YPREP

The Personal Responsibility Education Program Evaluation

Adapting an Evidence-based Curriculum in a Rural Setting:

The Early Impacts of *Reducing the Risk* in Kentucky

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Adapting an Evidence-based Curriculum in a Rural Setting: The Early 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 associated sexual risk behaviors.

In response to the need 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 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 Health. *Reducing the Risk* is a widely implemented, classroom-based abstinence and contraceptive education curriculum designed to prevent teen pregnancy, sexually transmitted infections (STIs), and associated sexual risk behaviors. The curriculum identifies abstinence as the most effective way to avoid STIs and unintended pregnancy, but also provides information on contraceptive methods. In Kentucky, to fit within the time allotted by area schools for delivering the curriculum, local health department staff shortened the original 12-hour curriculum to 8 hours, while retaining coverage of all the topics in the original curriculum. Funding for the programming came from Kentucky's federal Personal Responsibility Education Program (PREP) grant, which the state first received in 2010.

The evaluation team randomly assigned participating schools over the course of 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. To measure the impacts of the program on students' outcomes, the evaluation team obtained parental consent and collected survey data one and two years after study enrollment for a sample of more than 2,000 students.

The study findings indicate that the adapted version of *Reducing the Risk* had short-term impacts on some but not all of the program's targeted outcomes. At the time of the study's one-year follow-up survey, students in the *Reducing the Risk* schools reported greater exposure to information on birth control than did students in the control schools. 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. The program had no measurable short-term impacts on students' sexual risk behaviors, intentions to have sex, attitudes toward abstinence, or perceived ability to avoid sexual risk behaviors.

This report is the second in a series on the implementation and impacts of the adapted version of *Reducing the Risk* in Kentucky. An earlier process study report described the design and implementation of the program in study schools. A future report, which is scheduled for release in 2018, will examine the program's longer-term impacts on the same measures of students' knowledge, attitudes, skills, intentions, and sexual risk behaviors.

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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 2015). 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).

Despite the clear need for effective approaches to teen pregnancy prevention among youth in rural areas, these youth are often 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 prior 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 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.

This report is the second in a series on the implementation and impacts of the adapted version of *Reducing the Risk* in Kentucky. An earlier process study report described the design and implementation of the program in study schools (Shapiro and Wood 2015). The present report examines the early impacts of the program, measured a year after students enrolled in the study. It examines whether the program increased students' exposure to information on reproductive health topics and improved their knowledge of contraceptive methods and pregnancy prevention. It also examines impacts on important precursors of sexual risk behaviors targeted by the program, such as students'

> **Key findings and conclusions**
>
> The adapted version of *Reducing the Risk* increased students' exposure to information on birth control, knowledge of contraceptives and sexually transmitted infections (STIs), and support for condom use among sexually active youth.
>
> The program had no measurable short-term impacts on students' sexual risk behaviors, intentions to have sex, attitudes toward abstinence, or perceived ability to avoid sexual risk behaviors.
>
> These impacts are similar to what other organizations have recently achieved when implementing the standard 12-hour version of the curriculum.

attitudes toward sexual activity and perceived ability to avoid sexual risk behaviors. A future report will examine the program's longer-term impacts measured two years after study enrollment.

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, but it also provides information on 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.

Prior research on the effectiveness of *Reducing the Risk* dates to a 1991 study of California high school students (Kirby et al. 1991). That study involved students from 46 classrooms across 13 high schools. Teachers in half the classrooms volunteered to implement *Reducing the Risk* as part of a required 10th-grade health class. The other classrooms served as a comparison group that did not offer the program. Students in both groups completed two rounds of follow-up surveys, conducted 6 and 18 months after the program. The study found that students in the *Reducing the Risk* classrooms had higher average scores on a 20-item knowledge test on contraception. The students were also more likely to report having talked with their parents about abstinence and birth control. The study found modest impacts of *Reducing the Risk* on students' sexual risk behaviors. Among female students who were sexually inexperienced at baseline, the study found that students in the *Reducing the Risk* classrooms were statistically significantly less likely than students in the comparison classrooms to report having had sex without using birth control. The study found no statistically significant program impacts on other measures of sexual risk behavior or for male students who were sexually inexperienced at baseline.

Several subsequent studies have tested the effectiveness of *Reducing the Risk* in different settings and when adapting the curriculum in different ways. For example, Zimmerman et al. (2008) 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 9th-grade students from 17 high schools in Cleveland, Ohio, and the Louisville, Kentucky, area. The study team randomly assigned each participating school to one of three groups: (1) a group that delivered the standard version of *Reducing the Risk,* (2) a group that delivered the 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 immediately after the program in spring of 9th grade and about a year later near the end of 10th grade. For the 9th-grade follow-up, the study found that students in schools offering either the standard or adapted versions of *Reducing the Risk* had higher average scores on a 10-question knowledge test on pregnancy and STIs relative to students in the control schools. In addition, at the 10th-grade follow-up, students in the *Reducing the Risk* schools were statistically significantly less likely to report having initiated sexual intercourse than were students in the

control schools. The study found no statistically significant differences between schools that offered the standard and adapted versions of *Reducing the Risk.*

Most recently, the large-scale federal Teen Pregnancy Prevention (TPP) Replication Study (Kelsey et al. 2016) evaluated the full 12-hour version of *Reducing the Risk* among three organizations receiving federal grant funding through Tier 1 of the Office of Adolescent Health Teen Pregnancy Prevention Program (Kappeler and Farb 2014). The organizations delivered the curriculum in public school classrooms to a racially and ethnically diverse group of students in three predominately urban areas: Austin, Texas; San Diego, California; and St. Louis, Missouri. In each setting, the study team randomly assigned participating classrooms to either a treatment group that offered *Reducing the Risk* or a control group that did not. Findings from an interim follow-up survey conducted about 12 months after students had enrolled in the study showed favorable impacts on several student outcomes. Compared with students in the control group, students in the *Reducing the Risk* classrooms had higher average scores on both a 4-item knowledge test on pregnancy risk and a 12-item knowledge test on STI risk. Students in the *Reducing the Risk* classrooms also had higher average scores on a scale measuring support for contraceptive use among sexually active students. The study found no statistically significant program impacts on students' reported intentions to have sex or their intentions toward the use of condoms or birth control pills if sexually active. Similarly, the study found no statistically significant program impacts on students' perceptions of their abilities to say no to sex and to always use condoms when having sex. For one of the three evaluation sites (St. Louis), students in the *Reducing the Risk* classrooms were statistically significantly less likely than students in the control group to report having had sex in the past 90 days. The study found no statistically significant impacts of the program on sexual risk behaviors in the other two sites or for the combined evaluation sample. A planned future report will examine longer-term program impacts measured about 24 months after study enrollment.

Adapting *Reducing the Risk* in Kentucky

For the present evaluation, trained professional health educators from two local health departments in Kentucky delivered an adapted version of *Reducing the Risk* to high school students in relatively low-income, mostly rural areas of the state. The two participating health departments cover a multicounty region in central and southwestern Kentucky (Figure 1). The Barren River District Health Department provides services in the counties around the city of Bowling Green, Kentucky, located in Warren County. The Lincoln Trail District Health Department covers the counties around the city of Elizabethtown, Kentucky, located in Hardin County. Of the 13 high schools participating in the study, 3 are located in or close to Bowling Green, the largest city in the study region, with a population of about 60,000 at the time of the study. Two other study schools are near Elizabethtown, which had a population of about 30,000 at the time of the study. The remaining schools are located in or near smaller towns. In 2014, the eight counties in which the study schools are located had an average poverty rate of 17.8 percent, above the average national rate of 14.8 percent (U.S. Census Bureau 2014). The median income in the region—$40,489 in 2014—is below the national average of $53,482 (U.S. Census Bureau 2014).

