PREP

The Personal Responsibility Education Program Evaluation

Adapting an Evidence-based Curriculum in a Rural Setting:

The Longer-Term Impacts of *Reducing the Risk* in Kentucky

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Adapting an Evidence-based Curriculum in a Rural Setting: The Longer-Term Impacts of *Reducing the Risk* in Kentucky

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Overview

Although rural counties have the highest teen birth rates in the United States (Hamilton et al. 2016), teen pregnancy prevention practitioners and researchers have developed and tested relatively few programs for youth in rural areas. A few prior studies have tested the effectiveness of transferring programs developed for urban youth to more rural or suburban areas, but these studies have generally not found effects on rates of teen pregnancy or sexual risk behaviors.

To identify effective pregnancy prevention approaches for rural youth, the Administration for Children and Families within the U.S. Department of Health and Human Services funded Mathematica Policy Research to rigorously evaluate an adapted version of the *Reducing the Risk* teen pregnancy prevention curriculum in rural Kentucky. With federal grant funding through the Personal Responsibility Education Program (PREP), the Kentucky Department of Public Health has worked through 12 local health departments to implement *Reducing the Risk* in high schools across the state. For this study, Mathematica partnered with two of these local health departments to rigorously evaluate an adapted 8-hour version of *Reducing the Risk* in 13 high schools in a primarily rural area of central and southwestern Kentucky. This study is part of a broader national evaluation of PREP that Mathematica is conducting for ACF (Wood et al. 2015).

The study team randomly assigned participating schools during the 2013–2014 and 2014–2015 school years to either a treatment group that offered the adapted version of *Reducing the Risk* or to a control group that offered the school's standard health curriculum. In schools assigned to the treatment group, trained professional health educators from two local health departments delivered the curriculum as part of a mandatory health class for primarily 9th- and 10th-grade students. The study team measured students' outcomes by collecting survey data one and two years after study enrollment. The two-year outcomes are the focus of this report.

This report is the last in a series on the implementation and impacts of the adapted version of *Reducing the Risk*. It presents evidence on the program's longer-term impacts after two years. It also provides information on program costs and documents the study methods. An earlier report on the program's shorter-term impacts after one year showed that students in the *Reducing the Risk* schools had better knowledge of contraception and STIs and expressed greater support when asked about the importance of condom use among sexually active youth (Goesling et al. 2017). The program did not change students' sexual risk behaviors, intentions to have sex, attitudes toward abstinence, or perceived ability to avoid sexual risk behaviors after one year.

The longer-term impact findings presented in this report show that the adapted version of *Reducing the Risk* led to a sustained increase in students' knowledge of contraception and STIs after two years, and that a longer-term impact on sexual risk behavior had emerged for one subgroup of students. Relative to the standard school curriculum, *Reducing the Risk* did not change the likelihood of having sex or having sex without a condom in the three months before the follow-up survey for the overall sample. The program did, however, reduce the likelihood of having sex without a condom in the three months before the survey for the smaller sample of youth who were already sexually active prior to study enrollment. These impacts are commensurate with the dosage of programming offered (eight hours) and a modest operational cost of $113 per student.

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Introduction

Rural counties have the highest teen birth rates in the United States. In 2015, the teen birth rate in rural counties was 31 births per 1,000 women ages 15 to 19, compared with 19 births per 1,000 women in this age range in large urban counties and 24 births per 1,000 in smaller urban counties (Hamilton et al. 2016). This pattern of higher rural teen birth rates holds across all racial and ethnic groups (Ng and Kaye 2016). In addition, although teen birth rates in the United States have been falling across all geographic areas, the decline has been smaller in rural counties than in urban or suburban ones (Hamilton et al. 2016). Youth in rural areas account for nearly 19 percent of all teens nationwide (United Nations Statistics Division 2017).

Despite the need for effective approaches to teen pregnancy prevention in rural areas, youth in these areas are underrepresented in the research literature. Most of the teen pregnancy prevention programs the U.S. Department of Health and Human Services currently recognizes as having demonstrated evidence of effectiveness were developed and tested in urban or suburban areas (Lugo-Gil et al. 2016). A few studies have tested the effectiveness of transferring programs developed for urban youth to more rural or suburban areas (Borawski et al. 2009; Stanton et al. 2005, 2006). However, these studies have generally not found effects on adolescent sexual risk behaviors. The findings of these studies suggest the need to adapt existing programs and approaches to meet the unique needs of rural youth (Bell et al. 2007).

Recognizing that additional research is needed to identify effective pregnancy prevention approaches for this population of youth, the Administration for Children and Families (ACF) within the U.S. Department of Health and Human Services funded Mathematica Policy Research to conduct a rigorous evaluation of an adapted, eight-hour version of the teen pregnancy prevention curriculum *Reducing the Risk* in collaboration with the Kentucky Department of Public Health. With federal grant funding through the Personal Responsibility Education Program (PREP), the Kentucky Department of Public Health has worked through 12 local health departments to implement *Reducing the Risk* in high schools across the state. For this evaluation, Mathematica partnered with two of these local health departments to conduct a rigorous evaluation of the program in 13 high schools in a primarily rural area of central and southwestern Kentucky. The study is part of a broader national evaluation of PREP that Mathematica is conducting for ACF (Wood et al. 2015).

This report is the last in a series on the implementation and impacts of the adapted version of *Reducing the Risk* in Kentucky. It presents evidence on the program's longer-term impacts after two years. It also provides information on program costs and documents the study methods. An earlier report presented evidence on the program's shorter-term impacts after one year (Goesling et al. 2017). That earlier report showed that students in the *Reducing the Risk* schools had greater exposure to information on birth control than did students in the control schools after one year. Students in the *Reducing the Risk* schools also had better knowledge of contraception and STIs and expressed greater support when asked about the importance of condom use among sexually active youth. Relative to the standard school curriculum, *Reducing the Risk* did not change students' sexual risk behaviors, intentions to have sex, attitudes toward abstinence, or perceived ability to avoid sexual risk behaviors after one year.

The *Reducing the Risk* curriculum

Reducing the Risk is a widely implemented, classroom-based abstinence and contraceptive education curriculum designed to prevent teen pregnancy; sexually transmitted infections (STIs) including HIV; and associated sexual risk behaviors. The curriculum supplements classroom instruction with more interactive skill-building activities and role-play exercises. Students actively participate in curriculum activities designed to improve communication skills, refusal skills, and delaying tactics. *Reducing the Risk* identifies abstinence as the most effective way to avoid STIs and unintended pregnancies. For sexually active students, it recommends the use of condoms and other methods of protection. The current fifth edition of the curriculum has 16 sessions of 45 minutes each, for a total of 12 instructional hours (Barth 2011). Most sessions begin with a review of the topics covered in the previous session and end with a session summary.

Three prior studies have examined the effectiveness of *Reducing the Risk* when implemented in school as part of the regular curriculum (Table 1). Kirby et al. (1991) conducted the first evaluation of the curriculum with more than 1,000 high school students in grades 9 through 12 in urban and rural areas of California. Zimmerman et al. (2008) later examined an adapted version of the curriculum that changed some program content and activities to more fully account for common adolescent personality traits, such as impulsivity and thrill seeking. The study involved more than 2,500 9th-grade students from high schools in the urban areas of Cleveland, Ohio, and Louisville, Kentucky. Most recently, Kelsey et al. (2016) examined the standard 12-hour version of *Reducing the Risk* with more than 3,300 students in grades 8 through 10 from public schools in the urban areas of Austin, Texas; San Diego, California; and St. Louis, Missouri.

Table 1. Prior studies of *Reducing the Risk* in school settings

Study	Sample	Setting	Design
Kirby et al. (1991)	1,033 students in grades 9 through 12	46 classrooms from 13 high schools in urban and rural California	Quasi-experimental design: teachers in half the classrooms volunteered to implement the curriculum as part of a required health class; students in the other classrooms served as a comparison group and were not offered the program; students in both groups completed follow-up surveys 6 and 18 months after the program.
Zimmerman et al. (2008)	2,647 9th-grade students	17 schools in the urban areas of Cleveland, Ohio, and Louisville, Kentucky	Cluster randomized trial: Schools were randomly assigned to either (1) a group that delivered the standard version of *Reducing the Risk*, (2) a group that delivered an adapted version of the curriculum, or (3) a control group that delivered the school's regular curriculum; students in all three groups completed follow-up surveys in spring of 9th and 10th grades.
Kelsey et al. (2016)	3,314 students in grades 8 through 10	150 classrooms from 17 public schools in the urban areas of Austin, Texas; San Diego, California; and St. Louis, Missouri	Cluster randomized trial: In each of the three sites, eligible classrooms were randomly assigned to either a treatment group that delivered the curriculum or a control group that did not; students in both groups completed follow-up surveys 12 months after study enrollment.

All three studies found an impact of *Reducing the Risk* on students' knowledge of reproductive health topics. Kirby et al. (1991) found that the program increased students' scores

on a 20-item knowledge test on contraception. The impact persisted 18 months after the program. Zimmerman et al. (2008) found a short-term impact on a 10-question knowledge test on pregnancy and STIs. The impact faded a year after the program. Kelsey et al. (2016) found that *Reducing the Risk* increased students' scores on a 4-item knowledge test on pregnancy risk and a 12-item knowledge test on STI risk. The study measured these impacts one year after students enrolled in the study.

