aged 12–16 y) Parents/guardians of Nu-CULTURE students (aged ≥ 18 y) Self-selected subset of Nu-CULTURE students (aged ≥ 18 y)	Classroom, Take-Home Forms	50-min sessions	8 sessions/y, 24 sessions total
Virtual Classroom	Self-selected subset of Nu-CULTURE students (aged 10–16 y)	Online	Unlimited access	
Rhyming it Write	Self-selected subset of Nu-CULTURE students (aged 10–16 y)	After-school program	90-min sessions	10 sessions/y, 30 sessions total
Code A	Self-selected subset of Nu-CULTURE students (aged 10–16 y)	Summer program	240-min sessions	18 sessions total
Parent Web site True Connections	Self-selected parents/guardians (aged ≥ 18 y) of Nu-CULTURE students	Online, workshops	Unlimited access, 120-min sessions	Unlimited access, 4 sessions

Note. All activities other than the Nu-CULTURE curriculum had low participation. Additional information on these other components can be found in the final report on the Office of Adolescent Health Web site.¹⁶

school after the consent or assent process were ineligible.

Of the eligible 2346 sixth-grade students, 19% (n = 434) were opted out by a parent or personally declined, and 24% (n = 568) did not return consent forms. The remaining 57% (n = 1344) were enrolled. A larger percentage (39%) of those who consented were Hispanic versus 29% among those who opted out. Data were unavailable on students who did not return forms. Among enrolled students, 88% completed a baseline survey, and response rates for the immediate sixth-, seventh-, and eighth-grade follow-ups were 96%, 92%, and 84%, respectively. At the 1-year ninth-grade follow-up in the high schools, 80% (996 of 1247) of the cohort 1 sample was retained (data available as a supplement to the online version of this article at <http://www.ajph.org>). All schools were retained (15 for the eighth-grade analysis and 14 for the ninth grade analysis).

Data Collection and Measures

Implementation measures. We measured adherence and fidelity using (1) attendance logs, (2) fidelity checklists that health educators completed to document session duration and the activities completed or modified each session, and (3) a yearly health educator roster with demographic characteristics and training attendance logs. Classroom observers

rated the quality of implementation and youth engagement, whereas active engagement was defined as 75% to 100% of students participating. (See the final report on the Office of Adolescent Health Web site for details on the assessment tool and findings on other implementation measures.¹⁶)

Outcome measures. We collected 5 paper-and-pencil, self-administered student surveys: baseline; immediate sixth-, seventh-, and eighth-grade follow-ups (both cohorts); and ninth-grade follow-up (cohort 1 only). Treatment group surveys were scheduled on day 1 (sixth-grade baseline) of Nu-CULTURE before the program and on day 8 (sixth-, seventh-, and eighth-grade follow-ups) after program completion. Control group surveys were scheduled to coincide with the treatment group data collection. The ninth grade surveys for both groups were administered in high schools (cohort 1 only) approximately 1 year after program completion. Students without study consent received a similar length “faux” survey on unrelated topics (for example, physical activity) to ensure anonymity, comfort, and equal treatment. Only evaluation team members handled the surveys. Classroom-based surveys were in English and not incentivized. We implemented a retention protocol, including telephone surveys, to minimize attrition.

All surveys assessed student characteristics, knowledge, attitudes, and beliefs. Because of students’ young age in the sixth and seventh grades, only the eighth- and ninth-grade surveys asked about sexual activity, pregnancy, and sex intentions. Measures of sexual activity included age at first sex, ever having vaginal sex, sex in the past 3 months, and unprotected sex without contraception in the past 3 months. The primary outcome was ever having vaginal sex by the eighth-grade follow-up. Secondary outcomes included ever having vaginal sex by gender and race/ethnicity, sex in the past 3 months, and sex without birth control in the past 3 months at eighth-grade follow-up. Prevalence of ever having vaginal sex by the ninth-grade follow-up was also examined. Ever had sex was measured from the yes/no question: “For the purposes of this survey, by sex, we mean a male putting his penis into a female’s vagina. Other ways of saying sex are ‘doing it’ or ‘going all the way.’ Have you ever had sex?”

Statistical Analyses

We analyzed data from all participants based on their initially assigned status, regardless of participation, in accordance with the intent-to-treat framework. Dependent variables were binary (yes/no). We used hierarchical generalized linear mixed models to account for school-level clustering (the

nonindependence among students within the same schools) using Proc GLIMMIX in SAS version 9.4 (SAS Institute Inc., Cary, NC). We used type III tests of fixed effects to determine statistical significance.

For each analytic sample, we conducted baseline equivalence tests to assess differences between the treatment and control groups based on age, gender, race/ethnicity, and boyfriend or girlfriend status at sixth grade. We compared demographic characteristic variables at baseline after controlling for the match-pair indicator (we included the single cohort 2 school as part of the cohort 1 pair within its district) and adjusted for school clustering.