Figure 1. Map of service area included in the study

Lincoln Trail District   Barren River District
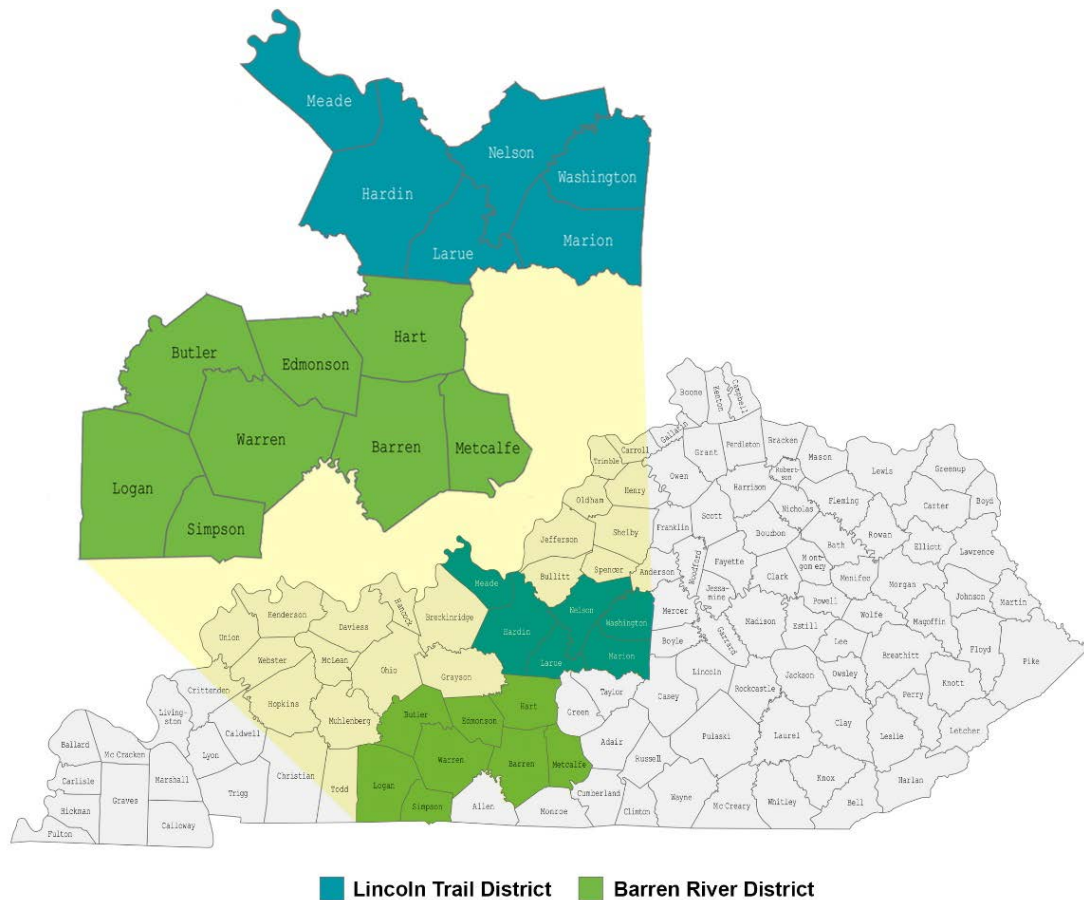
Although staff from the local health departments saw *Reducing the Risk* as a good fit for their communities, they also had need to adapt the curriculum to local circumstance. For example, although the current fifth edition of *Reducing the Risk* includes a total of 12 instructional hours, the local high schools in Kentucky could allot no more than 8 hours of instructional time for the program. As a result, staff from the local health departments had to shorten the curriculum from 12 to 8 instructional hours. As another example, because of the long distances and limited transportation options available in the largely rural region, staff dropped a curriculum activity that involved having students visit a health clinic during class or as part of a homework assignment. Instead, staff described available services to students during one of the curriculum sessions.

Specifically, as described in the earlier process study report (Shapiro and Wood 2015), the local health departments adapted the standard *Reducing the Risk* curriculum in six main ways:

1. **Less time spent on content reviews.** To help shorten the curriculum from the standard 12 instructional hours to the allotted 8 hours, the local health departments reduced the time they spent reviewing content from previous sessions and summarizing content at the end of each session. Staff felt comfortable making this change because the program delivery schedule often called for holding classes on consecutive days or twice per week, potentially reducing the need for review and summary at the start and end of each session.

2. **Less time spent focused exclusively on abstinence**. The first two sessions of the standard *Reducing the Risk* curriculum focus on abstinence. For the adapted version in Kentucky, the local health departments condensed these sessions into either a single session (Lincoln Trail) or one-and-a-half sessions (Barren River). In Barren River, health district officials made this adjustment in part because 11 of the 12 middle schools that feed into the study high schools provided abstinence education to students. In Lincoln Trail, one of ten feeder middle schools provided abstinence education.

3. **Less time on HIV in some study schools.** Staff in the Lincoln Trail District Health Department shortened the curriculum in part by combining the discussions on facts and risk behaviors related to both HIV and STIs, which are otherwise separate in the standard curriculum. Staff in the Barren River District Health Department kept these discussions separate.

4. **Fewer role-plays.** Staff in both the Lincoln Trail and Barren River District Health Departments shortened the curriculum in part by reducing the number of role-plays on refusal skills and delaying tactics. Despite this adaptation, role-plays still featured prominently in the adapted version of the curriculum, because of the large number of role-plays included in the standard curriculum.

5. **Modified role-plays.** In line with guidance provided by the curriculum publisher, staff in both the Lincoln Trail and Barren River District Health Departments modified the delivery of some role-plays to maximize students' engagement in the material. For example, rather than asking students to act out a semiscripted role-play, the health educators sometimes asked students to write down their responses, talk about the role-play in small groups, or discuss their responses in a larger group. These modifications affected only the delivery of the program materials, not their content.

6. **Tailored content to rural setting.** Staff in both the Lincoln Trail and Barren River District Health Departments tailored some content of the curriculum sessions to better fit the rural setting. For example, as noted earlier, because staff dropped an activity that involved having students visit a local health clinic, they added content to the curriculum sessions covering the reproductive health services available in the local area.

Following these changes, the resulting adapted version of *Reducing the Risk* had eight one-hour sessions (Table 1). The adapted sessions match the standard curriculum in covering the

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Adapting evidence-based interventions

The need to adapt an existing curriculum to local circumstance is common among agencies implementing evidence-based teen pregnancy prevention programs. A recent study of 128 agencies offering teen pregnancy prevention programming in California found that 95 percent of the agencies had adapted their curricula by adding, removing, or modifying content (Arons et al. 2016). Similarly, in a survey of states receiving federal PREP funding, administrators from nearly all states reported a policy of allowing program providers to make certain adaptations to program content or delivery (Zief et al. 2013). For their part, the developers and distributors of teen pregnancy prevention curricula also recognize and in some cases encourage the practice of adapting curricula to local circumstance. For example, ETR Associates, the curriculum publisher for *Reducing the Risk*, provides adaptation guidelines for the curriculum on its website (ETR Associates 2015). In Kentucky, staff in the Lincoln Trail and Barren River District Health Departments made the curriculum adaptations on their own, without direct consultation with ETR Associates.

main topics of abstinence, using contraception if sexually active, and developing skills to avoid risky situations. As in the standard curriculum, each session included a mix of lectures and more interactive activities. In some cases, staff in the Barren River and Lincoln Trail District Health Departments modified the curriculum sessions in slightly different ways. For example, for the third session on avoiding high-risk situations, Barren River used four classroom activities whereas Lincoln Trail used seven (Table 1). Because both health departments used the same overall structure, coverage, and sequencing of the curriculum sessions, the evaluation team designed the study to combine data from both districts and estimate the shared impact of *Reducing the Risk* across all study schools. However, as shown in the appendix to this report, for an additional exploratory analysis, the evaluation team also measured program impacts separately for each district. The earlier process study report (Shapiro and Wood 2015) provides a more detailed description of the process the health departments used to adapt the curriculum.