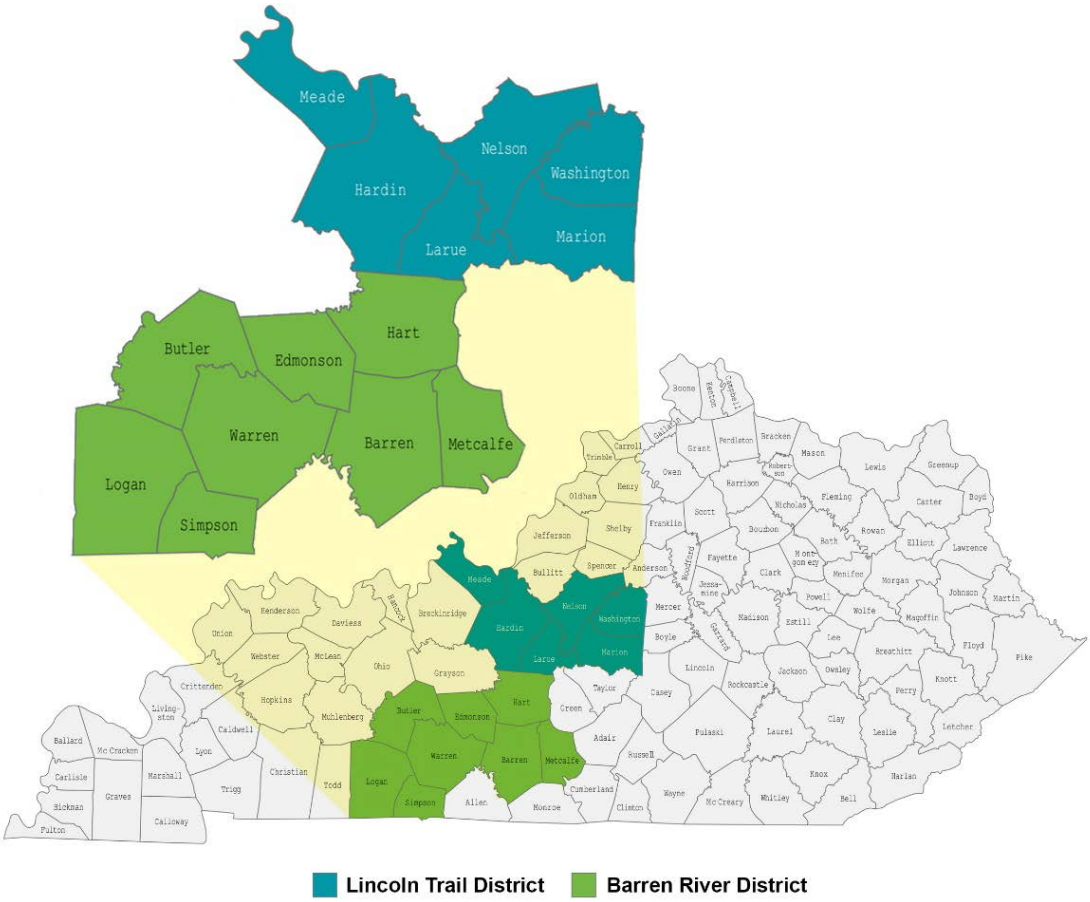
The three studies found limited impacts on other intermediate outcomes. For example, Kelsey et al. (2016) examined the impacts of *Reducing the Risk* on nine measures of students' attitudes, motivation, intentions, and skills. The study found a statistically significant impact for one of the nine measures: students in the *Reducing the Risk* classrooms had higher average scores on a scale measuring attitudes toward methods of protection. Relative to the standard school curriculum, the program did not change students' attitudes toward risky sexual behavior, motivation to delay childbearing, intentions to have sex, or perceived skills to avoid risky sexual behavior.

The studies found mixed evidence of the program's impact on students' sexual risk behavior. Both Kirby et al. (1991) and Zimmerman et al. (2008) concluded that the program reduced students' likelihood of becoming sexually active but did not change the likelihood of unprotected sex for students who were already sexually active. Kirby et al. (1991) found that the program's impact in delaying sexual activity was particularly focused on female students and students identified by the study authors as low risk. By contrast, Kelsey et al. (2016) found that the program had no behavioral impact beyond the regular school curriculum for either the overall sample or subgroups of students defined by sexual initiation status. However, in additional exploratory analyses, Kelsey et al. (2016) found differences in impacts across the three study sites. For the St. Louis site, the study found a favorable impact for two of six measures of sexual risk behavior at the 12-month follow up. For the San Diego and Austin sites, the study found no statistically significant impacts on students' sexual risk behaviors. None of the three studies examined the impacts of *Reducing the Risk* in a predominately rural setting.

Evaluating an adapted *Reducing the Risk* in Kentucky

For this study, Mathematica collaborated with staff from the Kentucky Department of Public Health and two local health departments—the Barren River District Health Department and the Lincoln Trail District Health Department—to conduct a rigorous random assignment evaluation of an adapted version of *Reducing the Risk* in Kentucky high schools. Study team members invited 15 high schools in the Barren River and Lincoln Trail health districts to participate. The schools are located in a relatively low-income, mostly rural area of central and southwestern Kentucky (Figure 1). Of the 15 schools, 13 agreed to participate. Three of the 13 schools are located in or close to the city of Bowling Green, which had a population of about 60,000 at the time of the study. The 10 other schools are located in or near smaller towns. At the time of the study, the average poverty rate of counties surrounding the schools was 17.8 percent, above the average national rate of 14.8 percent (U.S. Census Bureau 2014).

Figure 1. Map of service area included in the study



As described in an earlier process study report (Shapiro and Wood 2015), staff from the two local health districts adapted the curriculum to local circumstance. To fit within the time allotted by area schools for delivering the curriculum, staff shortened the original 12-hour curriculum to 8 one-hour sessions. The eight sessions covered all the main topics covered in the standard curriculum, including abstinence, contraception, and developing skills to avoid risky situations. As in the standard curriculum, each session of the adapted curriculum included a mix of lectures and more interactive activities. Staff shortened the curriculum by cutting back on repetition and reducing the number of role-plays. In addition to shortening the curriculum, staff tailored some content of the curriculum sessions to better fit the rural setting. For example, because of the long distances and limited transportation options available in the largely rural region, staff described during regular class time the services available at local health clinics, instead of visiting a health clinic, as the standard curriculum recommended. Staff from the two local health districts made these adaptations on their own, without direct consultation with the curriculum distributor, ETR Associates.

Available data on the study schools and students confirm the picture of a relatively low-income, mostly rural population. In the study schools, about half of the students were eligible for free or reduced-price lunch, compared with a national average of 40 percent of youth in secondary schools (National Center for Education Statistics School Locator n.d.). According to

survey data collected for the study (Table 2), 46 percent of students reported living with both their biological parents, compared with 66 percent among all children ages 12 to 17 nationally (U.S. Census Bureau 2014).

Table 2. Student characteristics at baseline

Measure	Percentage
Demographics	
Age	
14 or younger	67
15	27
16 or older	6
Race/ethnicity	
White, non-Hispanic	73
African American, non-Hispanic	13
Hispanic	7
Other	7
Female	50
Education	
Grade at study enrollment	
9	82
10	15
11 or 12	3
Family relationships[a]	
Lives with biological mother	83
Lives with biological father	53
Lives with biological mother and father	46
Biological parents are married	43
Information and knowledge	
Attended a class in the prior year on:	
Sexually transmitted infections (STIs)	33
Abstinence	24
Relationships, dating, or marriage	17
Methods of birth control	16
Where to get birth control	9
Correctly answered knowledge question on:	
Condoms and risk of pregnancy	51
Condoms and risk of getting HIV	37
Birth control pills and risk of pregnancy	44
Birth control pills and risk of getting HIV	37

Measure	Percentage
Romantic relationships and risk behaviors	
Currently in a dating relationship	37
Ever had sexual intercourse	16
Had sexual intercourse in the past 3 months	11
Had sexual intercourse without a condom in the past 3 months	6
Smoked in past 30 days	16
Drank alcohol in past 30 days	22
Used marijuana in past 30 days	12
Sample size	**2,190**

Source: Baseline survey conducted by Mathematica Policy Research.

Note: The reported sample size reflects the number of students who completed a baseline survey. Another 32 students did not complete a baseline survey but were retained in the study and eligible for follow-up survey data collection.

[a] Percentages for these categories do not sum to 100 because the categories are not mutually exclusive.

The study students reported limited exposure to abstinence and contraceptive education at baseline. At study enrollment, one in three students reported having had a class on STIs in the past 12 months, and one in four students reported having had a class on abstinence (Table 2). Fewer students reported having had a class on relationships, dating, or marriage (17 percent); methods of birth control (16 percent); or where to get birth control (9 percent). When asked a series of four knowledge questions about the effectiveness of condoms and birth control pills in reducing the risk of pregnancy and HIV, about one third to one half of the students answered each question correctly.

Students reported rates of recent sexual activity and other risk behaviors in line with state averages for Kentucky. For example, 11 percent of students reported having had sexual intercourse in the past three months, compared with the 2013 state average for Kentucky 9th graders of 13 percent (Centers for Disease Control and Prevention 2016). The 2013 national average for 9th graders was 19 percent (Centers for Disease Control and Prevention 2016). Similarly, 12 percent of students reported having used marijuana in the past 30 days, compared with the state average for Kentucky 9th graders of 11 percent (Centers for Disease Control and Prevention 2016). Student-reported rates of recent alcohol and cigarette use were also similar to state averages.

Evaluation design

To test the effectiveness of the adapted version of *Reducing the Risk*, the study team used a random assignment evaluation design. Schools assigned to the treatment group offered the adapted version of *Reducing the Risk* as part of a mandatory health class for primarily 9th- and 10th-grade students. Schools assigned to the control group offered the school's standard health curriculum. Students in both groups completed a baseline survey upon enrolling in the study and follow-up surveys one and two years later. Because the schools were assigned to groups at random, any difference in outcomes between students in the two research groups represents an unbiased estimate of the program's impact on students' outcomes.

To improve the study's ability to detect impacts of the program, the study team randomly assigned the 13 participating schools twice, at the beginning of each of two consecutive academic years. The first round of random assignment occurred in summer 2013 to determine the schools that would offer *Reducing the Risk* in the 2013–2014 academic year. A second round of random assignment occurred in summer 2014 to determine the schools that would offer *Reducing the Risk* in the 2014–2015 academic year. Having two rounds of random assignment increased the number of randomized groups from 13 to 26. The larger number of randomized groups improved the study's statistical power and shrunk the size of impact the study could detect, from the range of 8 to 9 percentage points to the range of 6 to 7 percentage points on binary outcomes (Wood et al. 2015). The appendix to this report provides additional detail on the random assignment procedures and evidence on the similarity of students across the two research groups.

In all study schools, students had to receive permission from a parent or legal guardian to partake in the study surveys. At the start of each academic year, the study team sought parental permission for all students who took their required health class in the fall semester. The team gathered parental permission by distributing forms in schools with the assistance of school administrators and staff. The permission-gathering process took place in the first few weeks of the school year, so that the study team could complete the baseline surveys before programing started in the *Reducing the Risk* schools. Among eligible students, 94 percent of parents returned a permission form and 75 percent of those who returned forms allowed their children to participate in the surveys. The permission process yielded a total study sample of 2,222 students.

Among the students who received parental permission, the study team administered the baseline surveys and most of the follow-up surveys in school during the regular school day. The team designed the surveys as self-administered paper-and-pencil questionnaires, which included a broad range of measures of family background, sociodemographic, and personal characteristics. For the follow-up surveys, the team administered a small proportion of surveys by telephone for students who had moved out of the area or were otherwise unavailable to complete the paper-and-pencil survey in school. The appendix to this report provides more detailed information on the survey administration procedures.

Survey response rates were similar across the treatment and control groups. For the treatment group, the response rate among students who received parental permission was 99 percent for the baseline survey, 89 percent for the one-year follow-up survey, and 81 percent for the two-year follow-up survey. For the control group, the response rate among students who received parental permission was 98 percent for the baseline survey, 91 percent for the one-year follow-up survey, and 85 percent for the two-year follow-up survey.

For the purpose of the analysis presented in this report, the study team used data from the two-year follow-up survey to measure program impacts on eight primary outcomes (Table 3). The team designated the two measures of sexual risk behavior as the study's confirmatory outcomes—meaning whether the program had an impact on these outcomes represents the study's central test of overall effectiveness. Both measures focus on students' sexual risk behavior in the three-month period immediately before the two-year follow-up survey. The measures use a three-month reference period to reduce the risk of recall bias that might result from asking students to report behaviors for a longer period. To help address the possibility of

program impacts occurring outside the three-month reference period, the appendix to this report presents findings for an alternative measure of whether the student had ever had sex. In addition, the earlier impact report (Goesling et al. 2017) presented evidence on the program's impact for a three-month period leading up to the one-year follow-up survey.