For the outcome variables, we imputed missing values to be logically consistent with other responses in the same survey (for example, we coded missing values for ever having had sex as yes for respondents who reported having sex in the past 3 months) and responses in other surveys (for example, we coded missing values for ever having sex in the ninth-grade survey as yes for participants who reported having had sex in the eighth-grade survey, and we imputed missing values for ever having sex in the eighth-grade survey based on reported age at first sex in the ninth-grade survey). (See the final report on the Office of Adolescent Health Web site for additional details on data cleaning.¹⁶)

For each analytic sample, we compared outcomes across conditions after controlling for the randomization matched-pair indicator, and participant demographic characteristics of gender, age, race/ethnicity (Hispanic; White, non-Hispanic; other, non-Hispanic), and boyfriend or girlfriend status in the sixth grade as fixed effects and school as a random effect. We used boyfriend or girlfriend status because baseline measures of sex behaviors were not collected because of students' young age.

We reported regression-adjusted mean probabilities, with statistical significance considered at a *P* value of less than .05 using 2-tailed tests. We made no adjustments for multiple hypothesis testing because of the single primary outcome of ever having vaginal sex at the eighth-grade follow-up, which was set before the analysis. We also analyzed secondary outcomes using the same method, and we used the Benjamini-Hochberg procedure to adjust for multiple testing. We

conducted sensitivity analyses using (1) raw data without cleaning; (2) data cleaned for within-survey logic, but not for across-survey logic; (3) modeling without controlling for baseline demographic characteristics; and (4) modeling that allowed for different residual variances by gender to assess whether results differed because of data cleaning and model specifications. Our study had 80% power to detect an 8-percentage-point significant difference in the primary outcome, based on a prospective power analysis that used generalized estimating equation logistic regressions through Monte Carlo simulations that accounted for the cluster randomized design, assuming a random school effect.

RESULTS

Nu-CULTURE was delivered each year (September 2011 to June 2014) during regularly scheduled classes in all treatment schools. Eighty-eight percent of activities were delivered as prescribed and with high fidelity. Weather-related school closures and conflicts with academic achievement test schedule accounted for most modified or canceled sessions. Sixteen of the 17 health educators were from the communities served, and more than half were racial/ethnic minorities. The average student attendance rate was highest in sixth grade (86%) and declined in seventh and eighth grades (73% and 68%, respectively). Students attended a mean of 18 and a median of 21 of the 24 intended sessions. Over the 3-year program, the evaluation team observed a random sample (9%) of sessions and rated 100% of the sixth- and seventh-grade and 87% of the eighth-grade sessions as excellent. Youths were actively engaged in an average of 95% of observed sessions.

Of the 1127 students surveyed in eighth grade, 94.1% (*n* = 1060) had data on the primary outcome of "ever had sex." At baseline, students averaged 12 years of age, approximately 47.8% were female, 40% were Hispanic, 18.5% had a boyfriend or girlfriend, and approximately 53.4% participated in extracurricular activities. For the secondary outcomes related to sex in the past 3 months, 1029 students with nonmissing data were included. Of the 996 students surveyed in the ninth grade, 90% (*n* = 895) were included in

the analysis of the secondary outcome of ever having had vaginal sex. There were no statistically significant differences between groups on baseline characteristics (Table 2).

Overall, 6.4% of treatment students reported ever having vaginal sex by the eighth-grade follow-up compared with 9.4% of control students. The estimated impact of the 3-percentage-point difference was not significant (*P* = .07). However, 2 of the 4 sensitivity analyses conducted using the raw data and the model without baseline covariate adjustments found a statistically significant overall program impact in reducing prevalence of ever having vaginal sex (both *P* = .04). The other 2 analyses also showed similar findings (*P* = .07; *P* = .06), which suggested some evidence of effectiveness.

Healthy Futures did significantly reduce the prevalence of female and Hispanic students who have ever had vaginal sex by eighth-grade follow-up (Table 3). Specifically, 2.9% of girls in the treatment group reported ever having vaginal sex versus 6.4% in the control group (*P* = .04). Among Hispanics, 6.3% in the treatment group versus 15.7% in the control group reported ever having vaginal sex (*P* = .002). No differences were observed for boys (9.9% vs 12.2%) or non-Hispanics (2.8% vs 3.1%). Although not statistically significant, White non-Hispanics had higher rates of vaginal sex by eighth-grade follow-up in the treatment group (13.4%) than in the control group (7.8%). No statistically significant differences were found in the prevalence of past 3 months sex and past 3 months sex without contraception at the eighth-grade follow-up.

By the 1-year ninth-grade follow-up for cohort 1, equal proportions of students (23%) in both the treatment and control groups reported ever having had vaginal sex.

