

How Do Teens' Romantic Relationship Skills, Knowledge, and Attitudes Change with Age?



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How Do Teens' Romantic Relationship Skills, Knowledge, and Attitudes Change with Age?

December 2022

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Overview

Introduction

Healthy marriage and relationship education (HMRE) programs for youth provide youth education on relationships through classroom-based curricula. Commonly used curricula cover topics such as knowing when you are ready for a relationship, understanding the difference between healthy and unhealthy relationships, avoiding teen dating violence, communicating effectively, and managing conflict. Some but not all curricula provide information on decision making about sexual activity and ways to avoid teen pregnancy and sexually transmitted infections.

However, teens also receive information on romantic relationships from many other sources, including their friends and families, the Internet, classmates, social media, and through their own relationship experiences. In addition, the participants in an HMRE program for youth might start the program with differences in their baseline relationship skills, knowledge, and attitudes. For HMRE programs to have their intended effects, curriculum developers and program providers need evidence on which relationship skills, knowledge, and attitudes teens are likely to develop on their own, and which can benefit from the support of an HMRE program.

Primary Research Questions

This study used longitudinal survey data collected from 595 high school students to address three interrelated research questions about changes in teens' romantic relationship skills, knowledge, and attitudes in middle and late adolescence:

- How do teens' romantic relationship skills, knowledge, and attitudes change with age?
- What predicts (1) differences in teens' romantic relationship skills, knowledge, and attitudes and (2) their changes with age?
- How do differences in teens' romantic relationship skills, knowledge, and attitudes—and their changes with age—relate to later relationship experiences?

Purpose

This report describes findings from an analysis of how teens' romantic relationship skills, knowledge, and attitudes change with age. The analysis was based on longitudinal survey data collected from 595 high school students who participated in an impact study of an HMRE program in two Atlanta-area high schools. For this analysis, we used data for only students randomly assigned to the impact study's control group. The report highlights key findings from the analysis and discusses their implications for HMRE programming and research. It also documents the study data, sample, and methods. The study was conducted by Mathematica as part of the Strengthening Relationship Education and Marriage Services (STREAMS) evaluation for the Administration for Children and Families in the U.S. Department of Health and Human Services.

What we learned

- For seven of the eight measures included in the analysis, we found that teens' relationship skills, knowledge, and attitudes changed from when they were in middle adolescence to when they were in late adolescence. For most of the measures, the direction of the change aligned with the intended

outcomes of common HMRE curricula. For about half of the measures, teens also differed from each other in how fast or slow the changes took place.

- Some of the teens' demographic and personal characteristics predicted their initial relationship skills, knowledge, and attitudes in middle adolescence, but they did not consistently predict how teens' skills, knowledge, and attitudes changed with age. Therefore, teens who started off lower or higher on these measures likely retained their relative position compared to their peers.
- Of the eight measures included in the analysis, perceived conflict management skills and one of two measures of attitudes toward adolescent sexual activity most consistently predicted teens' subsequent relationship experiences during late adolescence.

Methods

As part of a random assignment impact study of an HMRE program in two Atlanta-area high schools, students completed three rounds of surveys: (1) a baseline survey administered at study enrollment, (2) a one-year follow-up survey, and (3) a three-year follow-up survey. For the analysis in this report, we combined data from these three surveys for 595 students assigned to the study's control group. Most of the data captured youth ages 14–18, corresponding to when they were 9th through 12th grade students. We used the longitudinal data to estimate a series of mixed-effects growth models, a type of regression model appropriate for estimating change in individual outcomes over time. We also calculated predicted values from these models to examine the association between the predicted values and students' relationship outcomes at the time of the study's three-year follow-up survey.