Table 3. Outcome measures

Domain and outcome	Definition
Sexual risk behavior	
Had sexual intercourse in the past 3 months[a]	Binary variable: equals 1 if student reported having had vaginal intercourse in the past 3 months; equals 0 if student reported not having had vaginal intercourse
Had sexual intercourse without a condom in the past 3 months[a]	Binary variable: equals 1 if student reported having had vaginal intercourse without a condom in the past 3 months; equals 0 if student reported not having had vaginal intercourse or always using a condom
Knowledge	
Knowledge of contraception and STIs	Continuous index variable: sum of correct responses to eight knowledge questions—for example, "If condoms are used correctly and consistently, how much can they decrease the risk of pregnancy?" and "Can a woman give HIV to a man if they are having sexual intercourse without a condom?"; questions were adapted from Goldstein et al. (2010) and Trenholm et al. (2007); values on the index range from 0 to 8, with higher values indicating a higher number of correct responses
Attitudes	
Support for abstinence	Continuous scale variable: average of responses to four survey questions; each question asked students to report their level of agreement with a statement such as "At your age right now, having sex would create problems" or "Having sex is a good thing for you to do at your age"; questions were adapted from the Evaluation of Adolescent Pregnancy Prevention Approaches (Smith et al. 2012); values on the scale range from 1 to 4, with higher values indicating greater support for abstinence
Support for condom use	Continuous scale variable: average of responses to two survey questions, which asked students to report their level of agreement with the following two statements: "Condoms should always be used if a person your age has sex" and "Condoms are important to make sex safer"; questions were adapted from the Evaluation of Adolescent Pregnancy Prevention Approaches (Smith et al. 2012); values on the scale range from 1 to 5, with higher values indicating greater support for condom use among sexually active youth
Refusal skills	
Perceived refusal skills	Continuous scale variable: average of responses to five survey questions; each question asked students to report their perceived ability to say no to having sex under a different hypothetical circumstance—for example, with someone who was pushing them to have sex or with someone who did not want to use a condom; questions were adapted from Cecil and Pinkerton (1998); values on the scale range from 1 to 4, with higher values indicating greater perceived refusal skills
Communication with parents	
Communication about romantic relationships or sex	Binary variable: equals 1 if student reported talking with parents about romantic relationship or dating, how to resist pressures to have sex, or whether the student should be having sex at this time in his or her life; equals 0 if student reported not talking about any of these topics
Intentions	
Intentions to have sexual intercourse in the next year	Binary variable: equals 1 if student reported he or she will "definitely" or "probably" have sexual intercourse in the next year; equals 0 if student reported he or she will "definitely not" or "probably not" have intercourse

[a] Designates a confirmatory outcome for the impact analysis.

To provide a comprehensive assessment of the program, the team also included outcomes measuring students' knowledge, attitudes, refusal skills, communication with parents, and intentions (Table 3). The study team selected these outcomes on the basis of the program's logic model and with the goal of testing the effectiveness of *Reducing the Risk* as a promising approach for teen pregnancy prevention among youth in rural areas. The same outcomes were included in the earlier one-year impact report (Goesling et al. 2017).

Most of the findings presented in this report focus on the program's impact for the overall sample rather than specific subgroups of students. By focusing on the overall sample, the study team made use of all available data and maximized the sample size for the analysis. Focusing on the overall sample also limited the number of statistical tests required for the analysis, an important issue for reducing the chances of detecting a false positive impact (Schochet 2009). However, as discussed earlier in the report, prior studies have found that the impacts of *Reducing the Risk* might vary for certain subgroups of students (Kirby et al. 1991; Zimmerman et al. 2008). As a result, the study team also estimated impacts for subgroups of students defined by gender, baseline sexual initiation status, and health district (Barren River versus Lincoln Trail). Before conducting the analysis, the study team established a set of reporting rules intended to reduce the chances of detecting a false positive impact from the subgroup analysis. For the two confirmatory measures of sexual risk behavior, the reporting rules dictated presenting subgroup findings in the appendix to the report unless the analysis uncovered a statistically significant difference in impacts across subgroups. As discussed in the results section below, the subgroup analysis for baseline sexual initiation status met this criterion. The results of this analysis are therefore presented in the main body of the report. All other subgroup findings are presented in the appendix.

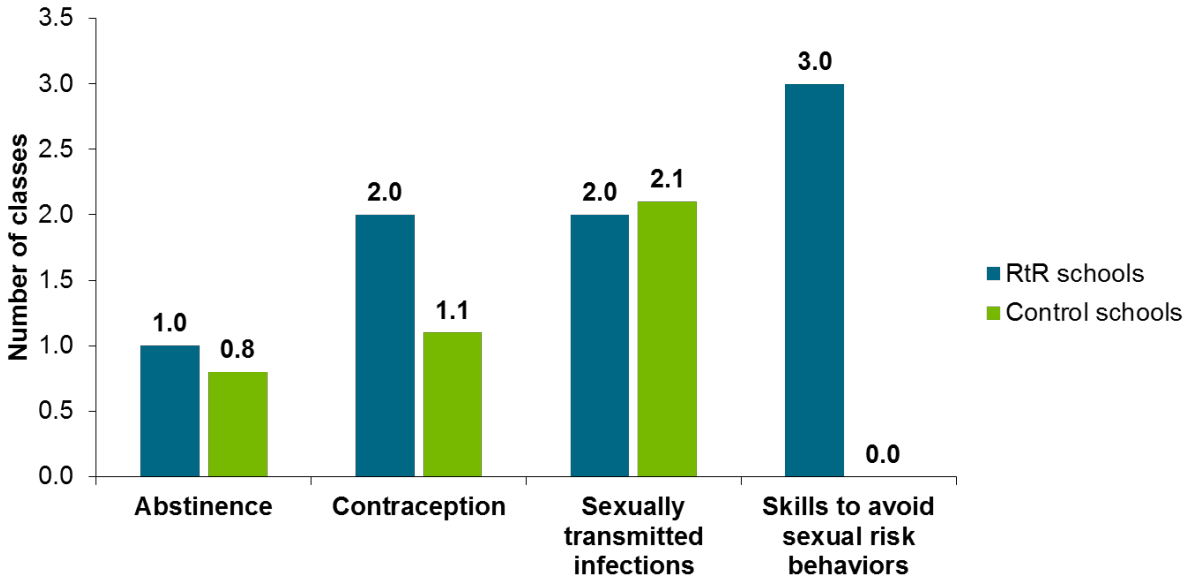
Program implementation and costs

In schools assigned to the treatment group, nine professional health educators from the two local health departments delivered the curriculum as part of a mandatory health class for primarily 9th- and 10th-grade students. The educators were required to have at least a bachelor's of science degree in health education and to participate in a training before implementing the curriculum. Depending on each school's schedule and the health classroom teacher's preference, the educators delivered the eight curriculum sessions either once a week for eight weeks, twice a week for four weeks, or on consecutive days within a two-week period. Staff from the local health departments periodically observed the health educators as they delivered the curriculum and provided feedback and support as needed.

The process study concluded that health educators generally implemented the adapted curriculum as intended (Shapiro and Wood 2015). During the study period, health educators covered more than 90 percent of their planned activities. As would be expected for a curriculum offered as part of regular school programming, attendance rates were high. Students in the study sample attended 93 percent of scheduled sessions. In student focus groups, students in the *Reducing the Risk* schools reported that they enjoyed and learned from the classes. They especially enjoyed the more interactive elements, such as role-plays and small-group discussions. During focus groups, students indicated that additional interactive elements would have kept them more engaged.

The process study confirmed that the adapted version of *Reducing the Risk* provided substantially more sex education content than the control schools offered through their standard health curricula (Figure 2). Although the Kentucky Department of Education mandates that middle and high schools teach sex education, it does not require a specific curriculum, and schools offer varying levels of pregnancy prevention programming to students. In most cases, study schools assigned to the control group did little more than meet the minimum state requirements. On average, the control schools offered four class periods of sex education, compared with the eight class periods offered in *Reducing the Risk* schools (Shapiro and Wood 2015). Most of the additional content received by *Reducing the Risk* students in study schools was instruction on skills for avoiding sexual risk behaviors. *Reducing the Risk* students received three sessions on this topic; control schools did not offer this instruction. In addition, students in the *Reducing the Risk* schools received two sessions on contraception, compared with an average of about one session in control schools. Students in both research groups received similar amounts of instruction on abstinence and STIs.

Figure 2. Average number of sex education classes offered at study schools



Source: Shapiro and Wood (2015).

RtR = *Reducing the Risk*.

The adapted version of *Reducing the Risk* cost relatively little to implement. On the basis of cost information collected from the local health departments, the study team estimated the cost of the program to the health departments as $113 per student. About two-thirds of that cost reflects labor expenses for the health educators and supervisory staff. Other costs included program supplies, office equipment, and shared administrative and indirect resources required to operate the local health departments. By comparison, a recent study of 26 federally funded organizations implementing nine evidence-based teen pregnancy prevention programs found an average cost per youth ranging from $68 to $11,541 (Zaveri et al. 2017). The median program cost was $927 per youth. All but one of the organizations had a higher average cost per youth than the estimate of $113 for *Reducing the Risk* in Kentucky. For teen pregnancy prevention programs, differences in cost are driven primarily by the dosage of programming offered and by the program setting

and other implementation characteristics. Whereas the adapted version of *Reducing the Risk* in Kentucky had eight one-hour sessions, other programs offer supplementary academic assistance, recreational and volunteer activities, and related support services that can increase the dosage of programming more than tenfold. Implementing a program in school as part of the regular curriculum can also drive down the per-participant cost, because the program can reach a large number of youth in a single setting without need for ongoing participant recruitment and retention activities. The appendix to this report provides additional detail on the study's cost estimates.

Program impacts after two years

Overall, the study found that the adapted version of *Reducing the Risk* in Kentucky led to a sustained increase in students' knowledge of contraception and STIs after two years, and that a longer-term impact on sexual risk behavior had emerged for one subgroup of students. Relative to the standard school curriculum, the program did not change the likelihood of having sex or having sex without a condom in the three months before the follow-up survey for the overall sample. The program did, however, reduce the likelihood of having sex without a condom in the three months before the survey for the smaller sample of students who were already sexually active. For the overall sample, the program increased students' knowledge of contraception and STIs. Relative to the standard school curriculum, the program did not change students' attitudes, refusal skills, communication with parents, or intentions.

Relative to the standard school curriculum, *Reducing the Risk* did not change the likelihood of having sex or having sex without a condom for the overall sample

Students in both the *Reducing the Risk* schools and control schools had a similar likelihood of having sex and having sex without a condom in the three months before the follow-up survey (Table 4). At the two-year follow-up, 33 percent of students in the *Reducing the Risk* schools and 30 percent of students in the control schools reported having had sex in the three months before the survey. Students in the two groups also had a similar likelihood of having sex without a condom, with 19 percent of students in the *Reducing the Risk* schools and 22 percent of students in the control schools reporting sex without a condom in the three months before the survey. These findings are similar to those from analysis of the one-year follow-up survey (Goesling et al. 2017).