Table 1. Overview of the adapted 8-session *Reducing the Risk* curriculum

Session	Objectives	Barren River District	Lincoln Trail District
1. Abstinence, Sex, and Protection	Introduce curriculum, demonstrate refusal skills to help prevent pregnancy, and discuss advantages of abstinence and risks teens face when they engage in unprotected sex	• One-and-a-half sessions with 8 activities (lectures, role-plays, and group discussions) • Discuss pregnancy prevention, HIV prevention, abstinence, and communication skills	• One session with 4 activities (lecture, role-plays, group discussion, and video) • Discuss pregnancy prevention and abstinence
2. Refusals	Introduce verbal and nonverbal communication skills and demonstrate skills important to abstaining and using protection	• Half a session with 5 activities (lecture, role-plays, and group discussions) • Discuss components of a successful relationship, beliefs about sex and protection, communication skills, and refusal skills	• One session with 5 activities (lecture, role-plays, group discussion, and quiz) • Discuss components of a successful relationship, beliefs about sex and protection, communication skills, and refusal skills
3. Avoiding High-Risk Situations	Introduce delay tactics, identify and practice handling situations that can lead to unwanted or unprotected sex	• One session with 7 activities (lecture, role-plays, group discussions, and quiz) • Discuss refusal skills, delay tactics, situations that can lead to unwanted or unprotected sex, and how to protect oneself from pregnancy or STIs/HIV	• One session with 4 activities (lecture and group discussions) • Discuss situations that can lead to unwanted or unprotected sex and how to protect oneself from pregnancy or STIs/HIV
4. Getting and Using Protection I	Provide information on methods of protection against unplanned pregnancy and STIs	• One session with 3 activities (lecture, demonstration, and group discussion) • Discuss types of contraception and which methods are best to avoid pregnancy and STIs/HIV	• One session with 2 activities (lecture and video) • Discuss types and cost of contraception

Session	Objectives	Barren River District	Lincoln Trail District
5. Getting and Using Protection II	Discuss where to obtain protection and which methods best prevent pregnancy and STIs/HIV	• One session with 4 activities (lecture, role-plays, and group discussion) • Discuss clinic visits, myths and truths related to contraception, and how to handle difficult situations	• One session with 4 activities (lecture and group discussion) • Discuss clinic visits, cost of contraception, which methods are best to avoid pregnancy, and myths and truths related to contraception
6. Preventing HIV and Other STIs	Explore information about transmission and prevention of STIs/HIV	• One session with 1 activity (lecture) • Discuss STIs/HIV transmission and prevention	• One session with 3 activities (lecture, demonstration, group discussion) • Discuss prevention methods, STIs/HIV transmission and prevention, and how HIV would change life
7. Risk Behaviors	Apply knowledge about HIV transmission and identify which behaviors put students at greatest risk for exposure to STIs/HIV	• One session with 2 activities (lecture, group discussion) • Discuss HIV/AIDS transmission and prevention methods, myths and facts about HIV, risk behaviors and statistics on HIV risk	• One session with 5 activities (role-plays and health educator-led and group discussions) • Discuss how HIV would change life, risk behaviors, statistics on HIV risk, and condom use
8. Sticking with Abstinence and Protection	Discuss skills learned for abstinence or avoiding unprotected sex	• One session with 2 activities (group discussions) • Discuss what students have learned about why to delay sex	• One session with 4 activities (role-plays and group discussions) • Discuss refusal skills and delay tactics, why to delay sex, and what students have learned

Source: Shapiro and Wood (2015).

Note: The Barren River and Lincoln Trail health educators did not collaborate with ETR Associates when adapting the curriculum. Currently, ETR encourages sites wishing to adapt its programs to work with ETR on the process. New guidelines around adaptations are available at http://www.etr.org/ebi/programs/adaptations-policy/. ETR also provides specific adaptation guidelines for *Reducing the Risk* (ETR Associates 2015).

STI = sexually transmitted infection.

Evaluation design

To test the effectiveness of the adapted version of *Reducing the Risk*, Mathematica collaborated with staff from the Kentucky Department of Public Health and the Barren River and Lincoln Trail District Health Departments to conduct a rigorous random assignment evaluation of the curriculum among local high schools. Evaluation team members invited 15 high schools located in the Barren River and Lincoln Trail districts to participate in the evaluation. Of the 15 schools, 13 (87 percent) agreed to participate. The evaluation team randomly assigned each school to either a treatment group that offered the adapted version of the *Reducing the Risk* curriculum in a mandatory health class for primarily 9th- and 10th-grade students or to a control group that offered the school's standard health curriculum. Because the schools were assigned

randomly, differences in outcomes between students in the *Reducing the Risk* schools and control schools represent an unbiased estimate of the program's impact on students' outcomes.

To increase the study's ability to detect program effects, the evaluation team randomly assigned the 13 participating schools twice, at the beginning of each of the two academic years when programming was offered as part of the evaluation. The first round of random assignment occurred in summer 2013 to determine the schools that would offer *Reducing the Risk* during the 2013–2014 academic year. The second round of random assignment occurred in summer 2014 to determine the schools that would offer *Reducing the Risk* during the 2014–2015 academic year. Because of these two rounds of randomization, some schools were assigned to the treatment group in both academic years covered by the evaluation, some were assigned to the control group both years, and some were assigned to the treatment group in one year and the control group in the other year. Because schools randomly assigned to the treatment group offered *Reducing the Risk* as part of a mandatory health class that students took only once during high school, students in the control group were not offered the program in years their schools were instead assigned to the treatment group. Having two rounds of random assignment increased the number of randomized groups of students (or clusters) from 13 to 26. The larger number of clusters 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). As shown in the appendix to this report, the random assignment procedure yielded two groups of students that had similar sociodemographic and personal characteristics at baseline. The appendix also provides additional detail on the random assignment procedures.

The adapted version of *Reducing the Risk* provided substantially more sex education content than the control schools offered through their standard health curricula. 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 (Figure 2). *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.

Within each participating school, students who took their required health class during the fall of 2013 or 2014 were eligible for the study. To enroll a student in the research sample, the evaluation team had to obtain active consent from a parent or legal guardian. The evaluation team gathered consent by distributing forms in schools with the assistance of school administration and staff. The consent-gathering process took place in the first few weeks of the school year, so that baseline data collection could be completed before programming started. Among the eligible students, 94 percent of parents returned a consent form and 75 percent of those who returned forms agreed to have their children participate in the study, for an overall consent rate of 71 percent. The consent process yielded a total study sample of 2,222 students.

Figure 2. Average number of sex education classes offered at study schools
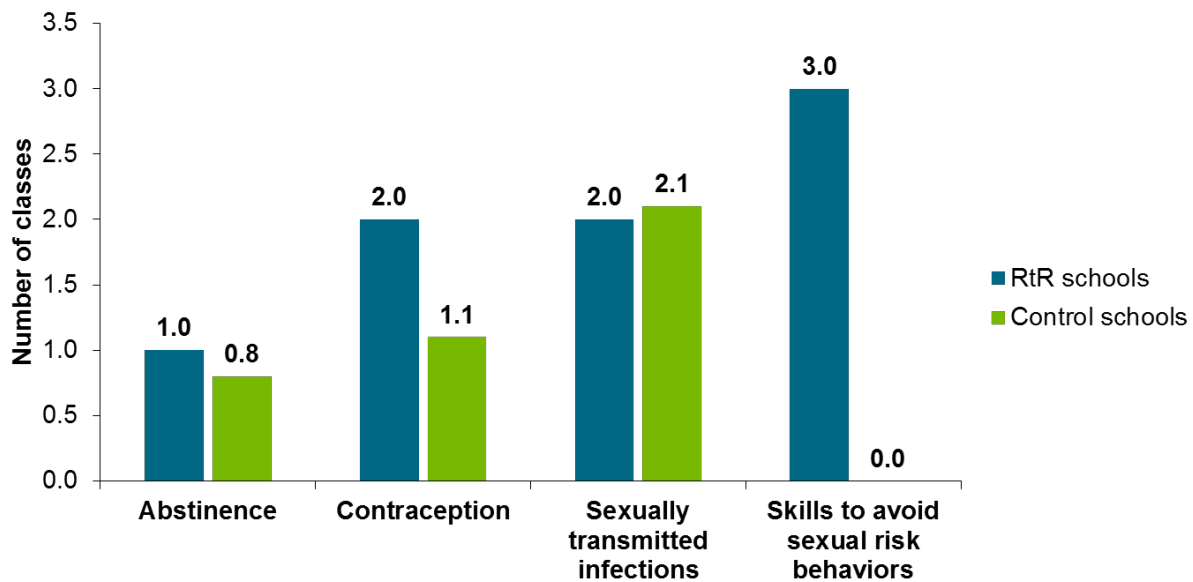
Source: Shapiro and Wood (2015).