DISCUSSION

Although Healthy Futures was intended as a multicomponent intervention targeting individual (students), interpersonal (peer-to-peer interactions and parent-child relationships), and environmental (school and community) level changes, low participation in the supplemental activities made this randomized controlled trial an evaluation of the Nu-CULTURE curriculum. We did not

TABLE 2—Baseline Demographics for the Immediate Eighth-Grade and 1-Year Ninth-Grade Follow-Up Analytic Samples: Healthy Futures Program and Adolescent Sexual Behaviors, Massachusetts, 2011–2015

Characteristics	8th-Grade Follow-Up			9th-Grade Follow-up		
	Treatment (n = 464), Mean \pm SD or %	Control (n = 596), Mean \pm SD or %	Difference \pm SD	Treatment (n = 437) Mean \pm SD or %	Control (n = 458) Mean \pm SD or %	Difference \pm SD
Age, y	12.2 \pm 0.59	12.3 \pm 0.55	-0.1 \pm 0.12	12.2 \pm 0.60	12.2 \pm 0.53	-0.1 \pm 0.06
Female	45.9	49.3	-3.4 \pm 0.24	45.5	49.6	-4.0 \pm 0.27
Race/ethnicity						
Hispanic	40.1	39.8	0.3 \pm 0.81	38.7	40.6	-1.9 \pm 0.24
Non-Hispanic White	32.8	25.2	7.6 \pm 0.69	31.1	22.9	8.2 \pm 0.28
Non-Hispanic Asian	11.0	19.0	-8.0 \pm 0.40	13.3	21.2	-7.9 \pm 0.65
Non-Hispanic Black	4.5	5.4	-0.9 \pm 0.95	4.6	4.8	-0.2 \pm 0.75
Non-Hispanic other	11.6	10.7	0.9 \pm 0.58	12.4	10.5	1.9 \pm 0.35
Have a boy/girlfriend	19.6	17.6	2.0 \pm 0.80	19.2	17.5	1.7 \pm 0.79
Participate in extracurricular activity	53.8	53.0	0.8 \pm 0.85	55.1	52.6	2.5 \pm 0.58

Note. Baseline measures of behavioral outcomes were not measured because of students' young age in sixth grade.

find a treatment group difference in the prevalence of ever having vaginal sex by the eighth-grade follow-up, although 2 of the 4 sensitivity analyses did demonstrate effectiveness. However, the intervention was associated with a reduction in the prevalence of female and Hispanic students who reported ever having vaginal sex. There was no difference in the prevalence of sex and unprotected sex in the past 3 months.

We also had no evidence of long-term impact on the prevalence of ever having vaginal sex at the 1-year ninth-grade follow-up. Although we made every effort to survey students as soon as possible after the school year started, it was possible that interaction between treatment and control group students in high school might have affected their survey responses or actual behaviors, thereby undermining long-term effects.

Although environmental influences on adolescent sexual activity are recognized and interventions have targeted relational, familial, community or societal elements, most study findings still focus on the individuals' demographic characteristics and behaviors that predict sexual behavior.¹⁷ Evidence increasingly suggests the importance of considering the environmental factors that either support healthy behaviors or encourage risky

TABLE 3—Postintervention Estimated Effects Using Data From the Immediate Eighth-Grade Follow-Up and 1-Year Follow-Up Ninth-Grade Survey: Healthy Futures Program and Adolescent Sexual Behaviors, Massachusetts, 2011–2015

Outcome Measures	Treatment Mean \pm SE (%)	Control Mean \pm SE (%)	Treatment Compared With Control, Mean % Difference (P)
Eighth-grade outcomes			
Ever had vaginal sex, overall	6.4 \pm 1.9	9.4 \pm 2.1	-3.0 (.07)
Ever had vaginal sex, by gender and race/ethnicity			
Male	9.9 \pm 3.4	12.2 \pm 3.3	-2.3 (.43)
Female	2.9 \pm 1.7	6.4 \pm 2.9	-3.4 (.04)
Hispanic	6.3 \pm 3.0	15.7 \pm 5.8	-9.4 (.002)
Non-Hispanic White	13.4 \pm 7.6	7.8 \pm 3.7	+5.6 (.29)
Non-Hispanic other	2.8 \pm 3.9	3.1 \pm 4.2	-0.3 (.83)
Sex in the past 3 mo	1.2 \pm 5.1	1.3 \pm 5.7	-0.1 (.72)
Unprotected sex in past 3 mo without an effective method of birth control	0.01 \pm 0.0	0.01 \pm 0.0	0.0 (.47)
Ninth-grade outcomes			
Ever had vaginal sex	22.8 \pm 2.6	22.5 \pm 2.5	-0.0% (.92)