Considerations for HMRE programming and research

For HMRE curriculum developers and program providers, the study findings highlight the importance of identifying and addressing the romantic relationship skills, knowledge, and attitudes most in need of intervention. Our results suggest that even without intervention, many of teens' relationships skills, knowledge, and attitudes are likely to change with age in the direction intended by HMRE programs. HMRE programs can further support teens' development by (1) identifying and addressing the specific skills, knowledge, and attitudes teens are less likely to develop on their own and (2) helping teens develop their relationship skills, knowledge, and attitudes at an earlier age or faster rate than they would on their own.

Results from this study also highlight the importance of accounting for teens' varying levels of relationship skills, knowledge, and attitudes. We found that teens enter high school with different relationship skills, knowledge, and attitudes based on their demographic and personal characteristics. For some of these skill, knowledge, and attitude measures, we also found that they change at different rates. This finding raises the possibility that different types of program content might resonate with some youth more than others; youth might have different interests and needs in the education they receive; and HMRE programs might affect youth in different ways, thus making it important to account for possible variation in impacts across youth. HMRE curriculum developers and program providers should account for this possibility when they design and implement HMRE programs.

Introduction

Healthy marriage and relationship education (HMRE) programs for youth provide youth education on relationships through classroom-based curricula. Commonly used curricula cover topics such as knowing when you are ready for a relationship, understanding the difference between healthy and unhealthy relationships, avoiding teen dating violence, communicating effectively, and managing conflict (Scott and Huz 2020). Some but not all curricula provide information on decision making about sexual activity and ways to avoid teen pregnancy and sexually transmitted infections (STIs). Since the mid-2000s, the federal government has funded HMRE programs for youth through the competitive Healthy Marriage grant program administered by the Office of Family Assistance in the Administration for Children and Families (ACF) at the U.S. Department of Health and Human Services. To date, the state and local organizations funded by these grants have provided HMRE programming to more than 80,000 youth around the country (Avellar et al. 2020; Scott et al. 2017).

For HMRE programs to have their intended effects, curriculum developers and program providers need foundational evidence on how teens' romantic relationship skills, knowledge, and attitudes change with age, and relate to other personal characteristics and relationship experiences. HMRE programs aim to teach youth about healthy relationships and the skills they need to develop and maintain them. However, teens receive information on romantic relationships from many sources, including their friends and families, the Internet, classmates, social media, and through their own relationship experiences. For HMRE programs to have their intended effects, curriculum developers and program providers need evidence on which relationship skills, knowledge, and attitudes teens are likely to develop on their own, and which can benefit from the support of an HMRE program. In addition, the participants in an HMRE program for youth might start the program with differences in their baseline relationship skills, knowledge, and attitudes. For example, there might be differences in these areas between males and females or based on family relationships or past romantic relationship experiences. If so, the program content might have more relevance and meaning to certain groups of youth and the potential to impact their outcomes in different ways. Evidence on differences in teens' relationship skills, knowledge, and attitudes can help curriculum developers and program providers understand what types of information to provide different groups of youth.

To provide evidence on these issues, ACF's Office of Planning, Research, and Evaluation, with funding from the Office of Family Assistance, contracted with Mathematica to conduct an analysis of teens' relationship skills, knowledge, and attitudes. As discussed in this report, the analysis sought to examine (1) how these skills, knowledge, and attitudes change with age; (2) the predictors of differences in teens' romantic relationship skills, knowledge, and attitudes, and their changes with age; and (3) how these differences and their changes with age relate to their later relationship experiences. To examine these issues, we analyzed longitudinal data collected at three timepoints from 595 high school students for a study of an HMRE program conducted as part of the Strengthening Relationship Education and Marriage Services (STREAMS) evaluation (see box).