Table 4. Impacts of *Reducing the Risk* on sexual risk behaviors

Measure	RtR youth	Control youth	Impact	Effect size
Had sexual intercourse in the past 3 months (%)	33	30	3	0.08
Had sexual intercourse without a condom in the past 3 months (%)	19	22	-3	-0.11
Sample size	**797**	**1,053**		

Source: Baseline and follow-up surveys conducted by Mathematica Policy Research.

Note: The numbers in the columns labeled "RtR youth" and "Control youth" are regression-adjusted predicted values.

**/*/+ Impact estimates are statistically significant at the .01/.05/.10 levels, respectively, two-tailed test.

RtR = Reducing the Risk.

For students who were already sexually active, the program reduced the likelihood of having sex without a condom

Subgroup findings showed that the program's impact varied by baseline sexual initiation status. For sexually experienced students, the program did not reduce the likelihood of having sex in the three months before the follow-up survey. However, students in the *Reducing the Risk* schools were less likely than students in the control group to report having had sex without a condom in the three months before the survey (42 versus 52 percent). The difference in rates was marginally statistically significant at the 10 percent level. The program's impact for this subgroup did not translate to a comparable impact for the overall sample because sexually experienced students accounted for a relatively small share (less than 20 percent) of the overall sample.

Relative to the standard school curriculum, the program did not change the likelihood of having sex or having sex without a condom for students who were sexually inexperienced at baseline. For this subgroup, students in both research groups were equally likely to report having had sex and having had sex without a condom in the three months before the follow-up survey. The appendix to this report provides more detailed information on these subgroup findings.

Reducing the Risk increased students' knowledge of contraception and STIs

At the two-year follow-up, students in the *Reducing the Risk* schools had better knowledge of contraception and STIs than did control group students (Table 5). Students in the *Reducing the Risk* schools answered an average of 5.6 of 8 knowledge questions correctly (or 70 percent), compared with an average of 5.2 correct responses (or 65 percent) for students in the control schools. This impact after two years was only slightly smaller than the impact found for the earlier one-year follow-up (Goesling et al. 2017). Looking at students' answers to each individual knowledge question (shown in the appendix), students in the *Reducing the Risk* schools were more likely to answer correctly on every question. The differences ranged from 2 to 12 percentage points and were statistically significant for half the questions.

Table 5. Impacts of *Reducing the Risk* on knowledge, attitudes, skills, communication, and intentions

Measure	RtR youth	Control youth	Impact	Effect size
Knowledge of contraception and STIs index (range: 0 to 8)	5.6	5.2	0.4**	0.20
Support for abstinence scale (range: 1 to 4)	2.8	2.8	0.0	0.01
Support for condom use scale (range: 1 to 5)	4.4	4.4	0.0	0.04
Perceived refusal skills scale (range: 1 to 4)	2.9	2.9	0.0	0.04
Talked with parents in the past three months about romantic relationships or sex (%)	72	72	-1	-0.02
Intends to have sexual intercourse in the next year (%)	57	54	3	0.08
Sample size	**797**	**1,053**		

Source: Baseline and follow-up surveys conducted by Mathematica Policy Research.

Note: The numbers in the columns labeled "RtR youth" and "Control youth" are regression-adjusted predicted values.

**/*/+ Impact estimates are statistically significant at the .01/.05/.10 levels, respectively, two-tailed test.

RtR = *Reducing the Risk.*

Relative to the standard school curriculum, *Reducing the Risk* did not change students' attitudes, refusal skills, communication with parents, or intentions to have sex

At the two-year follow-up, students in both research groups were equally likely to agree with statements indicating that people their age should not have sex (Table 5). The average score was 2.8 for both research groups on a four-point scale measuring support for abstinence. Similarly, students in both research groups were equally likely to agree with statements indicating that sexually active youth should use condoms. The average scale score was 4.4 for both research groups on the five-point scale measuring support for condom use. In contrast, *Reducing the Risk* had a small positive impact on this scale at the one-year follow-up (Goesling et al. 2017).

Similar to the one-year results, students in both research groups reported similar perceptions of their refusal skills. The average score was 2.9 for both groups on a four-point scale measuring students' perceived ability to say no to sex under different hypothetical circumstances. Similarly, students in the *Reducing the Risk* schools and control schools were equally likely to report having talked with their parents about romantic relationships or sex. About 7 in 10 students in both groups reported having had such conversations in the three months before the two-year follow-up survey. When asked if they intended to have sex in the next year if they had the chance, a similar percentage of students in both research groups said they definitely or probably would have sex.

Discussion

This study sought to evaluate one state's effort to design and implement a school-based teen pregnancy prevention program with funding through PREP. In designing the program, the Kentucky Department of Public Health selected *Reducing the Risk* in response to a perceived need for improved abstinence and contraceptive education among Kentucky high school students, particularly those living in relatively low-income, mostly rural areas of the state. At the time of study enrollment, fewer than one-quarter of students in the study sample reported having had a class on abstinence (24 percent) or methods of birth control (16 percent). The students also had limited knowledge of the effectiveness of common methods of protection in reducing the risk of pregnancy and STIs. State and local administrators saw *Reducing the Risk* as having the potential to address these needs by supplementing the existing school course offerings with an established, widely implemented abstinence and contraceptive education curriculum.

In evaluating the implementation and impacts of *Reducing the Risk* in Kentucky, the study also sought to address a gap in the broader research literature on teen pregnancy prevention programs. Available evidence suggests that rural youth face barriers that put them at heightened risk of teen pregnancy, such as lower rates of college enrollment, relatively high rates of family poverty, and less access to health services (Ng and Kaye 2015). Despite these risks, teen pregnancy prevention practitioners and researchers have developed and tested relatively few programs designed specifically for youth in rural areas (Goesling et al. 2014). By implementing *Reducing the Risk* with schools in rural Kentucky, staff from the Kentucky Department of Public Health created an opportunity to expand the available evidence on pregnancy prevention approaches for rural youth.

The study found that the program was well implemented. During the study period, health educators from two local Kentucky health departments successfully delivered the curriculum to

hundreds of high school students in their service regions (Shapiro and Wood 2015). To fit within the time allotted by area schools for delivering the curriculum, the educators shortened the original 12-hour curriculum to 8 hours, while retaining coverage of all the topics in the original curriculum. In delivering the adapted 8-hour curriculum, the health educators covered more than 90 percent of their planned activities. Students in the study sample attended 93 percent of scheduled sessions. According to classroom observations and focus group reports, students were receptive to the curriculum material, especially the activities with interactive components.

Relative to the standard school curriculum, the adapted version of *Reducing the Risk* did not change the likelihood of having sex or having sex without a condom in the past three months for the overall sample. At the two-year follow-up, students in both the *Reducing the Risk* schools and control schools were similarly likely to report having had sex in the three months before the survey. In addition, students in both research groups were similarly likely to report having had sex without a condom. The lack of behavioral impacts for the overall sample is not unique to the rural setting or the adapted version of the curriculum, as earlier studies of *Reducing the Risk* reported similar findings for schools in non-rural areas and the standard version of the curriculum (Kirby et al. 1991; Kelsey et al. 2016; Zimmerman et al. 2008). Even so, given that one motivation for this study was to identify programs effective in addressing the risk of teen pregnancy in rural areas, the lack of behavioral impacts for the overall sample is an important limitation.

The program did, however, reduce the likelihood of having sex without a condom for the smaller sample of youth who were already sexually active. For these students, the program reduced the likelihood of having sex without a condom in the three months before the follow-up survey by 10 percentage points, a difference that was marginally statistically significant. The study found no comparable effect for sexually inexperienced students, who made up the majority of the study sample.

There are several possible explanations for this pattern of results. One possibility is that because the decision to have sex represents a major behavioral change, it may be harder to influence this behavior than the prevalence of condom use. In addition, when interviewed for the earlier process study report, a few of the health educators questioned whether all students were mature enough to take the program material seriously, particularly the situations depicted in the interactive role-plays (Shapiro and Wood 2015). The educators commented that some students did not seem to take the time to think through how they would actually respond to a situation, such as being alone with another person who wants to have sex, and as a result would provide unrealistic responses. The health educators suggested that, in acting out the role-plays, some students were not yet ready to "put themselves in that situation." If the program activities had greater meaning for the students who were already sexually active, this difference could potentially explain why the program had a greater impact for these students.

For the overall sample, the program increased students' knowledge of contraception and STIs. In particular, the study found that students in the *Reducing the Risk* schools scored higher on an eight-item knowledge test on contraception and STIs at the two-year follow-up. The impact after two years was only slightly smaller than the impact found for the earlier one-year follow-up (Goesling et al. 2017). This impact on students' knowledge is notable in part because earlier studies of *Reducing the Risk* found a similar impact for the standard 12-hour version of

the curriculum (Kirby et al. 1991; Zimmerman et al. 2008; Kelsey et al. 2016). The similarity of findings across studies suggests that shortening the curriculum from 12 to 8 hours in Kentucky did not diminish what students learned. The program's impact on knowledge is also notable because more than half the study students were not yet sexually active when the study ended. If these students use their increased knowledge to inform their future decisions, the program could have a longer-term impact on students' sexual risk behavior not reflected in the two-year follow-up data.

These impacts of the adapted version of *Reducing in the Risk* in Kentucky are commensurate with the time and resources required to implement the program. The study team calculated the cost to the local health departments as $113 per student, an amount on the lower end of the range for federally funded teen pregnancy prevention programs (Zaveri et al. 2017). For the study schools, the program required eight hours of instructional time, equivalent to about one school day or less than one percent of a full academic year. Available evidence suggests that to achieve larger, more widespread impacts on teen pregnancy and associated sexual risk behaviors, programs must offer a more substantial dosage of programming (for example, Allen et al. 1997; Walsh-Buhi et al. 2016) or target specialized populations of higher-risk youth outside of regular school settings (for example, Covington et al. 2016; DiClemente et al. 2004; Philliber et al. 2002; Stevens et al. 2017). For rural schools that do not have the time or resources to invest in substantially more intensive or costly programs, *Reducing the Risk* could represent an acceptable balance of expected impacts, feasibility, and cost.

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TECHNICAL APPENDIX

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This appendix is a technical supplement to the longer-term impact report of the implementation of an adapted version of *Reducing the Risk* in Kentucky, conducted as part of the Personal Responsibility Education Program (PREP) Multi-Component Evaluation. The appendix provides additional detail on the evaluation's design, methods, and findings. The first section of the appendix describes the methods used to randomly assign schools to the treatment and control groups. The second section describes the methods used to estimate the operational costs of the program. The third section describes the survey administration procedures and consent and response rates. The fourth and fifth sections of the appendix describe the outcome measures and analytic methods, respectively. The sixth section presents impact findings for key subgroups, and the last section shows findings for a select number of secondary outcomes.

Random assignment

For the evaluation of *Reducing the Risk*, the study team used a school-level random assignment design. Schools assigned to the treatment group offered the adapted version of *Reducing the Risk* to eligible students. Schools assigned to the control group offered their standard health curriculum to students. Researchers describe this type of school-level random assignment as a cluster or group randomized trial (Donner and Klar 2000; Hayes and Moulton 2009) because it involves randomly assigning all students in the same school to the same research group (treatment or control) rather than randomly assigning each individual student.