Note. Sample size for eighth-grade treatment group was 464, and the control group was 596. Sample size for ninth-grade treatment group was 437, and the control group was 458. Outcomes measured immediately after the intervention (eighth-grade follow-up survey) were collected during the 2013–2014 school year from the 14 cohort 1 schools and during the 2014–2015 school year from the single cohort 2 school. The 1-year ninth-grade follow-up survey was collected during the 2014–2015 school year from the 14 cohort 1 schools only. Regression-adjusted mean probabilities are shown, with $P < .05$ indicating a statistically significant difference.

decisions.¹⁷ Because the supplemental Healthy Futures components were not highly attended or not implemented with fidelity, it was, in effect, an adolescent-oriented, classroom-based program (Nu-CULTURE) with peer interaction and some parent-student relationship building. The absence of environmental reinforcements might partially explain the lack of long-term impact.

Healthy Futures was associated with a reduction in the prevalence of vaginal sex among girls ($P = .04$). Adolescent girls from low-income urban settings such as the 3 study communities are at elevated risk for HIV, sexually transmitted infections, and unintended pregnancies.¹⁸ Fine-tuning female-tailored interventions and promoting maintenance of intervention gains are needed.¹⁸ This program did not have an impact for boys. However, some coeducational programs were successful for boys, but not girls. Many that worked for boys included a parent, teacher, school, or community service component.¹⁹ Therefore, again, the missing supplemental components might partially explain the lack of impact on boys.

Healthy Futures was associated with a reduction in the prevalence of ever having vaginal sex among Hispanics ($P = .002$). Previous research suggested interventions that encourage educational and career achievement, involve or emphasize family, and recognize gender roles were more successful for Hispanic youths.^{20–22} These are all Nu-CULTURE components, which might explain the positive impact on Hispanics. We need additional research to determine whether the gender and ethnicity effects observed would persist if the study were replicated elsewhere, with a different population, and by other health educators. Furthermore, future studies should evaluate the impact of the supplemental components on both short- and long-term outcomes.

Study Limitations

First, although our sample included youths from 3 diverse Massachusetts cities, it was not representative of the US youth population, Hispanic youths, or female adolescents; therefore, the results might not be generalizable. Second, although Healthy Future's multilevel approach intended to cultivate healthy adolescent relationships and sexual

decision-making, findings could only be attributed to the Nu-CULTURE curriculum, because participant exposure to the supplemental components was low. Third, the program impact estimates might be either under- or overestimated, depending on the accuracy of self-reported sex behavior, which could have been influenced by underlying biases and motivations (such as social desirability to respond a certain way). Fourth, although our original design included 20 schools based on a priori power calculations, our final sample was reduced to 15 schools because 1 district went under state receivership and was excluded before randomization. This might have minimized our ability to detect statistically significant differences. Fifth, influences on youths changed (e.g., technology, social media) since the studies that provided the evidence base for adolescent pregnancy prevention research were conducted. Sixth, the lack of longer-term, sustained behavior change might be attributed to adolescents increased independence from family and becoming more embedded in peer culture and norms, factors that are beyond the influence of many adolescent pregnancy prevention programs. Nevertheless, this was a rigorous evaluation of a program that showed promise and could contribute to the adolescent pregnancy prevention field.

Conclusions

Healthy Futures showed some evidence of delaying sexual initiation by the end of the 3-year Nu-CULTURE curriculum for middle school students. It was effective for girls and Hispanics, but research should examine why the program did not work for boys and how to sustain protective behaviors into high school. Future studies should also focus on improving implementation of the supplemental components intended to foster interpersonal and environmental protective factors and to determine whether they can reinforce healthy behaviors and prevent sexual activity and adolescent pregnancy over the long term. **AJPH**

CONTRIBUTORS

T. Vehige Calise directed the conceptualization, design, and implementation of the evaluation; interpreted the data; and drafted, revised, and approved the final version of the article. W. Chow was involved in the design and implementation of the evaluation; analyzed and interpreted the data; and drafted, revised, and

approved the final version of the article. K. F. Doré managed the implementation of the evaluation; interpreted the data; and drafted, revised, and approved the final version of the article. M. J. O'Brien, E. R. Heitz, and R. R. Millock were involved in the implementation of the evaluation and approved the final version of the article.

ACKNOWLEDGMENTS

This manuscript was prepared under grant number TP2AH000006 from the Office of Adolescent Health, US Department of Health and Human Services.

The authors thank the Black Ministerial Alliance of Greater Boston, Inc. staff; Healthy Futures staff; and the administration, staff, students, and parents of the participating schools for their involvement in this study. Without their support and participation, this research would not have been possible.

Note. The views expressed in this article are those of the authors and do not necessarily represent the policies of the US Department of Health & Human Services or the Office of Adolescent Health.

HUMAN PARTICIPANT PROTECTION

The study was approved by the Essex and JSI institutional review boards (ClinicalTrials.gov Identifier: NCT02554825).

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