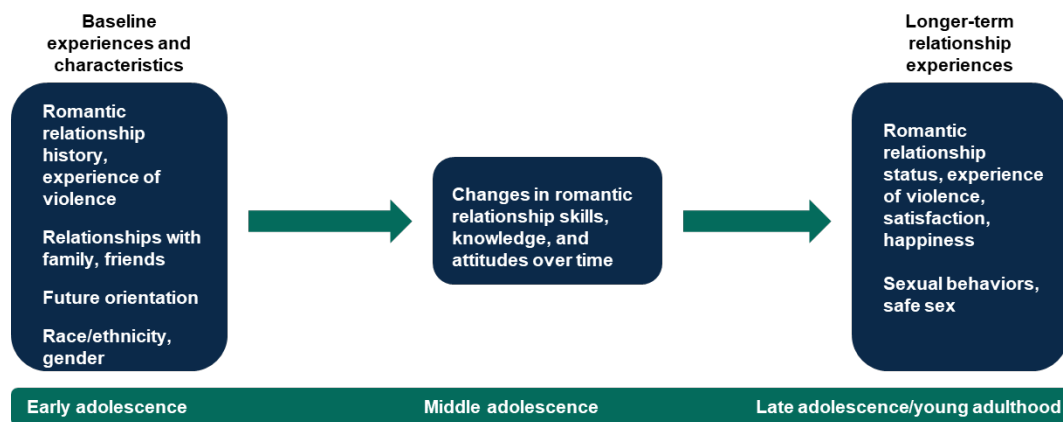
About the STREAMS evaluation

Since the early 2000s, the Administration for Children and Families (ACF) in the U.S. Department of Health and Human Services has led a sustained effort to expand the available evidence on healthy marriage and relationship education (HMRE) programs. In 2015, ACF contracted with Mathematica and its partner, Public Strategies, to conduct the Strengthening Relationship Education and Marriage Services (STREAMS) evaluation to identify strategies for improving the delivery and effectiveness of HMRE programs. The evaluation has a particular emphasis on understudied populations and program approaches not covered in ACF's prior federal evaluations. STREAMS includes in-depth process studies, random assignment impact studies, a rapid-cycle evaluation of text message reminders to improve attendance at HMRE group workshops, a formative evaluation of a facilitation training curriculum for HMRE programs for high school students, and predictive analytic modeling of attendance at HMRE group workshops. Learn more about the evaluation at <https://www.acf.hhs.gov/opre/research/project/strengthening-relationship-education-and-marriage-services-streams>.▲

Literature Review

Our analysis is informed by prior research on teens' relationship skills, knowledge, and attitudes, and how they are expected to change with age (Figure 1). We draw on research examining (1) how teens' relationship skills, knowledge, and attitudes relate to baseline experience and characteristics, (2) how they change with age, and (3) how teens' characteristics and changes in relationship skills, knowledge, and attitudes relate to longer-term relationship experiences. Below, we briefly discuss the existing literature for each of these three areas of research. Taken together, we theorized that our focal interest—changes in romantic relationship skills, knowledge, and attitudes—are both (1) predicted by baseline experiences and characteristics and (2) predictive of longer-term relationship and sexual behavior outcomes (Figure 1).

Figure 1. Theorized changes in teens' skills, knowledge, and attitudes



Baseline experience and characteristics

Several studies have examined how teens' personal characteristics and experiences relate to their relationship skills, knowledge, and attitudes. For example, studies have examined how teens' attitudes toward marriage vary according to personal characteristics such as gender, race/ethnicity, family structure, and where they grew up (Goesling and Alamillo 2018; Wood et al. 2008). Most teens express

general positive attitudes toward marriage, regardless of their racial and ethnic background. However, on average, boys express more positive attitudes toward marriage than girls do. Teens who live with both of their biological parents and those who grew up in rural areas also express more positive attitudes. Studies have also demonstrated associations between parent-adolescent relationship quality and adolescents' attitudes toward sex (Shneyderman and Schwartz 2012). Teens who report having higher quality relationships with their parents are more likely to have disapproving attitudes toward sex. Adolescents' prior relationship experiences are also associated with romantic relationship attitudes. For example, prior experience of violence is associated with more accepting attitudes of dating violence during young adulthood (Copp et al. 2019). Characteristics such as future orientation—defined as the ability to set future plans and goals—might also relate to teens' relationship skills and attitudes (Lindstrom Johnson et al. 2014). For example, youth who think more about the future might view relationship problems or teen pregnancy as a threat to their academic or future career goals. Therefore, they might also express less support for adolescent romantic relationships and greater disapproval of adolescent sexual activity.