RtR = *Reducing the Risk*.

To measure the impact of *Reducing the Risk* on students' outcomes, the evaluation team administered surveys to students in both the treatment and control groups at three points: (1) baseline, before the start of programming; (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 program. This interim impact report uses data only from the baseline and one-year follow-up surveys. The evaluation 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. The survey asked potentially sensitive questions on contraceptive use and other sexual risk behaviors only of students who reported being sexually experienced. Of the 2,222 students who received consent from a parent or guardian to participate in the study, 2,003 (90 percent) completed the one-year follow-up survey and are therefore included in the analysis. The response rate among consented students was similar for students in the treatment and control groups (89 and 91 percent, respectively). The evaluation team administered most of the completed follow-up surveys in school during the regular school day (96 percent). The team administered a smaller proportion of surveys by telephone (4 percent) for students who had moved out of the area or were otherwise unavailable to complete the paper-and-pencil survey in school. The appendix provides a more detailed description of the consent process, survey administration procedures, and response rates.

To provide a comprehensive assessment of the program, this report assesses program impacts on a broad range of student outcomes (Table 2). The evaluation team selected these outcomes to align both with the key topics covered in the curriculum and with the goals the Kentucky Department of Public Health hoped to achieve in implementing the program. For example, the team included measures of students' exposure to information on contraceptive methods and other reproductive health topics, both because the curriculum aims to provide students new information on these topics and because the Kentucky Department of Public Health

viewed increased exposure to reproductive health information as an important goal of the program. The evaluation team also included outcomes similar to those measured in prior studies of *Reducing the Risk*. For example, as discussed earlier, prior studies have found that *Reducing the Risk* increased students' knowledge of contraceptive methods and the prevention of teen pregnancy and STIs (Kirby et al. 1991; Zimmerman et al. 2008; Kelsey et al. 2016). Therefore, the evaluation team included a similar knowledge measure for this evaluation in Kentucky. Because the ultimate goal of *Reducing the Risk* is to reduce rates of unprotected sexual behavior, the evaluation team designated the two 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 additional measures shown in Table 2 serve as other primary outcomes. The final impact report will analyze the same outcomes with data from the two-year follow-up survey.

Table 2. Outcome measures

Domain and outcome	Definition
Exposure to information	
Attended classes on reproductive health topics	Series of five continuous variables: student report of the number of classes he or she attended in the past 12 months on each of the following five topics: relationships, dating, or marriage; abstinence; birth control methods; where to get birth control; and STIs
Received information from a doctor, nurse, or clinic	Series of three binary variables: equals 1 if student reported receiving information from a doctor, nurse, or clinic in the past 12 months on each of three reproductive health topics (birth control methods, where to get birth control, and STIs); equals 0 if student reported not receiving such information
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 greater knowledge
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 federal 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 federal 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

Domain and outcome	Definition
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 and 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
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

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

Program implementation

In the schools assigned to the treatment group, trained professional health educators from the Barren River and Lincoln Trail District Health Departments worked with school staff to develop a schedule for delivering *Reducing the Risk* during the regular school day. In all schools, the health educators delivered the curriculum as part of a mandatory health class for primarily 9th- and 10th-grade students. Depending on each school's schedule and the classroom teacher's preference, health educators delivered the eight sessions either once a week for eight weeks, twice a week for four weeks, or on consecutive days within a two-week period (Shapiro and Wood 2015). In the Lincoln Trail District, health educators delivered six sessions and trained nurse educators delivered the two sessions on obtaining and using methods of protection. In Barren River, the health educators delivered all eight sessions themselves. A total of nine health educators—eight women and one man—delivered the program to over 1,000 students across the two health districts.

To help ensure that schools implemented Reducing the Risk as planned, the health departments put into place a number of supports. In each health department, a program director supervised the health educators who implemented Reducing the Risk. In addition, all health educators had to have at least a bachelor's of science degree in health education and to participate in a training before implementing the curriculum. During the academic year, program leaders observed the health educators deliver the curriculum in schools and provided feedback to the educators as needed. During site visit interviews conducted by the evaluation team, all health educators reported that they felt adequately prepared to deliver the curriculum.

Results from the accompanying process study of the program found that health educators generally implemented the adapted version of *Reducing the Risk* as planned (Shapiro and Wood 2015). 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 addition, in session logs documenting completed or omitted planned activities, health educators reported covering more than 90 percent of planned activities. Some educators omitted activities (such as role-plays) when sessions ran long, which most often occurred when students had many comments or questions about the material. According to several health educators, discussions about birth control often led to many questions from students. The health educators believed it was important to answer all questions about contraception fully, even though this occasionally put them behind schedule. During site visits, evaluation team members observed 10 sessions delivered by five different health educators. These observations confirmed information provided in service use logs. In 9 of 10 observed sessions, health educators covered all the planned material. In the one instance the health educator did not cover all the planned material, she reported that she would cover it in the following session along with the other material prescribed for that session.

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. They felt that the lectures were sometimes monotonous or included too much information to take in at once, whereas the interactive exercises created a more fun and interesting environment. In addition, students in focus groups commented that they learned a lot from the sessions on birth control methods and would have appreciated more time devoted to them. Students also appeared to welcome the information on STI transmission and prevention, which was new to them. In focus groups, students reported that *Reducing the Risk* had given them a better understanding of the transmission and potential consequences of STIs.

Health educator perceptions

Health educators reported generally favorable perceptions of the curriculum. They believed in teaching students both the value of abstinence and the correct use of contraception. They also appreciated the curriculum's emphasis on the development of communication skills. As one health educator put it, "The refusal skills are very important in all aspects of life, not just sex." The health educators felt that the curriculum filled an unmet need among local students, noting that most students do not receive this information in middle school.

According to the health educators, students appeared to become more responsive to the materials over the sequence of program sessions. They felt that students were particularly engaged in the activities and discussions about contraception and the consequences of having sex. The health educators felt that the students were also very engaged in the role-play and small-group activities. However, a few health educators questioned whether all students were mature enough to approach the situations presented in some of the role-plays in a serious matter.

Student characteristics

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 2016). Similarly, according to data from the baseline survey of participating students (Table 3), about 46 percent

of the 2,190 students who completed a baseline survey reported living with both their biological parents, compared with 66 percent among all children ages 12 to 17 nationally (U.S. Census Bureau 2014). Almost three-quarters (73 percent) of the youth were white; most others were African American (13 percent) or Hispanic (7 percent). Most students were just entering high school, with 82 percent in 9th grade at study enrollment.

Table 3. Baseline student characteristics

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	
9th	82
10th	15
11th or 12th	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
Romantic relationships and risk behaviors	
Currently in a dating relationship	37

Measure	Percentage
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 surveys conducted by Mathematica Policy Research.

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

Students reported relatively limited exposure to information on reproductive health topics and limited knowledge of the effectiveness of contraceptive methods. 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 3). 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, slightly more than a third to about half of the study participants 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). 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.