The study team used schools, not individual students, as the unit of random assignment because staff at the Kentucky Department of Public Health and local health departments intended for the program to be implemented at the school level in the required health classes. The study team did not have the option to randomly assign individual students to different class schedules or to exclude members of the control group from the required health classes. Rather, the team assigned all students in the same school to the same research group.

As discussed earlier in this report, the study team randomly assigned the 13 participating schools twice, at the beginning of each of the two academic years when the local health departments offered the programming as part of the evaluation. The first round of random assignment took place in summer 2013 to determine the schools that would offer *Reducing the Risk* for the 2013–2014 academic year. The second round of random assignment took place in summer 2014 to determine the schools that would offer *Reducing the Risk* during the 2014–2015 academic year. As a result of the two rounds of random assignment, three schools were assigned to the treatment group in both academic years, another three schools were assigned to the control group in both years, and seven schools were randomly assigned once to the treatment group and once to the control group (Table A.1).

For the seven schools randomly assigned once to each group, having both treatment group and control group students in the same school presented some risk of contamination or spillover effects. Such effects could arise, for example, through interactions between students in the treatment and control groups outside of their regular school classes, or if students in schools assigned to the control group during one academic year received exposure to the program during the other academic year. To help mitigate this risk, students in the control group were not offered the program in the year their school was instead assigned to the treatment group. For example, in the four schools assigned to the control group for the 2013–2014 academic year and the

Table A.1. *Reducing the Risk* schedule and control condition at study schools

School	Health district	Frequency of *Reducing the Risk*	Average *Reducing the Risk* class length	Control condition
Treatment schools in 2013 and 2014				
School A	Barren River	Two times per week for four weeks	55 minutes	n.a.
School B	Barren River	One time per week for eight weeks	57 minutes	n.a.
School C	Lincoln Trail	Eight consecutive days	55 minutes	n.a.
Treatment schools in 2013; control schools in 2014				
School D	Barren River	One time per week for eight weeks	55 minutes	No sex education offered
School E	Lincoln Trail	Eight consecutive days	55 minutes	Health educator provides two classes on contraception and STIs
School F	Lincoln Trail	Eight consecutive days	72 minutes	Health educator provides two classes on birth control methods and STIs
Control schools in 2013; treatment schools in 2014				
School G	Barren River	Five days over two weeks	74 minutes	Health educator provides two classes on contraception and STIs
School H	Barren River	Two times per week for four weeks	55 minutes	Health educator provides two classes on contraception and STIs
School I	Lincoln Trail	Eight consecutive days	72 minutes	Health educator provides two classes on contraception and STIs
School J	Lincoln Trail	Eight consecutive days	50 minutes	Health educator provides two classes on contraception and STIs
Control schools in 2013 and 2014				
School K	Barren River	n.a.	n.a.	Health teacher provides one or two classes on abstinence and two or three classes on STIs; no coverage of contraception
School L	Barren River	n.a.	n.a.	Health teacher provides two classes on abstinence and contraception and five classes on STIs
School M	Lincoln Trail	n.a.	n.a.	Health teacher provides three classes on abstinence, three classes on contraception, and three classes on STIs

Source: Shapiro and Wood (2015).

n.a. = not applicable; STI = sexually transmitted infection.

treatment group for the 2014–2015 academic year, students in the control group classes for the 2013–2014 academic year were not offered the program during the 2014–2015 academic year. As a result, there was relatively little chance of students in the control group having any direct exposure to the program. In addition, the study team considered the possibility of contamination or spillover effects when the team initially determined the study's sample size requirements. The risk of spillover or contamination effects resulted primarily from the team's decision to conduct two rounds of random assignment. The team determined that the precision gained from the second round of random assignment (about two percentage points) more than offset the precision lost from risk the risk of contamination or spillover effects (less than one percentage point). The

similarity of the study findings to earlier studies of *Reducing the Risk* also suggests that spillovers between the two research groups do not drive the results.

To further improve the precision of the study's impact estimates and to avoid a chance imbalance in student characteristics between the treatment and control groups, the study team stratified the 13 participating schools into four separate blocks before each round of random assignment (Imbens 2011). To create the four blocks, the team first stratified schools by local health department, separating the seven schools in the Barren River District from the six schools in the Lincoln Trail District. Within each health district, the team further stratified schools into separate blocks based on school district. Each health district had one larger school district with multiple high schools and additional smaller school districts with single high schools. The study team used the two larger school districts as two of the four random assignment blocks, and grouped the smaller school districts within each health district to form the other two blocks. This stratification process resulted in one block of two schools in the Lincoln Trail District, one block of three schools in the Barren River District, and one block of four schools in both health districts. For the blocks with an even number of schools, the study team randomly assigned half the schools to the treatment group and half to the control group. For the block of three schools in the Barren River District, the team randomly assigned one school to the treatment group during the first round of random assignment before the 2013–2014 academic year and two schools to the treatment group during the second round of random assignment before the 2014–2015 academic year.

In schools assigned to the treatment group, staff from the local health departments worked with school staff to develop a specific schedule to deliver the curriculum (Table A.1). In some schools, health educators delivered the curriculum over eight consecutive school days. In other schools, health educators spread out the curriculum over a longer period. The length of the average class period also varied across schools, from about 50 minutes to more than 70 minutes. Regardless of the specific schedule, all treatment schools offered the full set of eight sessions defined in the adapted version of the curriculum. As a token of appreciation for participating in the study, the study team provided schools a payment of $1,000 for each year they were assigned to the treatment group.

In schools assigned to the control group, students received varying amounts and types of sex education as part of the school's standard health curriculum (Table A.1). In the most common scenario, students received two classes on sexually transmitted infections (STIs) and contraception from a health educator as part of their required health class. One school reported offering no sex education to students. Three schools provided five or more classes. On average, the control schools offered four class periods of sex education, compared with the eight class periods offered in the *Reducing the Risk* schools. As a token of appreciation for participating in the study, the study team provided schools a payment of $5,000 for each year they were assigned to the control group.

Data from the baseline student survey show that the random assignment process yielded groups of students that were generally similar at baseline (Table A.2). The groups were similar on the demographic characteristics of race/ethnicity and gender. Students in the *Reducing the Risk* schools were somewhat older than students in the control schools, but the difference between groups was not statistically significant. Most of the students in both groups of schools were 9th graders at the time of study enrollment. The groups had similar levels of prior exposure

Table A.2. Characteristics for the full student sample at baseline

Measure	RtR youth	Control youth	Difference
Demographics			
Age (%)			
14 or younger	64	69	-5
15	29	25	4
16 or older	7	6	2
Race/ethnicity (%)			
White, non-Hispanic	74	72	2
African American, non-Hispanic	12	13	-2
Hispanic	7	8	-1
Other	7	7	0
Female (%)	51	50	1
Education			
Grade at study enrollment (%)			
9	77	83	-6
10	17	13	4
11 or 12	4	2	2
Exposure to information			
Attended classes or sessions in the prior year on (%):			
Relationships, dating, or marriage	15	19	-4
Abstinence	24	24	0
Methods of birth control	16	15	0
Where to get birth control	9	9	0
Sexually transmitted infections (STIs)	34	33	1
Received information in the prior year from a doctor, nurse, or clinic on (%):			
Methods of birth control	15	15	0
Where to get birth control	11	12	-1
STIs	16	16	-1
Knowledge, attitudes, skills, communication, and intentions			
Knowledge of contraception and STIs index (range: 0 to 4)	2.28	2.19	0.09
Support for abstinence scale (range: 1 to 4)	3.11	3.08	0.03
Support for condom use scale (range: 1 to 5)	4.44	4.41	0.02
Perceived refusal skills scale (range: 1 to 4)	2.85	2.78	0.07
Talked with parents in the past three months about romantic relationships and sex (%)	72	70	2
Intends to have sexual intercourse in the next year (%)	30	31	-1
Sexual risk behaviors			
Had sexual intercourse in the past three months (%)	9	12	-3+
Had sexual intercourse without a condom in the past three months (%)	5	7	-2+
Sample size	**971**	**1,219**	

Source: Baseline and follow-up surveys conducted by Mathematica Policy Research.

Note: The reported sample size reflects the number of students who completed a baseline survey. Another 32 students did not complete a baseline survey but were retained in the study and eligible for follow-up survey data collection.

RtR = Reducing the Risk.

**/*/+ Differences are statistically significant at the .01/.05/.10 levels, respectively, two-tailed test.

to information on birth control and other reproductive health topics. Students in the *Reducing the Risk* schools had somewhat lower rates of recent sexual activity and unprotected sex. The difference between groups was statistically significant at the 10-percent level. As discussed in greater detail below, the study team adjusted for any marginal differences between groups in the regression models used to estimate program impacts. The groups had similar baseline values on all of the other outcome measures examined in this report.

Program cost estimates

To provide additional context on the implementation of the adapted version of *Reducing the Risk* in Kentucky, the study team estimated total annual program cost and per-participant cost for the Barren River and Lincoln Trail districts. The team calculated these estimates both separately for each district and combined across districts. The resulting cost estimate combined across districts is presented in the main body of this report.

The study team estimated the program costs using the "ingredients" or resource cost method (Levin and McEwan 2001), a common standard in the field. The first step of this method involves identifying all of the resources required to deliver the program. In Kentucky, these resources included the health educators who delivered the program, administrative staff who provided oversight, program supplies, office equipment, and other shared administrative and indirect resources required to operate the local health departments and their programs. The study team collected information on required resources from local health department staff. The second step of the resource cost method involves assigning a dollar value to each resource identified, either directly from accounting records or by estimating the value using market prices or "shadow" prices (for resources for which there is no available market price). For this step, the study team relied primarily on the local health department's accounting records, with a few exceptions noted later in this section of the report.

The study team estimated the costs for the 2013–2014 academic year, a period of regular or "steady state" operations for the local health departments. Although the 2013–2014 academic year was the first year of sample enrollment for the evaluation, both the Barren River and Lincoln Trail health districts had a history of implementing *Reducing the Risk* in local school districts. As a result, the resources the health districts required for implementing the program during the 2013–2014 academic year excluded common start-up activities such as hiring and training new staff. The cost estimates presented in this report thus represent the cost of steady state operations, not the cost of launching a new program or delivering *Reducing the Risk* for the first time.

The study team estimated both (1) total annual program cost for the 2013–2014 academic year and (2) the average cost to serve one participant (also known as the per-participant cost). The team calculated the per-participant cost by dividing total annual program cost by the total number of students who attended at least one program session during the 2013–2014 academic year. The total annual program cost estimates included the resources health districts used to provide services to all youth during the school year, so the study team obtained the number of students attending at least one session from the PREP performance measures data for the 2013–2014 reporting period. This number is greater than the number of students who participated in

the evaluation, because not all students offered the program were asked or agreed to participate in the evaluation.

A cost analysis can describe program costs from different perspectives (Levin and McEwan 2001). From the perspective of the Barren River and Lincoln Trail health districts, resources like the physical classroom space and the time schoolteachers spend sitting in on the *Reducing the Risk* sessions were not considered costs to their agencies, because the schools provided these resources free of charge. However, when considering program costs from a broader societal perspective, classroom space and teacher time are included in program cost, because they reflect public resources that could instead be used for other purposes. In this way, the choice of perspective in a cost analysis can influence both the list of resources included in the analysis and interpretation of the resulting estimates.