Changes in teens' romantic relationship skills, knowledge, and attitudes

Researchers generally expect a person's relationship skills, knowledge, and attitudes to change in adolescence. For example, in part due to structural and functional changes in the brain, adolescents develop new skills for managing conflict and navigating interpersonal relationships (Albert et al. 2013). Similarly, teens' attitudes toward romantic relationships change as these relationships become more common and central to their lives. As one example, evidence indicates that disapproval of teen dating violence increases across the high school years (Karlsson et al. 2018; Orpinas et al. 2013). Consistent with these expectations, prior evaluations of HMRE programs for youth have often found improvements in teens' relationship skills, knowledge, and attitudes around the time the program ended (McElwain et al. 2017; Simpson et al. 2018).

However, research also suggests the possibility that teens' relationship skills, knowledge, and attitudes change at different rates depending on other personal characteristics and experiences. For example, given evidence that teens' relationship attitudes vary according to personal characteristics such as gender, family structure, and where they grew up (Goesling and Alamillo 2018; Wood et al. 2008), their attitudes might also change at different rates based on these characteristics. As another example, supportive family and peer relationships can help increase the development of effective interpersonal skills and prepare teens for more positive healthy romantic relationship experiences later (Schacter et al. 2019). Alternatively, having a negative or unhealthy relationship experience in adolescence might slow the development of effective relationship skills or foster negative attitudes toward future relationships.

Connections to longer-term relationship experiences and outcomes

Researchers study teens' relationship skills, knowledge, and attitudes in part because of their potential consequences for longer-term relationship experiences and outcomes. Many teens experience their first romantic relationship in high school. For instance, in 2021, 41 percent of high school seniors reported recent or current dating (Miech et al. 2022). Young adults and high schoolers who have had a romantic relationship report higher levels of dating competence, whereas those without romantic relationship experience indicate higher levels of social anxiety about dating (La Greca and Mackey 2007; Lesure-Lester 2001). Teen relationship experiences are also associated with subsequent behaviors and attitudes. For instance, early romantic relationship quality is a strong predictor of current and future physical and mental health (Braithwaite et al. 2010; Davila et al. 2017; Gómez-López et al. 2019). In addition, prior experience with interpersonal violence (which includes both family violence and dating violence) is

associated with an increased risk of dating violence and more accepting attitudes of dating violence in adulthood (Copp et al. 2019).

Changes in teens' relationship skills, knowledge, and attitudes might interact with these associations in several ways. Teens who develop relationship skills more quickly or begin adolescence with greater skills might have a protective advantage that leads to more positive relationships outcomes. Conversely, teens who begin adolescence with fewer relationship skills or develop these skills more slowly might have a heightened risk of negative or unhealthy relationship outcomes. For instance, although disapproval of teen dating violence tends to increase with age (Karlsson et al. 2018; Orpinas et al. 2013), the change might happen at different times or rates. If these attitudes relate to the chances of experiencing relationship violence during the late teen years (Flood and Pease 2009), teens whose attitudes change more slowly or at a later age might face a greater risk of relationship violence as late teens or young adults. Similarly, studies show that teens' attitudes toward contraception predict their contraceptive behavior as adults (Guzzo and Hayford 2018). If so, the rate at which teens learn about contraception and develop protective attitudes and decision-making skills might also predict their adult contraceptive use.