Impacts on students' outcomes

Reducing the Risk aims to reduce rates of unprotected sexual activity among adolescents by providing youth information on both contraception and abstinence, educating youth about the risks associated with unprotected sexual activity, and helping youth build the skills and beliefs necessary to avoid sexual risk behaviors. Reflecting these aims, this section of the report first examines whether Kentucky's adapted version of *Reducing the Risk* succeeded in increasing students' exposure to information on contraception, abstinence, and other reproductive health topic. It then examines the impacts of the program on measures of students' knowledge, attitudes, skills, and intentions. The section ends by examining whether *Reducing the Risk* had short-term impacts on rates of sexual activity and unprotected sex. The appendix provides additional evidence about program impacts on secondary outcomes and program impacts for key subgroups of students.

Reducing the Risk increased students' exposure to information on birth control

As discussed earlier, the Kentucky Department of Education requires state high schools to provide students instruction on pregnancy, STIs, and contraception. Consistent with that requirement, at the time of the one-year follow-up, students in both the *Reducing the Risk* schools and the control schools reported having attended, on average, one to two classes on abstinence, methods of birth control, and STIs during the past year (Table 4). In addition, students in both the *Reducing the Risk* schools and control schools reported having attended similar numbers of classes on relationships, dating, or marriage—about one class on average during the past year for both groups. However, students in the *Reducing the Risk* schools reported having attended a greater number of classes on where to get birth control—an average of 1.25 classes reported for students in the *Reducing the Risk* schools, compared with 0.81 classes reported for students in the control schools.

Table 4. Impacts of *Reducing the Risk* on exposure to information

Measure	RtR youth	Control youth	Impact	Effect size
Number of classes attended in the prior year on:				
Relationships, dating, or marriage	0.91	0.94	-0.03	-0.01
Abstinence	1.34	1.09	0.25	0.11
Methods of birth control	1.45	1.19	0.25	0.10
Where to get birth control	1.25	0.81	0.44**	0.21
Sexually transmitted infections (STIs)	1.61	1.39	0.21	0.08
Received information in the prior year from a doctor, nurse, or clinic on (%):				
Methods of birth control	33	31	2	0.05
Where to get birth control	31	25	6**	0.17
STIs	31	28	3	0.09
Sample size	**870**	**1,133**		

Source: Baseline and one-year 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.*

At the one-year follow-up, students in the *Reducing the Risk* schools were also more likely than students in the control schools to report having received information from a doctor, nurse, or clinic on where to get birth control (Table 4). In particular, 31 percent of the *Reducing the Risk* students reported having received such information, compared with 25 percent of students in the control schools. This difference could partly reflect the decision by the Lincoln Trail District Health Department to use nurse educators rather than the health educators to deliver the two *Reducing the Risk* sessions on obtaining and using protection (Shapiro and Wood 2015). Students in the *Reducing the Risk* schools might have been thinking of these nurse educators when answering the survey question at the one-year follow-up. Another possibility is that students in the *Reducing the Risk* schools were more likely to seek information from a doctor, nurse, or clinic after learning about available health services as part of the curriculum sessions. The results of additional subgroup analyses showed that the magnitude of the impact for this

outcome was indeed larger for schools in Lincoln Trial than for schools in Barren River (an impact of 8 versus 3 percentage points), though a test of the difference in impacts across districts did not reach statistical significance at the 5 percent level (shown in the appendix).

Reducing the Risk had favorable impacts on students' knowledge and students' attitudes toward condom use

At the one-year follow-up, *Reducing the Risk* students had better knowledge of contraception and STIs than did control group students (Table 5). In particular, students in *Reducing the Risk* schools answered an average of 5.4 of 8 knowledge questions correctly (or 68 percent correct), compared with an average of 4.8 correct responses for students in the control schools (or 60 percent correct). Looking at students' answers to each individual knowledge question, a higher percentage of *Reducing the Risk* students answered correctly on 7 of the 8 questions. For example, 81 percent of the *Reducing the* Risk students answered correctly that it is possible to get an STI from having oral sex, compared with 73 percent of students in the control schools. For any one of the 7 questions for which the *Reducing the Risk* students had higher scores, the difference between groups ranged from 8 to 13 percentage points.

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)	5.44	4.75	0.69**	0.33
Support for abstinence scale (range: 1 to 4)	2.90	2.90	0.00	0.00
Support for condom use scale (range: 1 to 5)	4.49	4.39	0.10**	0.12
Perceived refusal skills scale (range: 1 to 4)	2.93	2.88	0.05	0.06
Talked with parents in the past three months about romantic relationships or sex (%)	73	70	3	0.09
Intends to have sexual intercourse in the next year (%)	44	44	0	0.00
Sample size	**870**	**1,133**		

Source: Baseline and one-year 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.*

These impacts on students' knowledge are comparable to those reported in prior studies of *Reducing the Risk*. For example, in a study of predominately 9th and 10th grade students in 13 California high schools, Kirby et al. (1991) reported an average score of 76 percent correct on a 20-item knowledge test on contraception for students in the *Reducing the Risk* classrooms. Students in the study's comparison group had an average score of 65 percent correct. Among students participating in the federal TPP Replication Study (Kelsey et al. 2016), students offered the full 12-hour version of *Reducing the Risk* had average scores of 66 percent correct on a 4-item knowledge test of pregnancy risk and 60 percent correct on a 12-item knowledge test of STI risk. Students in the control group had average scores of 62 and 52 percent, respectively.

The study involved a mix of 8th, 9th, and 10th grade students in three predominately urban areas (Austin, Texas; San Diego, California; and St. Louis, Missouri).

In Kentucky, students in the *Reducing the Risk* schools were more likely than students in control schools to support condom use among sexually active youth. On a scale ranging from 1 to 5, with higher values indicating more supportive attitudes, students in the *Reducing the Risk* schools reported an average scale score of 4.49, compared with an average score of 4.39 for students in the control schools (Table 5). The estimated effect size (0.12 standard deviations) is comparable in magnitude to the impact on students' attitudes reported by the federal TPP Replication Study for the full 12-hour version of *Reducing the Risk*. In particular, the TPP Replication Study reported an effect size of 0.13 standard deviations on a 12-item scale measuring support for contraceptive use among sexually active youth (Kelsey et al. 2016).

Students in the *Reducing the Risk* and control group schools had similar views concerning whether people their age should be abstinent. On a scale ranging from 1 to 4, with higher values indicating more support for abstaining from early sexual activity, students in both the *Reducing the Risk* and control schools had the same average score (2.90). A prior study by Zimmerman et al. (2008) of 9th-grade high school students in Cleveland, Ohio, and the Louisville, Kentucky, area found similar results for the standard version of *Reducing the Risk* on a two-item measure of attitudes toward waiting to have sex. In particular, the study found that students offered the standard version of *Reducing the Risk* were equally likely as students in the study's control schools to report support for waiting to have sex until they were older. Neither the original evaluation of *Reducing the Risk* from the early 1990s (Kirby et al. 1991) nor the TPP Replication Study (Kelsey et al. 2016) examined students' attitudes toward abstinence.

Reducing the Risk had no measurable effect on students' refusal skills, communication with parents, or intentions to have sex

Reducing the Risk and control group students reported similar levels of confidence in their ability to say no to sex under five hypothetical circumstances. Both research groups had very similar scores on a 4-point scale of perceived refusal skills, in which a score of 1 represents being not at all likely to be able to say no to sex under each of the five circumstances and 4 represents being very likely to be able to say no under all five circumstances. The *Reducing the Risk* students had an average scale score of 2.93 and the control group students had an average scale score of 2.88 (Table 5), consistent with reporting being somewhat likely to be able to say no in each of the five hypothetical situations. Similarly, *Reducing the Risk* and control group students were equally likely to report having talked with their parents about romantic relationships or sex (73 versus 70 percent) and to report intentions to have sexual intercourse in the next year (44 percent of both groups).