As presented in the main body of this report, the study team estimated the per-participant cost to the local health districts as $113 per student (Table A.3). This estimate represents a weighted average of the separate per-participant costs for the Barren River district ($123) and Lincoln Trail district ($104), with weights proportionate to the number of students served. The Barren River district had a slightly higher program cost because the agency's health promotion director spent a relatively larger proportion of time on the program supporting the health educators.

For comparison purposes, the study team also estimated costs from the societal perspective (Table A.3). These estimates start with the costs to the local health departments and then add the value of two additional resources: (1) the physical classroom space used for delivering the *Reducing the Risk* sessions and (2) the time required for regular classroom teachers to sit in during the *Reducing the Risk* sessions. For Barren River, the societal perspective increases the estimated per-participant cost by 31 percent, from $123 to $161 per student. For Lincoln Trail, the societal perspective increases the estimated per-participant cost by 35 percent, from $104 to $140 per student.

Table A.3. Program cost estimates

Health district	Total annual cost	Number of students	Cost per student
Cost to the health districts			
Barren River	$68,887	560	$123
Lincoln Trail	$59,248	571	$104
Total	$128,135	1,131	$113
Costs to society			
Barren River	$89,977	560	$161
Lincoln Trail	$79,658	571	$140
Total	$169,635	1,131	$150

Source: Cost data collected by Mathematica Policy Research from the Barren River and Lincoln Trail health districts.

For all of these cost estimates, the study team relied primarily on the local health departments' accounting records to value the resources, with four exceptions. First, to account

for local prices or cost of living in Kentucky, the study team used a wage index to adjust the reported value of personnel resources (staff salaries, payroll taxes, and benefits) as reported by the local health departments. The team created the index using state-level and national wages for community and social service occupations as reported for May 2014 by the Bureau of Labor Statistics. Second, to value physical classroom space, the study team identified market rates to rent comparable spaces, such as meeting rooms in community centers. The team used a resulting market estimate of $42 per hour. Third, to value the time the schoolteachers spent in the classroom, the study team multiplied the number of implementation hours in each health district during the 2013–2014 academic year by the national average contractual wage rate for secondary schoolteachers from the Bureau of Labor Statistics ($43.04 per hour). Fourth, for equipment resources, the team calculated an annual value by dividing the value of the original purchase price of the equipment (as estimated by the local health departments) by the equipment's estimated useful life.

Survey administration

For the impact study, students had to receive permission from a parent or guardian to participate in the study surveys. To facilitate the permission process, the study team worked with school and health district staff at the beginning of the school year to identify a list of eligible classrooms and students. The schools then distributed to eligible students written permission forms developed by the study team. These permission forms did not identify a school's treatment status and were distributed before any students or parents were made aware of the random assignment results. The study team offered each student a $5 gift card for returning a signed permission form, regardless of whether the student's parent or guardian had given permission. In addition, each participating classroom received a $50 gift card from the study team if at least 90 percent of the students in the classroom returned a permission form. Some schools also offered non-monetary incentives, such as a free gym period, for returning the permission form. For students who did not return their permission forms, some schools allowed members of the study team to call the students' parents or guardians from the school offices to request permission by phone. During these phone calls, a member of the study team read the permission form aloud over the phone and then marked a response on a printed copy of the form on behalf of the parent or guardian. Permissions received in this manner required a third-party witness from the study team to observe the phone conversation and initial the completed permission form. The New England Institutional Review Board approved all of the study's consent and data collection procedures.

For those students who received permission from a parent or guardian, the study team administered surveys at three time points: (1) baseline, before the start of the program, (2) one year later, about 12 months after the start of the program, and (3) two years later, about 24 months after the start of the program. The study team designed the surveys as paper-and-pencil questionnaires that the team administered during the regular school day. For the two-year follow-up survey, the study team also completed about 12 percent of surveys by telephone for students who had moved out of the area or were otherwise unavailable to complete the paper-and-pencil survey in school. All consented students were eligible to complete the one-year and two-year follow-up surveys regardless of whether they completed a baseline survey. The study team also requested assent from the eligible students themselves before each round of surveys.

The study team designed the surveys to capture a broad range of demographic and personal characteristics, including students' exposure to information on reproductive health topics, knowledge of contraception and STIs, views and attitudes toward sexual activity, and involvement in sexual activity and other risk behaviors. To avoid asking youth who were not yet sexually active potentially sensitive questions about contraceptive use and other sexual risk behaviors, the study team designed the survey to have three separate parts. All students completed Part A of the survey, which asked general questions about demographics, family background, views, attitudes, and knowledge. At the end of Part A, the survey asked students a single yes/no screening question about whether they had ever had sexual intercourse or oral sex. For students who answered yes to the screening question, the survey directed them to complete Part B1 of the survey, which contained more detailed questions about sexual activity, contraceptive use, and other risk behaviors. For students who answered no to the screening question, the survey directed them to instead complete Part B2 of the survey, which included an alternative set of questions. The study team formatted Parts B1 and B2 of the survey to look indistinguishable, so that when administering the survey in a group setting, students could not tell which part of the survey other students were completing. Parts B1 and B2 also began by repeating the screening question from the end of Part A, to confirm students were completing the correct section of the questionnaire. For all three parts of the survey, the study team drew most of the questions from established surveys such as the National Longitudinal Study of Adolescent Health, the National Survey of Family Growth, and the Youth Risk Behavior Survey.

Table A.4. Consent and survey response rates

	RtR youth	Control youth	All youth
Number of students:			
Eligible for study	1,333	1,808	3,141
Returned consent form	1,251	1,695	2,946
Received consent	983	1,239	2,222
Completed baseline survey	971	1,219	2,190
Completed one-year follow-up survey	870	1,133	2,003
Completed two-year follow-up survey	797	1,053	1,850
Consent rate (%):			
Returned consent form	94	94	94
Received consent:			
All eligible students	74	69	71
Students who returned consent form	79	73	75
Baseline survey response rate (%):			
All eligible students	73	67	70
Consented students	99	98	99
One-year follow-up survey response rate (%):			
All eligible students	65	63	64
Consented students	89	91	90
Two-year follow-up survey response rate (%):			
All eligible students	60	58	59
Consented students	81	85	83

Source: Baseline and follow-up surveys administered by Mathematica Policy Research.

RtR = *Reducing the Risk*.

These survey procedures yielded generally high consent and survey response rates (Table A.4). Of the 3,141 students eligible for the study, 2,946 students (94 percent) returned a

permission form and 2,222 students (71 percent) received permission to participate. The consent rate was marginally higher for the *Reducing the Risk* schools than for schools in the control group (74 versus 69 percent). A prior review article on school-based evaluations of adolescent risk behaviors found that studies requiring active parental consent often achieve consent rates in the range of 30 to 60 percent (Tigges 2003). The observed consent rate of 71 percent for Kentucky exceeded this expected range.

As described in greater detail later in this appendix, the study team based the impact estimates in this report on data for the 1,850 students who completed the two-year follow-up survey. This sample represents 83 percent of the 2,222 students who received permission to participate in the study and 59 percent of the larger group of 3,141 eligible students (Table A.4). Among the sample of consent students, the survey response rate at the two-year follow-up was marginally lower for students in the *Reducing the Risk* schools (81 percent) than for students in the control schools (85 percent). Among the larger group of all eligible students, the two-year follow-up survey response rate was similar across the two research groups (60 percent and 58 percent, respectively).

Nonresponse to the two-year follow-up survey had little material effect on the similarity of students in the treatment and control groups (Table A.5). When examining baseline demographic and personal characteristics for only those students who completed a two-year follow-up survey, the study team found that students in the *Reducing the Risk* schools and control group schools were similar on age, race/ethnicity, and gender. The groups were also similar on grade level, prior exposure to information on reproductive health topics, and baseline values for most of the outcome measures featured in this report. Students in the *Reducing the Risk* schools were less likely than students in the control group schools to report having had sex in the past three months (5 versus 9 percent) and to report having had sex without a condom in the past three months (3 versus 5 percent). However, these differences were similar in magnitude to the differences observed for the full student sample (see Table A.2). To adjust for any marginal differences between the research groups, the study team controlled for age, gender, race/ethnicity, and baseline sexual initiation status in the regression models used to estimate program impacts, as described in greater detail below.

Table A.5. Baseline characteristics for the analytic sample

Measure	RtR youth	Control youth	Difference
Demographics			
Age (%)			
14 or younger	68	73	-5
15	28	24	5
16 or older	4	3	0
Race/ethnicity (%)			
White, non-Hispanic	75	74	1
African American, non-Hispanic	11	13	-1
Hispanic	7	8	-1
Other	8	6	1
Female (%)	51	50	1

Measure	RtR youth	Control youth	Difference
Education			
Grade at study enrollment (%)			
9	80	86	-5
10	16	12	4
11 or 12	2	1	1
Exposure to information			
Number of classes or sessions attended in the past year on (%):			
Relationships, dating, or marriage	15	18	-4
Abstinence	23	24	-1
Methods of birth control	15	14	1
Where to get birth control	8	7	1
Sexually transmitted infections (STIs)	34	32	2
Received information in the past year from a doctor, nurse, or clinic on (%):			
Methods of birth control	13	13	0
Where to get birth control	11	10	0
STIs	14	15	-1
Knowledge, attitudes, skills, communication, and intentions			
Knowledge of contraception and STIs index (range: 0 to 4)	2.25	2.17	0.07
Support for abstinence scale (range: 1 to 4)	3.18	3.12	0.05
Support for condom use scale (range: 1 to 5)	4.46	4.41	0.04
Perceived refusal skills scale (range: 1 to 4)	2.89	2.80	0.09
Talked with parents in the past three months about romantic relationships and sex (%)	73	70	3
Intends to have sexual intercourse in the next year (%)	25	28	-3
Sexual risk behaviors			
Had sexual intercourse in the past three months (%)	5	9	-4**
Had sexual intercourse without a condom in the past three months (%)	3	5	-2*
Sample size	**797**	**1,053**	

Source: Baseline surveys conducted by Mathematica Policy Research.

**/*/+ Differences are statistically significant at the .01/.05/.10 levels, respectively, two-tailed test.

RtR = *Reducing the Risk*.

Outcome measures

To assess the impact of the adapted version of *Reducing the Risk* in Kentucky, the study team measured students' outcomes in five domains: (1) knowledge, (2) attitudes, (3) refusal skills, (4) communication with parents, (5) intentions, and (6) sexual risk behavior. As discussed earlier in the report, the study team designated the measures of sexual risk behavior to serve as confirmatory outcomes—meaning that whether the program has impacts on these outcomes represents the study's central test of overall effectiveness. The other domains align with those included in the early impact report (Goesling et al. 2017). This section of the appendix outlines the construction of specific outcome measures within each domain.