Research Questions

For this analysis, we aimed to add to the research literature on teens' romantic relationship skills, knowledge, and attitudes. As described in the methods section below, we analyzed longitudinal data collected at three timepoints from 595 high school students. Therefore, the analysis focused on the period of middle to late adolescence, when HMRE programs for youth are commonly offered (Avellar et al. 2020; Scott et al. 2017). The analysis addressed the following three research questions:

1. **How do teens' romantic relationship skills, knowledge, and attitudes change with age?** To what extent do these changes vary among teens?
2. **What predicts differences in teens' romantic relationship skills, knowledge, and attitudes, and their changes with age?** Specifically, do gender, race and ethnicity, earlier relationship experiences, relationships with parents and friends, or future orientation predict differences in teens' skills, knowledge, and attitudes, and their changes with age?
3. **How do differences in teens' romantic relationship skills, knowledge, and attitudes, and their changes with age relate to later relationship experiences?** Specifically, do teens with higher levels or greater changes in relationship skills, knowledge, and attitudes have different relationship experiences later in adolescence?

Study Design

Sample

To conduct this analysis, we used longitudinal survey data collected from 595 high school students who participated in an impact study of an HMRE program conducted by Mathematica for the STREAMS evaluation (Alamillo and Goesling 2021; Baumgartner and Zaveri 2018). For two consecutive school years (2016–2017 and 2017–2018), members of the STREAMS evaluation team worked with More Than Conquers, Inc. (MTCI), a not-for-profit organization located near Atlanta, Georgia, to enroll students in the impact study from the health classes of two public high schools in the Atlanta area. Across the two schools, the study team invited students from 61 health classes to participate in the study. A total of 1,836 students received permission from a parent or guardian to participate, representing about 92 percent of all eligible students. For the longitudinal analysis presented in this report, we restricted the sample to the

subset of students assigned to the study's control group (n = 600). Students in this group did not receive any HMRE programming as part of the impact study. We also excluded a small number of students (n = 5) who did not respond to any of the study surveys.

The 595 students in our analysis are reflective of the two schools in the STREAMS impact study but were not intended to represent a broader population of teens or all teens nationwide. As shown in Table 1, most students were 9th graders when they enrolled in the study and contributed baseline data (87 percent) but some students were in higher grades (13 percent). We included students of all ages in our primary analysis but found similar results when limiting the sample to the most common ages (as described in greater detail later in this report). The students were split about evenly between males (53 percent) and females (47 percent). More than half of the students identified as Hispanic (57 percent) and described their family's primary language as Spanish (42 percent) or a language other than English (10 percent). Most students said they either lived with both of their biological parents (52 percent) or with their biological mother only (38 percent). About one-third (31 percent) said they were currently in a romantic relationship when they enrolled in the study.

Table 1. Student characteristics and experiences at baseline

Measure	Percentage
Grade in school	
9th grade	87
10th grade or higher	13
Gender	
Male	53
Female	47
Race and ethnicity	
Hispanic	57
Black, non-Hispanic	26
White, non-Hispanic	5
Other	12
Born outside of the United States	16
Primary language spoken at home	
English	48
Spanish	42
Other	10
Living arrangements	
Lives with both biological parents	52
Lives with biological mother only	38
Lives with biological father only	4
Lives with neither biological parent	6
Biological parents are currently married	52
Baseline characteristics and experiences	
Currently in a relationship	31
Currently in an aggressive relationship	22

Measure	Percentage
Relationship quality with parents	2.95 ^a
Relationship quality with friends	2.69 ^a
Career planning expectations	2.39 ^a
Sample size	595

Source: Baseline survey conducted by Mathematica.

Note: Percentages may not sum to 100 due to rounding.

^a Scale ranges from 1-4. See Table 2 for more scale information.