These findings are similar to those reported by the TPP Replication Study for the full 12-hour version of *Reducing the Risk* (Kelsey et al. 2016). For example, on a similar 4-point scale of perceived refusal skills, the TPP Replication Study reported an effect size of 0.06 standard deviations, comparable to the effect size found for Kentucky. For intentions, the TPP Replication Study found that 53 percent of the *Reducing the Risk* students and 51 percent of the control group students reported intentions to have sexual intercourse in the next year, somewhat higher than the rates found for Kentucky students (44 percent for both the *Reducing the Risk* and control

group students). The TPP Replication Study did not measure program impacts on communication with parents.

Reducing the Risk had no short-term effect on sexual risk behaviors

Reducing the Risk and control group students reported similar levels of recent sexual activity. At the one-year follow-up, 21 percent of students in both groups reported having had sexual intercourse in the past three months (Table 6). The two groups of students also reported similar levels of recent unprotected sex, with 12 percent reporting having had sexual intercourse without a condom in the past three months. Rates of sexual activity will likely increase among these students as they progress through high school. The two-year follow-up survey will allow for an analysis of whether an impact on these measures emerges as the prevalence of sexual activity among these students increases.

Table 6. 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 (%)	21	21	0	0.00
Had sexual intercourse without a condom in the past 3 months (%)	12	12	0	0.00
Sample size	870	1,133		

Source: Baseline and one-year 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.*

Discussion

The Kentucky Department of Public Health implemented *Reducing the Risk* in response to a perceived need for improved sex education among Kentucky high school students, including 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), methods of birth control (16 percent), or where to get birth control (9 percent). The students also had limited knowledge of the effectiveness of common methods of protection in reducing the risk of pregnancy and HIV. State and local administrators saw *Reducing the Risk* as having the potential to address these needs by supplementing the relatively limited sex education these students typically received with a more comprehensive school curriculum.

From that perspective, these results show that the program succeeded in achieving several of its targeted outcomes. During the study period, health educators from two local Kentucky health departments successfully adapted and delivered the curriculum to hundreds of high school students in their service regions. The health educators covered more than 90 percent of their planned activities and students in the study sample attended 93 percent of scheduled sessions. According to classroom observations and focus group reports, students were receptive to the material, especially those activities with interactive components. At the one-year follow-up

survey, students in the *Reducing the Risk* schools reported greater exposure to information on birth control than did students in the control schools. They also had better knowledge of contraception and STIs and expressed greater support when asked about the importance of condom use among sexually active youth. All of these findings align with the outcomes state and local health administrators had in mind when implementing the program.

What difference did the adaptation make?

In Kentucky, a main component of the adaptation involved shortening the curriculum from 12 to 8 instructional hours, to fit within the time local high schools had available for the program. The study findings show little evidence to suggest that the adaptations local health district staff made to the curriculum diminished the program's impacts on students' outcomes, at least in the short run. Indeed, the findings suggest that the adapted version of the curriculum produced impacts similar to what other organizations have achieved when implementing the full 12-hour curriculum. In particular, the interim impact report for the TPP Replication Study (Kelsey et al. 2016) found similar impacts of the full 12-hour curriculum on measures of students' knowledge and attitudes toward contraceptive use. In addition, both studies found limited or no evidence of short-term impacts on perceived refusal skills, intentions to have sex, and sexual risk behaviors.

More broadly, this study to evaluate an adapted version of *Reducing the Risk* in Kentucky also sought to address a more general need for evidence-based approaches to teen pregnancy prevention among youth in rural areas. Available evidence suggests that rural youth face a range of risk factors that could 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 the unique risks these youth might face, teen pregnancy prevention practitioners and researchers have developed and tested relatively few programs designed specifically for youth in rural areas (Goesling et al. 2014).

From this broader perspective, the evidence presented in this report reflects a more modest level of success for *Reducing the Risk*. Data from the one-year follow-up survey showed no short-term impacts on students' sexual risk behaviors. Students in the *Reducing the Risk* schools were as likely as students in the control schools to report having had sexual intercourse in the past three months (21 percent in both groups) or having had sexual intercourse without a condom in the past three months (12 percent in both groups). Similarly, the study findings showed no measurable impacts on students' intentions to have sex, attitudes toward abstinence, or perceived refusal skills.

The lack of program impacts on perceived refusal skills is especially notable, because *Reducing the Risk* places a strong emphasis on interactive activities and role-plays designed to build these types of skills. It is unlikely that the adaptations made to the curriculum fully explain the lack of program impacts on this outcome, as the federal TPP Replication Study reported similar results for the full 12-hour version of the curriculum (Kelsey et al. 2016). In addition, the health educators in Kentucky reported that students were very engaged in the role-play and small-group activities, and both the health educators and students reported viewing these activities as an important part of the program. However, a few health educators questioned whether all students were mature enough to approach the situations presented in some of the role-plays in a serious manner (Shapiro and Wood 2015). They 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." It is possible that the role-play activities would have had greater meaning among older students or those with higher rates of sexual activity.

The final impact report from this study, which is scheduled for release in 2018, will use data from the two-year follow-up survey to determine whether the program's short-term impacts on students' knowledge and attitudes were sustained over a longer period. It will also examine whether these short-term impacts led to longer-term changes in students' sexual risk behaviors. These longer-term impacts will provide a more definitive test of *Reducing the Risk* as a potential strategy for reducing sexual risk behaviors among youth in rural areas.

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Technical Appendix

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This appendix is a technical supplement to the early impact report of the implementation of an adapted version of *Reducing the Risk* in Kentucky, conducted as part of the Personal Responsibility Education Program 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 survey administration procedures and consent and response rates. The third and fourth sections of the appendix describe the outcome measures and analytic methods, respectively. The fifth section presents impact findings for key subgroups, and the last section presents impact findings for a select number of secondary outcomes.

Random assignment

For the evaluation of *Reducing the Risk*, the evaluation 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 evaluation 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 evaluation 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 had to assign all students in the same school to the same research group.

As discussed earlier in this report, the evaluation 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 to determine the schools that would offer *Reducing the Risk* during the 2013–2014 academic year occurred in summer 2013. The second round of random assignment to determine the schools that would offer *Reducing the Risk* during the 2014–2015 academic year occurred in summer 2014. 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 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 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 evaluation 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 more than offset any risk of attenuation bias resulting from possible contamination or spillover effects.

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.

STI = sexually transmitted infection.

n.a. = not applicable.

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 evaluation 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 evaluation 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 evaluation 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 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 over 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 evaluation 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. As discussed earlier in this report, 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 evaluation 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 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, but the difference between groups was not statistically significant. As discussed in greater detail below,

the evaluation team also 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.

Table A.2. Baseline characteristics for the full student sample

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 (%)			
9th	77	83	-6
10th	17	13	4
11th or 12th	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	30	-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 surveys and one-year follow-up surveys conducted by Mathematica Policy Research.

RtR = Reducing the Risk.

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

Survey administration

Students had to receive permission from a parent or guardian to participate in the study surveys. To facilitate the permission process, the evaluation 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 evaluation 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 evaluation 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 or not. In addition, each participating classroom received a $50 gift card from the evaluation 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 evaluation 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 evaluation 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 evaluation 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 evaluation 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. This report uses data only from the baseline and one-year follow-up surveys. A future report will examine data from the two-year follow-up survey. The evaluation team designed the surveys as paper-and-pencil questionnaires that the team administered during the regular school day. For the one-year follow-up survey, the evaluation team also completed a small proportion of surveys by telephone (four percent) 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 evaluation team also requested assent from the eligible students themselves before each round of surveys.

The evaluation 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 evaluation 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 evaluation 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 evaluation 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.

These survey procedures yielded generally high consent and survey response rates (Table A.3). 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 evaluation team based the impact estimates in this report on data for the 2,003 students who completed the one-year follow-up survey. This sample of 2,003 students represents 90 percent of the 2,222 students who received permission to participate in the study (Table A.3). The survey response rate among consented students was similar for students in the *Reducing the Risk* schools (89 percent) and control group schools (91 percent). The one-year follow-up survey response rate was also similar across the two research groups among all youth who were eligible for the study, including those who did not consent to participate. Of this larger group, 65 percent of youth in *Reducing the Risk* schools and 63 percent of youth in the control schools completed the first follow-up survey.