1. Knowledge

The study team created a summary measure of students' knowledge of contraception and STIs from the following series of eight questions included on the survey:

- If condoms are used correctly and consistently, how much can they decrease the risk of pregnancy? Not at all, a little, a lot, completely, or don't know.
- If condoms are used correctly and consistently, how much can they decrease the risk of getting HIV, the virus that causes AIDS? Not at all, a little, a lot, completely, or don't know.
- If birth control pills are used correctly and consistently, how much can they decrease the risk of pregnancy? Not at all, a little, a lot, completely, or don't know.
- If birth control pills are used correctly and consistently, how much can they decrease the risk of getting HIV, the virus that causes AIDS? Not at all, a little, a lot, completely, or don't know.
- Can you get a sexually transmitted disease, also known as an STD or STI, from having oral sex? Yes or no.
- Can a woman give HIV to a man if they are having sexual intercourse without a condom? Yes or no.
- Can a person who has sexual intercourse only with people he or she knows well ever get HIV? Yes or no.
- Which of the following methods offers the most protection against HIV, the virus that causes AIDS, and other sexually transmitted diseases, also known as STDs or STIs? Birth control pills, the shot (Depo-Provera), condoms, the patch, or don't know.

The questions were adapted from prior studies of adolescents (Goldstein et al. 2010; Trenholm et al. 2007). For each question, the study team coded each student as having provided either a correct or an incorrect response. The study team considered skipped questions incorrect responses. The team then totaled the number of correct responses across the eight questions to create an eight-item knowledge test of contraception and STIs. Possible scores on the measure ranged from 0 to 8, with higher values indicating a greater number of correct responses.

2. Attitudes

The study team constructed two summary measures of students' attitudes: one measuring support for abstinence and one measuring support for condom use among sexually active youth. For the measure of support for abstinence, the survey asked students to report their level of agreement with each of the following four statements:

- Having sex is a good thing for you to do at your age.
- At your age right now, having sex would create problems.
- At your age right now, not having sex is important for you to be safe and healthy.
- At your age right now, it is okay for you to have sex if you use birth control, like a condom, the pill, etc.

For each statement, the survey asked students to respond on a four-point scale ranging from strongly disagree to strongly agree. The study team drew the questions from a similar survey administered as part of the federal Evaluation of Adolescent Pregnancy Prevention Approaches (Smith et al. 2012). To construct a scale from students' responses to these statements, the study team first assigned each response category a number ranging from 1 to 4. When assigning these numbers, the study team organized the response categories for each statement so that higher values indicated greater support for abstinence. This required reverse-coding two of the four items. For students who responded to at least three of the four statements, the study team calculated a scale score for each student by taking the average value of the student's responses across the different statements. The team did not calculate scores for students who responded to only one or two statements. The resulting scale ranged from 1 to 4, with higher values indicating greater support for abstinence. The scale had high internal reliability at baseline (alpha coefficient = 0.77) and the two-year follow-up (alpha coefficient = 0.77).

For the measure of support for condom use among sexually active youth, the survey asked students to report their level of agreement with each of the following two statements:

- Condoms should always be used if a person your age has sex.
- Condoms are important to make sex safer.

For each statement, the survey asked students to respond on a five-point scale ranging from strongly disagree to strongly agree. The study team drew the questions from a similar survey administered as part of the federal Evaluation of Adolescent Pregnancy Prevention Approaches (Smith et al. 2012). To construct a scale from students' responses to these statements, the study team first assigned each response category a number ranging from 1 to 5. For students who responded to both statements, the team calculated a scale score for each student by taking the average value of the student's responses across the two statements. The team did not calculate scale scores for students who responded to only one statement. The resulting scale ranged from 1 to 5, with higher values indicating greater support for condom use if one is sexually active. The scale had high internal reliability at baseline (alpha coefficient = 0.80) and the two-year follow-up (alpha coefficient = 0.84).

3. Refusal skills

The study team created a summary measure of students' perceived refusal skills from a series of five questions on the survey. For each question, the survey asked students to report their perceived ability to say no to having sex under each of the following hypothetical circumstances:

- With someone you have known for a few days or less
- With someone you have dated for a long time
- With someone with whom you have already had sex
- With someone who is pushing you to have sex
- With someone who does not want to use a condom

For each question, the survey asked students to respond on a four-point scale, with a score of 1 for students who said they felt not at all likely to have the ability to say no and a score of 4 for students who said they felt very likely to have the ability to say no. The questions were adapted from a 1998 study by Cecil and Pinkerton. For students who responded to at least four of the five questions, the study team calculated a scale score for each student by taking the average value of the student's responses across the different questions. The team did not calculate scale scores for students who responded to three or fewer questions. The resulting scale ranged from 1 to 4, with higher values indicating greater perceived refusal skills. The scale had high internal reliability at baseline (alpha coefficient = 0.82) and the two-year follow-up (alpha coefficient = 0.81).

4. Communication with parents

The survey included three questions measuring students' level of communication with their parents about relationships and sex. These questions asked students how many times they had discussed each of the following topics with their mother or father in the past three months: (1) romantic relationships or dating; (2) how to resist pressures to have sex; and (3) whether you should be having sex at this time in your life. For each question, response categories ranged from never to 10 or more times. The study team used responses to these questions to construct a binary measure of whether students had discussed any of these topics with their parents in the past three months.

5. Intentions

To measure students' intentions to have sex, the survey asked students the following question: "Do you intend to have sexual intercourse in the next year, if you have the chance?" Response categories included the following: yes, definitely; yes, probably; no, probably not; and no, definitely not. The study team used responses to this question to construct a binary measure indicating whether students said they definitely or probably intended to have sex.

6. Sexual risk behavior

The study team constructed two separate measures of sexual risk behavior. For one, the survey asked students whether they had sexual intercourse in the past three months. The study team used students' responses to this question to construct a binary measure of recent sexual activity. For the second measure, the survey asked students how many times they had sexual intercourse without using a condom in the past three months. The study team used students' responses to this question to construct a binary measure of unprotected sex. Both measures were limited to vaginal intercourse and did not include oral or anal intercourse. For the measure of unprotected sex, the study team retained students who reported having abstained from sexual intercourse in the past three months in the analysis by coding them as protected and combining them with respondents who reported having always used a condom when having sex.

In constructing these measures, the study team accounted for missing data (item nonresponse) and the potential for misreporting of sexual risk behaviors by comparing students' responses across multiple survey questions. The team began by constructing a binary measure of whether each student had ever had sexual intercourse. The team constructed this measure on the basis of students' responses to the screening question at the end of Part A of the survey (described earlier). For students who completed Part B1 of the survey (described earlier), the team also used students' responses to a direct question asking whether they had ever had vaginal

intercourse. In some cases, students did not respond to this direct question but responded to other survey questions about sexual activity, such as number of sexual partners or age at first sexual initiation. For some of these students, the study team could logically infer the students' sexual initiation status from their responses to these other survey questions. Similarly, if, on the baseline survey, a student reported having had sex but did not respond to the direct question on the follow-up survey, the study team logically inferred the student's sexual initiation status at follow-up using the baseline survey response. In other cases, students provided contradictory information about their sexual initiation status across different survey questions. For these cases, the study team coded the students' sexual initiation status as missing if the team could not determine a clear status.

The study team used this constructed measure of sexual initiation status when constructing the separate measures of recent sexual activity and unprotected sex. If the study team initially coded students as having a missing value on the constructed measure of sexual initiation status, they also coded the measures of recent sexual activity and unprotected sex as missing. Similarly, if the team initially coded students as having never had sexual intercourse, they coded the measures of recent sexual activity and unprotected sex as showing no involvement in these behaviors. One potential downside of these coding decisions is the risk of creating systematic differences in rates of item nonresponse on the basis of sexual initiation status. In particular, for the constructed measures of recent sexual activity and unprotected sex, these coding decisions eliminate any item nonresponse among students who have never had sexual intercourse but not among students who are either sexually experienced or missing information on sexual initiation status. This type of systematic difference in rates of item nonresponse has the potential to change the composition of the student sample and downwardly bias the estimated prevalence of recent sexual activity and unprotected sex (Trenholm et al. 2007). In the data for Kentucky, however, rates of item nonresponse among sexually experienced students for the measures of recent sexual activity and unprotected sex are low (fewer than 40 students per measure). As a result, the potential for systematic differences in rates of item nonresponse on the basis of sexual initiation status presents relatively little risk of bias for the impact estimates presented in this report.

To determine whether these coding decisions materially changed the study findings, the study team conducted a sensitivity test by taking the students' responses to the relevant survey questions as given, without accounting for any missing data or inconsistencies across survey questions. The results of this sensitivity test showed that the estimated rates of the sexual risk behavior outcomes and the estimated impacts of *Reducing the Risk* on these outcomes were similar regardless of the coding decisions used (Table A.6).

Analytic methods

Two key features of the research design shaped the study team's approach to estimating the impacts of *Reducing the Risk*. First, as described earlier, the design randomly assigned entire schools, not individual students, to the treatment and control groups. This method of school-level random assignment introduces a design effect that must be captured when estimating program impacts and calculating statistical significance tests (Donner and Klar 2000; Hayes and Moulton 2009). Second, the analytic methods also had to account for the two rounds of random assignment (one at the beginning of each school year) and having stratified schools by local health department and school district.

Table A.6. Sensitivity of impacts to coding of sexual risk behavior outcomes

Measure	RtR youth	Control youth	Impact	Effect size
Had sexual intercourse in the past three months (%)				
Primary coding[a]	33	30	3	0.08
Alternative coding[b]	34	31	3	0.09
Had sexual intercourse without a condom in the past three months (%)				
Primary coding[a]	19	22	-3	-0.11
Alternative coding[b]	19	22	-3	-0.12
Sample size	**797**	**1,053**		

Source: Baseline and follow-up surveys conducted by Mathematica Policy Research.

Notes: The numbers in the columns labeled "RtR youth" and "Control youth" are regression-adjusted predicted values.

[a]Refers to the coding used to produce the findings reported in the main text of this report. This approach aligned these measures with the constructed measure of students' sexual initiation status.

[b]Refers to a coding that took students' responses to the relevant survey questions as given and did not align these measures with the constructed measure of students' sexual initiation status.

**/*/+ Impact estimates are statistically significant at the .01/.05/.10 levels, respectively, two-tailed test.

RtR = *Reducing the Risk*.

To account for these design features, the study team estimated the impacts of *Reducing the Risk* using a multilevel regression model. With a school-level random assignment design, a multilevel regression model specifies two levels of analysis—one at the student level and one at the school level. For the student-level component of the model, the study team specified a linear regression predicting students' outcomes at the two-year follow-up as a function of students' demographic and personal characteristics measured on the baseline survey. For the school-level component of the model, the team specified a regression predicting the average student-level outcomes from the first level of the model as a function of treatment status and a series of indicator variables for the blocks of schools created for random assignment. The team estimated the models using the multilevel mixed-effects linear regression command in the Stata 14.1 statistical software program (StataCorp, College Station, TX).