Data collection

For each of the 595 students included in our analysis, we used data from up to three surveys administered as part of the STREAMS impact study:

1. **Baseline survey.** Soon after students enrolled in the study, members of the study team administered a baseline survey in school during health class using tablet computers. The survey collected information on students' demographics; family backgrounds; perceived skills, knowledge, and attitudes; and relationship experiences. Of the students in the study's control group who received permission for the study, nearly all (99 percent) completed the baseline survey.
2. **One-year follow-up survey.** About one year after the baseline survey, the study team contacted students to complete a one-year follow-up survey. The team administered most of the surveys in school using tablet computers. For students who were unavailable to complete the survey in school or had moved to a different school, the team attempted to contact them outside of school to administer the survey by telephone. The one-year survey collected information on teens' attitudes, perceived skills, and relationship experiences in the year following the program. The evaluation team obtained responses from 87 percent of students in the study's control group.
3. **Three-year follow-up survey.** About three years after the baseline survey, the study team contacted students to complete a longer-term follow-up survey. The team initially planned to administer this survey during the 2019–2020 school year, when students were in 11th or 12th grades. However, because of the COVID-19 pandemic and associated disruptions, data collection for some students extended into summer and fall 2020. As a result, on average, students completed the survey about three years (34.4 months) after the baseline survey, and most respondents (59 percent) were in 12th grade when they completed it. By comparison, 26 percent of survey respondents were in 11th grade and 13 percent were in college or no longer enrolled in school. Also because of the COVID-19 pandemic, data from the survey were primarily collected online or by telephone, rather than in person. The survey collected information on students' attitudes, perceived skills, and relationship experiences three years following the program. The survey had an overall response rate of 72 percent for students in the study's control group.

The STREAMS impact study reports provide additional information on these surveys and the study team's survey administration procedures (Alamillo and Doran 2022; Alamillo and Goesling 2021).

Measures

To examine how teens' relationship skills, knowledge, and attitudes change with age (Research Question 1), we constructed eight separate outcome measures from the STREAMS impact study surveys (Table 2). In selecting these measures, we were limited to those the STREAMS impact study team had included in

the baseline and follow-up surveys. However, by design, these measures capture some of the key outcomes of HMRE programs for youth that the programs aim to improve. For more details on the measures, including reliability statistics for multi-item scales, see the appendix to this report.

Table 2. Measures of teens' relationship skills, knowledge, and attitudes

Outcome	Measure
Relationship skills	
Perceived general relationship skills	Continuous scale variable: Average of responses to six survey questions; each question asked teens to report their level of agreement with a statement such as, "I believe I will be able to effectively deal with conflicts that arise in my relationship" or "I have the skills needed for a lasting, stable romantic relationship"; questions are a subset of items from the Relationship Deciding Scale (Vennum and Fincham 2011); scale values range from 1 to 4, with higher values indicating greater perceived relationship skills.
Perceived conflict management skills	Continuous scale variable: Average of responses to five survey questions; each question asked teens to report their perceived ability to perform certain conflict management skills, such as listening to another person's opinion during a disagreement or working through problems without arguing; adapted from the Conflict Management Subscale of the Interpersonal Competence Scale (Buhrmester et al. 1988); scale values range from 1 to 4, with higher values indicating greater perceived skills.
Relationship knowledge and attitudes	
Disapproval of teen dating violence	Continuous scale variable: Average of responses to 12 survey questions; each question asked teens to report their level of disagreement with a statement such as, "A boy angry enough to hit his girlfriend must love her very much" and "There are times when violence between dating partners is okay"; taken from the Acceptance of Couple Violence Scale (Dahlberg et al. 2005); scale values range from 1 to 4, with higher values indicating greater disapproval of teen dating violence.
Disagreement with unrealistic relationship beliefs: One true love	Categorical variable: Reported level of disagreement with the statement, "There is only one true love out there who is right for me to marry"; taken from the Attitudes About Romance and Mate Selection Scale (Cobb et al. 2003) and used in a prior evaluation of Relationship Smarts PLUS (RQ+) by Kerpelman and colleagues (2009); variable ranges from 1 to 4, with higher values indicating stronger disagreement.
Disagreement with unrealistic relationship beliefs: Love should be enough	Categorical variable: Reported level of disagreement with the statement, "In the end, feelings of love should be enough to sustain a happy marriage"; taken from the Attitudes About Romance and Mate Selection Scale (Cobb et al. 2003) and used in a prior evaluation of RQ+ by Kerpelman and colleagues (2009); variable ranges from 1 to 4, with higher values indicating stronger disagreement.
Disagreement with unrealistic relationship beliefs: Living together improves chances	Categorical variable: Reported level of disagreement with the statement, "Living together before marriage will improve a couple's chances of remaining happily married"; taken from the Attitudes About Romance and Mate Selection Scale (Cobb et al. 2003) and used in a prior evaluation of RQ+ by Kerpelman and colleagues (2009); variable ranges from 1 to 4, with higher values indicating stronger disagreement.
Disapproval of adolescent sexual activity: In love	Categorical variable: Reported level of disagreement with the statement, "Two people who are in love do not need to use condoms/birth control"; taken from the Child Trends 3M project; variable ranges from 1 to 4, with higher values indicating stronger disagreement.
Disapproval of adolescent sexual activity: At my age	Categorical variable: Reported level of disagreement with the statement, "At my age right now, it is okay to have sexual intercourse if I use protection, like a condom, the pill, etc."; taken from the Child Trends 3M project; variable ranges from 1 to 4, with higher values indicating stronger disagreement.