Table A.3. 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 12-month follow-up survey	870	1,133	2,003
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
Follow-up survey response rate (%):			
All eligible students	65	63	64
Consented students	89	91	90

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

RtR = *Reducing the Risk.*

Nonresponse to the one-year follow-up survey had little material effect on the similarity of students in the treatment and control groups (Table A.4). When examining baseline demographic and personal characteristics for only those students who completed a one-year follow-up survey, the evaluation 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 (7 versus 11 percent) and to report having had sex without a condom in the past three months (4 versus 6 percent). However, these differences were similar in magnitude to the differences observed for the full student sample (see Table A.3). To adjust for any marginal differences between the research groups, the evaluation team controlled for a limited number of baseline characteristics in the regression models used to estimate program impacts, as described in greater detail below.

Table A.4. Baseline characteristics for the analytic sample

Measure	RtR youth	Control youth	Difference
Demographics			
Age (%)			
14 or younger	66	71	-5
15	28	24	4
16 or older	5	4	1
Race/ethnicity (%)			
White, non-Hispanic	74	73	1
African American, non-Hispanic	11	13	-1
Hispanic	7	7	0
Other	7	7	0
Female (%)	51	50	1
Education			
Grade at study enrollment (%)			
9th	79	85	-6
10th	17	12	4
11th or 12th	3	2	2
Exposure to information			
Number of classes or sessions attended in the past year on (%):			
Relationships, dating, or marriage	15	19	-4
Abstinence	24	25	-1
Methods of birth control	16	15	1
Where to get birth control	8	8	0
Sexually transmitted infections (STIs)	34	33	2
Received information in the past year from a doctor, nurse, or clinic on (%):			
Methods of birth control	14	15	-1
Where to get birth control	11	11	-1
STIs	15	16	-1

Measure	RtR youth	Control youth	Difference
Knowledge, attitudes, skills, communication, and intentions			
Knowledge of contraception and STIs index (range: 0 to 4)	2.27	2.17	0.10
Support for abstinence scale (range: 1 to 4)	3.15	3.09	0.05
Support for condom use scale (range: 1 to 5)	4.45	4.42	0.03
Perceived refusal skills scale (range: 1 to 4)	2.88	2.80	0.08
Talked with parents in the past three months about romantic relationships and sex (%)	73	70	2
Intends to have sexual intercourse in the next year (%)	27	29	-2
Sexual risk behaviors			
Had sexual intercourse in the past three months (%)	7	11	-3*
Had sexual intercourse without a condom in the past three months (%)	4	6	-2+
Sample size	**870**	**1,133**	

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

In selecting outcome measures, the evaluation team sought to balance two competing demands. To provide a comprehensive assessment of the program, the team sought to identify a relatively broad range of outcomes that would sufficiently capture the breadth of topics covered in the curriculum sessions. However, such a focus on a very broad range of outcomes can increase the chances of identifying a spurious statistically significant impact (Schochet 2009). As discussed later in this appendix, the evaluation team deemed program impacts statistically significant if the associated *p*-value of the estimate fell below five percent, a common standard. A five percent chance of incorrectly identifying an estimated effect as a true impact is a relatively modest risk for a single test. However, the more outcomes examined, the more likely that at least one of the tests will estimate a spuriously statistically significant impact.

To balance these competing demands, the evaluation team began by identifying a set of seven outcome domains representing areas *Reducing the Risk* could affect: (1) exposure to information, (2) knowledge, (3) attitudes, (4) refusal skills, (5) communication with parents, (6) intentions, and (7) sexual risk behavior. Within each domain, the team then identified a limited number of outcomes to assess the impacts of the program within that domain. This approach met the demand for assessing impacts across a broad range of outcomes while also minimizing the total number of tests by focusing on a limited number of outcomes within each domain. The remainder of this section describes these outcomes in greater detail.

1. Exposure to information

The survey included a series of questions designed to assess students' exposure to information on reproductive health topics. The first question asked students how often they had attended any classes or sessions in the past 12 months on each of the following topics: (1) relationships, dating, or marriage; (2) abstinence from sex; (3) methods of birth control;

(4) where to get birth control; and (5) STIs. Response categories ranged from never to 10 or more times. The evaluation team assigned numerical values to each response category, then used the numerical values to construct a series of five continuous variables indicating the number of classes or sessions attended on each topic.

Using the same 12-month reference period, the survey also asked students how often they had received information from a doctor, nurse, or clinic on each of the following three topics: (1) methods of birth control, (2) where to get birth control, and (3) STIs. Response categories ranged from never to 10 or more times. The evaluation team used responses to this question to construct a series of three binary (yes/no) measures of whether the student had received information from a doctor, nurse, or clinic on each topic.

2. Knowledge

The evaluation 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 evaluation team coded each student as having provided either a correct or an incorrect response. The evaluation 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 zero to eight, with higher values indicating a greater number of correct responses.

3. Attitudes

The evaluation 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 evaluation 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 evaluation team first assigned each response category a number ranging from one to four. When assigning these numbers, the evaluation team organized the response categories for each statement so that higher values indicated greater support for abstinence. For students who responded to at least three of the four statements, the evaluation 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 one to four, with higher values indicating greater support for abstinence. The scale had high internal reliability at baseline (alpha coefficient = 0.77) and the one-year follow-up (alpha coefficient = 0.80).

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 evaluation 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 evaluation team first assigned each response category a number ranging from one to five. 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 one to five, 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 one-year follow-up (alpha coefficient = 0.86).

4.   Refusal skills

The evaluation 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 one for students who said they felt not at all likely to have the ability to say no and a score of four for students who said they felt very likely to have the ability to say no. The questions were adapted from a prior study by Cecil and Pinkerton (1998). For students who responded to at least four of the five questions, the evaluation 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 one to four, with higher values indicating greater perceived refusal skills. The scale had high internal reliability at baseline (alpha coefficient = 0.82) and the one-year follow-up (alpha coefficient = 0.82).

5.   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 evaluation 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.

6.   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 were: yes, definitely; yes, probably; no, probably not; and no, definitely not. The evaluation team used responses to this question to construct a binary measure indicating whether students said they definitely or probably intended to have sex.

7.   Sexual risk behavior

The evaluation team constructed two separate measures of sexual risk behavior. For one, the survey asked students if they had sexual intercourse in the past three months. The evaluation 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 evaluation 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 evaluation 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 evaluation 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 if 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 sex. For some of these students, the evaluation team could logically infer the students' sexual initiation status from their responses to these other survey questions. Similarly, if a student reported having had sex on the baseline survey but did not respond to the direct question on the follow-up survey, the evaluation 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 evaluation team coded the students' sexual initiation status as missing if the team could not make a clear determination of the status.

The evaluation team used this constructed measure of sexual initiation status when constructing the separate measures of recent sexual activity and unprotected sex. If the evaluation 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 non-response on the basis of sexual initiation status presents relatively little risk of bias for the impact estimates presented in this report.

To determine if these coding decisions materially changed the study findings, the evaluation 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 (Table A.5) 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.5. 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]	21	21	0	0.00
Alternative coding[b]	21	21	0	0.00
Had sexual intercourse without a condom in the past three months (%)				
Primary coding[a]	12	12	0	0.00
Alternative coding[b]	12	12	-1	-0.03
Sample size	**870**	**1,133**		

Source: Baseline and 12-month 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*.

Analytic methods

Two key features of the research design shaped the evaluation 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.