The impact estimates presented in this report are the coefficients for the treatment status variable in the school-level component of the multilevel regression model. The study team deemed the impact estimates as "statistically significant" or "marginally significant" if the estimated *p*-value for the coefficient fell below 5 or 10 percent, respectively, based on a two-tailed hypothesis test. To help interpret the magnitude of the reported impact estimates, the study team also calculated the standardized mean difference in outcomes (effect sizes) between students in the *Reducing the Risk* schools and the control schools. For continuous outcomes, the team calculated the standardized effect size as Hedges' g, which equals the impact estimate from the regression model divided by the unadjusted pooled standard deviation of the outcome for students across both the treatment and control schools (Hedges 1981). For binary outcomes, the study team calculated the effect size as the Cox index, which equals the log odds ratio divided by the constant 1.65 (Cox 1970).

To improve the precision of the impact estimates, and to account for any chance imbalances between the treatment and control groups, the study team used data from the baseline survey to include a limited number of students' demographic and personal characteristics as covariates in the regression model. In particular, for each outcome, the team included covariates for students' age, gender, race/ethnicity, sexual experience at baseline, and the baseline value of the outcome measure (when available). To the extent that these covariates are correlated with students' outcomes, they can improve the precision of the impact estimates by reducing the residual variation in the outcome measures (Orr 1999).

The study team accounted for missing data using two approaches. For missing baseline data, the team used dummy variable adjustment, which involves setting any missing baseline values to constants and including missing value flag variables as additional covariates in the regression model. Studies using simulation have shown that dummy variable adjustment for missing baseline data presents a low risk of bias and performs similarly to other, more complex missing data techniques in cluster randomized trials of school-based interventions (Puma et al. 2009). For missing outcome data (from either survey nonresponse or item nonresponse), the study team used case deletion—meaning that the regression models excluded students with missing data for a particular outcome for the analysis of that outcome. Case deletion is appropriate in this context for three reasons. First, as described earlier, the study team achieved a high response rate to the one- and two-year follow-up surveys, which minimized the missing data resulting from survey nonresponse. Second, the survey data also had low rates of item nonresponse—less than 4 percent for any one outcome. For the attitude scales and other outcomes constructed as combinations of items, the study team further limited the missing outcome data by calculating a scale score for any student who responded to at least three-quarters of the component items. Third, for outcomes for which data are missing at random (either conditionally on covariates or unconditionally), studies using simulation have shown that case deletion presents minimal risk of bias and performs similarly to other, more complex missing data techniques in cluster randomized trials of school-based interventions (Puma et al. 2009).

Subgroup impacts

As an additional exploratory analysis, the study team examined whether *Reducing the Risk* was more effective for certain subgroups of students. The team defined the subgroups on the basis of the following characteristics: gender, baseline sexual initiation status, and health district (Barren River or Lincoln Trail). To conduct this analysis, the study team adjusted the multilevel regression model (described earlier) to include an interaction term between treatment status and an indicator variable for the subgroup of interest. For the analysis of subgroup impacts by health district, the team also changed the regression model by replacing the indicator variables for random assignment block with a simpler set of indicator variables for health district (Barren River or Lincoln Trial) and academic year (2013–2014 or 2014–2015). This change to the indicator variables was necessary to allow for an interaction term between treatment status and health district.

This analysis is exploratory for two reasons. First, the study team determined the required sample size for the evaluation assuming an analysis of the overall student sample. Because of the smaller sample sizes, the impact estimates for subgroups of students have less statistical precision. Second, estimating impacts for different subgroups of students greatly increases the

number of statistical tests conducted. The greater the number of tests, the more likely that at least one test will find a false positive impact (Schochet 2009). As discussed in the main body of the report, before conducting the analysis, the study team established a set of reporting rules intended to reduce the chances of detecting a false positive impact from the subgroup analysis. For the two confirmatory measures of sexual risk behavior, the reporting rules dictated presenting subgroup findings in the appendix unless the analysis uncovered a statistically significant difference in impacts across subgroups. As shown in the tables below, the subgroup analysis for baseline sexual initiation status met this criterion. The results of this analysis are therefore presented in the main body of the report. All of the other subgroup findings are reported only in the appendix.

Results of the analysis showed few differences in impacts across subgroups. Statistically significant differences across subgroups are indicated in the column naming the outcome measure. For the subgroup analysis by gender (Table A.7), differences in impacts for male and female students were not statistically significant for any of the outcome measures examined. For the subgroup analysis by baseline sexual experience (Table A.8), impacts varied for one of the confirmatory measures of sexual risk behavior. As a result, the subgroup findings for the measures of sexual risk behavior are discussed in the main body of the report. For the subgroup analysis by health district (Table A.9), no statistically significant differences in impacts were evident between the Barren River and Lincoln Trial districts.

Table A.7. Subgroup impacts, by gender

Measure	Full sample	Male students	Female students
Knowledge, attitudes, skills, communication, and intentions			
Knowledge of contraception and STIs index (range: 0 to 8)	0.41**	0.46**	0.36*
Support for abstinence scale (range: 1 to 4)	0.01	0.07+	-0.06
Support for condom use scale (range: 1 to 4)	0.03	0.03	0.04
Perceived refusal skills scale (range: 1 to 4)	0.03	0.07	-0.01
Talked with parents in the past three months about romantic relationships and sex (%)	-1	2	-3
Intends to have sexual intercourse in the next year (%)	3	1	5
Sexual risk behaviors			
Had sexual intercourse in the past three months (%)	3	4	2
Had sexual intercourse without a condom in the past three months (%)	-3	-1	-4
Sample size[a]	**1,850**	**929**	**920**

Source: Baseline and follow-up surveys conducted by Mathematica Policy Research.

[a] Subgroup sample sizes do not sum to the full sample because one student had missing survey data on gender.

**/*/+ Impact is statistically significant at the .01/.05/.10 levels, respectively, two-tailed test.

†††/††/† Difference in impacts between subgroups is statistically significant at the .01/.05/.10 levels, respectively, two-tailed test.

STI = sexually transmitted infection.

Table A.8. Subgroup impacts, by baseline sexual initiation status

Measure	Full sample	Had sex prior to baseline survey: Yes	No
Knowledge, attitudes, skills, communication, and intentions			
Knowledge of contraception and STIs index (range: 0 to 8)	0.41**	0.07	0.45**
Support for abstinence scale (range: 1 to 4)	0.01	0.07	0.01
Support for condom use scale (range: 1 to 4)	0.03	0.20+	0.02
Perceived refusal skills scale (range: 1 to 4)	0.03	0.05	0.03
Talked with parents in the past three months about romantic relationships and sex (%)	-1	-6	-0
Intends to have sexual intercourse in the next year (%)	3	-1	3
Sexual risk behaviors			
Had sexual intercourse in the past three months (%) †	3	10	2
Had sexual intercourse without a condom in the past three months (%)	-3	-11+	-2
Sample size[a]	**1,850**	**237**	**1,583**

Source: Baseline and follow-up surveys conducted by Mathematica Policy Research.

[a] Subgroup sample sizes do not sum to the full sample because 30 students had missing survey data on baseline sexual initiation status.

**/*/+ Impact is statistically significant at the .01/.05/.10 levels, respectively, two-tailed test.

†††/††/† Difference in impacts between subgroups is statistically significant at the .01/.05/.10 levels, respectively, two-tailed test.

STI = sexually transmitted infection.

Table A.9. Subgroup impacts, by health district

Measure	Full sample	Barren River	Lincoln Trail
Knowledge, attitudes, skills, communication, and intentions			
Knowledge of contraception and STIs index (range: 0 to 8)	0.41**	0.61**	0.21
Support for abstinence scale (range: 1 to 4)	0.01	-0.03	0.05
Support for condom use scale (range: 1 to 4)	0.03	0.07	0.02
Perceived refusal skills scale (range: 1 to 4)	0.03	0.08	0.02
Talked with parents in the past three months about romantic relationships and sex (%)	-1	0	-1
Intends to have sexual intercourse in the next year (%)	3	6	-1
Sexual risk behaviors			
Had sexual intercourse in the past three months (%)	3	6+	-1
Had sexual intercourse without a condom in the past three months (%)	-3	0	-6+
Sample size	**1,850**	**1,059**	**791**

Source: Baseline and follow-up surveys conducted by Mathematica Policy Research.

**/*/+ Impact is statistically significant at the .01/.05/.10 levels, respectively, two-tailed test.

†††/††/† Difference in impacts between subgroups is statistically significant at the .01/.05/.10 levels, respectively, two-tailed test.

STI = sexually transmitted infection.

Impacts for secondary outcomes

As an additional exploratory analysis, the study team estimated impacts on three groups of secondary outcomes: (1) the eight individual survey questions that make up the summary knowledge index included in the main body of the report, (2) the three individual survey questions that make up the summary communication index included in the main body of the report, and (3) additional measures of sexual risk behavior beyond the two confirmatory outcomes included in the main body of the report.

The results of this exploratory analysis corroborate the overall substantive findings presented in the main body of the report (Table A.10). For the individual knowledge questions, the secondary impact findings showed that students in the *Reducing the Risk* schools were more likely than students in the control schools to provide a correct response for four of the eight questions. For these four questions, the magnitude of the impact ranged from 5 to 12 percentage points. For the communication questions, the secondary impact findings show that students in the *Reducing the Risk* schools were no more likely than students in the control schools to talk to their parents about romantic relationships and sex. For the additional measures of sexual risk behavior, the program had no consistent pattern of impacts favoring either research group. Five of the seven measures showed no statistically significant difference in rates of sexual risk behavior between students in the *Reducing the Risk* schools and students in the control schools. Two of the seven measures showed higher rates for the *Reducing the Risk* students.

Table A.10. Impacts on secondary outcomes

Measure	RtR youth	Control youth	Impact	Effect size
Knowledge				
Correctly answered question on: (%)				
Condoms and risk of pregnancy	70	65	5*	0.13
Condoms and risk of getting HIV	52	46	6*	0.14
Birth control pills and risk of pregnancy	68	60	7**	0.20
Birth control pills and risk of getting HIV	62	59	3	0.08
Female-to-male transmission of HIV when condoms are used	88	85	2	0.11
Risk of getting HIV from people you know well	74	70	4+	0.13
Protective methods against HIV	65	53	12**	0.30
Getting STIs from oral sex	81	80	2	0.06
Communication with parents				
Communication with parents about: (%)				
Romantic relationships	65	66	-1	-0.02
How to resist pressures to have sex	31	32	-1	-0.03
Whether the student should be having sex	39	42	-3	-0.07
Sexual risk behavior				
Ever had sexual intercourse (%)	43	44	0	-0.01
Had sexual intercourse without any effective contraceptive method in past three months (%)	12	14	-2	-0.11
Had multiple sexual partners (%)	27	28	-1	-0.03

Measure	RtR youth	Control youth	Impact	Effect size
Ever had oral sex (%)	47	46	1	0.03
Had oral sex in past three months (%)	37	33	4*	0.12
Had oral sex without a condom in past three months (%)	32	28	4+	0.12
Sample size	**797**	**1,053**		

Source: Baseline and follow-up surveys conducted by Mathematica Policy Research.

Notes: The numbers in the columns labeled "RtR youth" and "Control youth" are regression-adjusted predicted values.

**/*/+ Impact estimates are statistically significant at the .01/.05/.10 levels, respectively, two-tailed test.

RtR = *Reducing the Risk*.

STI = sexually transmitted infection

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The Personal Responsibility Education Program Evaluation