To account for these design features, the evaluation 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 evaluation team specified a linear regression predicting students' outcomes at the one-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 evaluation team deemed the impact estimates as "statistically significant" or "marginally significant" if the estimated *p*-value for the coefficient fell below five or ten percent, respectively, based on a two-tailed hypothesis test. To help interpret the magnitude of the reported impact estimates, the evaluation 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 evaluation 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 evaluation 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 evaluation 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 evaluation 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 evaluation team achieved a high response rate to the one-year follow-up survey, which minimized the missing data resulting from survey nonresponse. Second, the survey data also had low rates of item nonresponse—less than four percent for any one outcome. For the attitude scales and other outcomes constructed as combinations of items, the evaluation 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 is 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 evaluation team examined whether *Reducing the Risk* was more effective for certain subgroups of students. They 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 evaluation 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 evaluation team determined the required sample size for the evaluation assuming an analysis of the full student sample. Because of the smaller sample sizes, the reported impact estimates for subgroups of students might not have sufficient precision. Second, estimating impacts for different subgroups of students greatly increases the number of outcomes examined. As discussed earlier, the more outcomes examined, the more likely that at least one of the tests will find a spurious, statistically significant impact (Schochet 2009). In part to reduce the chances of reporting a spurious, statistically significant impact, the evaluation team specified the subgroup impacts as exploratory before the data analysis began.

Results of the analysis showed few differences in impacts across subgroups. For the subgroup analysis by gender (Table A.6), impacts varied between boys and girls for only one of the 16 outcome measures examined: receipt of information on STIs. For the subgroup analysis by baseline sexual experience (Table A.7), impacts varied for only 3 of the 16 outcome measures examined: (1) receipt of information on relationships, dating, or marriage, (2) receipt of information on methods of birth control, and (3) the rate of sexual intercourse in the past three months. For the subgroup analysis by health district (Table A.8), there were no statistically significant differences in impacts between the Barren River and Lincoln Trial districts. The small number of subgroup differences suggests that the impacts of *Reducing the Risk* did not vary systematically across student subgroups.

Table A.6. Subgroup impacts by gender

Measure	Full sample	Males	Females
Exposure to information			
Number of classes or sessions attended in the past year on:			
Relationships, dating, or marriage	-0.03	0.00	-0.11
Abstinence	0.25	0.34+	0.12
Methods of birth control	0.25	0.25	0.22
Where to get birth control	0.44**	0.32*	0.51**
Sexually transmitted infections (STIs) †	0.21	0.35+	0.06
Received information in the past year from a doctor, nurse, or clinic on (%):			
Methods of birth control	2	0	3
Where to get birth control	6**	6*	5+
STIs	3	-1	7*
Knowledge, attitudes, skills, communication, and intentions			
Knowledge of contraception and STIs index (range: 0 to 8)	0.69**	0.67**	0.75**
Support for abstinence scale (range: 1 to 4)	0.00	0.03	-0.01
Support for condom use scale (range: 1 to 4)	0.10**	0.06	0.15**
Perceived refusal skills scale (range: 1 to 4)	0.05	0.03	0.06
Talked with parents in the past three months about romantic relationships and sex (%)	3	4	2
Intends to have sexual intercourse in the next year (%)	0	0	-2
Sexual risk behaviors			
Had sexual intercourse in the past three months (%)	0	1	-2
Had sexual intercourse without a condom in the past three months (%)	0	0	-1
Sample size	**2,003**	**963**	**974**

Source: Baseline and 12-month 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.

Table A.7. Subgroup impacts by baseline sexual initiation status

Measure	Full sample	Had sex prior to baseline survey: Yes	No
Exposure to information			
Number of classes or sessions attended in the past year on:			
Relationships, dating, or marriage ††	-0.03	-0.60*	0.08
Abstinence	0.25	0.10	0.28+
Methods of birth control †	0.25	-0.24	0.33+
Where to get birth control	0.44**	0.23	0.49**
Sexually transmitted infections (STIs)	0.21	0.15	0.23
Received information in the past year from a doctor, nurse, or clinic on (%):			
Methods of birth control	2	-3	3
Where to get birth control	6**	8	5*
STIs	3	7	2
Knowledge, attitudes, skills, communication, and intentions			
Knowledge of contraception and STIs index (range: 0 to 8)	0.69**	0.50+	0.72**
Support for abstinence scale (range: 1 to 4)	0.00	-0.09	0.01
Support for condom use scale (range: 1 to 4)	0.10**	0.08	0.11**
Perceived refusal skills scale (range: 1 to 4)	0.05	0.04	0.05
Talked with parents in the past three months about romantic relationships and sex (%)	3	-2	4+
Intends to have sexual intercourse in the next year (%)	0	1	0
Sexual risk behaviors			
Had sexual intercourse in the past three months (%) †	0	8+	-1
Had sexual intercourse without a condom in the past three months (%)	0	3	-1
Sample size	**2,003**	**288**	**1,677**

Source: Baseline and 12-month 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.

Table A.8. Subgroup impacts by health district

Measure	Full sample	Barren River	Lincoln Trail
Exposure to information			
Number of classes or sessions attended in the past year on:			
Relationships, dating, or marriage	-0.03	0.02	-0.13
Abstinence	0.25	0.36	-0.02
Methods of birth control	0.25	0.32	0.04
Where to get birth control	0.44**	0.43*	0.37+
Sexually transmitted infections (STIs)	0.21	0.25	0.02
Received information in the past year from a doctor, nurse, or clinic on (%):			
Methods of birth control	2	-1	5+
Where to get birth control	6**	3	8**
STIs	3	3	2
Knowledge, attitudes, skills, communication, and intentions			
Knowledge of contraception and STIs index (range: 0 to 8)	0.69**	0.83**	0.45+
Support for abstinence scale (range: 1 to 4)	0.00	-0.01	0.01
Support for condom use scale (range: 1 to 4)	0.10**	0.07	0.11*
Perceived refusal skills scale (range: 1 to 4)	0.05	0.04	0.06
Talked with parents in the past three months about romantic relationships and sex (%)	3	3	2
Intends to have sexual intercourse in the next year (%)	0	1	-1
Sexual risk behaviors			
Had sexual intercourse in the past three months (%)	0	1	-1
Had sexual intercourse without a condom in the past three months (%)	0	0	-2
Sample size	**2,003**	**1,147**	**856**

Source: Baseline and 12-month 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.

Impacts on secondary outcomes

As discussed earlier, to reduce the chances of finding a spurious, statistically significant impact of *Reducing the Risk*, the evaluation team limited the number of outcome measures it examined in the main body of the report. As an additional exploratory analysis, the team also 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.9). 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 seven of the eight questions. For these seven questions, the magnitude of the impact ranged from 8 to 14 percentage points. For the communication questions, the secondary impact findings show that students in the *Reducing the Risk* schools were somewhat more likely than control group students to report talking with their parents about romantic relationships (66 versus 62 percent). Impacts for the other two communication questions were small and did not reach statistical significance. For the measures of sexual risk behaviors, the secondary impact findings showed no statistically significant differences for any of the six secondary outcomes examined.

Table A.9 Impacts on secondary outcomes

Measure	RtR youth	Control youth	Impact	Effect size
Knowledge				
Correctly answered question on: (%)				
Condoms and risk of pregnancy	68	59	9**	0.23
Condoms and risk of getting HIV	52	44	8**	0.19
Birth control pills and risk of pregnancy	64	51	14**	0.34
Birth control pills and risk of getting HIV	61	57	3	0.08
Female-to-male transmission of HIV when condoms are used	87	79	8**	0.35
Risk of getting HIV from people you know well	71	61	10**	0.26
Protective methods against HIV	60	48	13**	0.31
Getting STIs from oral sex	81	73	8**	0.28
Communication with parents				
Communication with parents about: (%)				
Romantic relationships	66	62	4+	0.09
How to resist pressures to have sex	34	33	1	0.03
Whether the student should be having sex	43	42	1	0.04
Sexual risk behavior				
Ever had sexual intercourse (%)	29	30	-1	-0.02
Had sexual intercourse without any effective contraceptive method in past three months (%)	8	8	0	0.02
Had multiple sexual partners (%)	16	15	1	0.06
Ever had oral sex (%)	32	33	-1	-0.02
Had oral sex in past three months (%)	22	22	1	0.03
Had oral sex without a condom in past three months (%)	19	17	2	0.09
Sample size	**870**	**1,133**		

Source: Baseline and 12-month 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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