To examine the predictors of differences in teens' romantic relationship skills, knowledge, and attitudes, and their changes with age (Research Question 2), we constructed seven measures of teens' personal characteristics and experiences from the STREAMS baseline survey (Table 3). We selected these measures based on the findings of past research and our theorized model of how teens' baseline characteristics and experiences might relate to subsequent changes in their relationship skills, knowledge, and attitudes (described earlier in the report). For more details on these measures, including reliability statistics for multi-item scales, see the appendix to this report.

Table 3. Baseline measures of teens' personal characteristics and experiences

Characteristics	Measure
Demographics	
Gender	Binary variable: Coded "1" for students who identified as female, "0" for students who identified as male, and "missing" for students who did not respond or selected "don't know" to this survey question.
Race/ethnicity	Categorical variable: Combination of responses to two of the following two survey questions: (1) "What is your ethnicity?" and (2) "Which one best describes your race?" The resulting variable was coded "0" if they responded "Hispanic or Latino" to the first question; "1" if they responded "American Indian or Alaska Native," "Asian," "Native Hawaiian or other Pacific Islander," or "Other"; "2" if they responded "Black or African American"; and "3" if they responded "White."
Future orientation	
Career planning and expectations	Continuous scale variable: Average of responses to six survey questions; each question asked students to report their level of agreement with a statement about career planning and outcome expectations, such as, "I have a plan for reaching my future career goals." This scale is a subset of items adapted from the Personal Responsibility Education Program (PREP) Multi-Component Evaluation. Variable ranges from 1 to 4, with higher values indicating higher prioritization of future career.
Romantic relationship experiences	
Currently in a romantic relationship	Binary variable: Coded "1" for students who described their current relationship status as "Seriously dating" or "Casually dating," coded "0" for students who described their current relationship status as "Not currently in a relationship or dating," and coded "missing" for students who did not respond to the survey questions.
Currently in a verbally aggressive romantic relationship	Binary variable: Coded "1" for students in a current romantic relationship who reported experiencing any of six types of verbal aggression in their relationship, such as having a partner insult or swear at them. Coded "0" for students with no exposure to relationship aggression, including (1) students not currently in a relationship and (2) students in a current relationship without verbal aggression.
Relationship quality with parents and friends	
Relationship quality with parents	Continuous scale variable: Average of responses to three survey items; each question asked students to report how they felt about their relationship with their parents, such as "In the past month, how often did you feel like you could count on at least one of your parents to be there when you needed them?" Questions were a subset of items from the Parent-Adolescent Relationship Inventory (Lippman et al. 2014). Scale values range from 1 to 4, with higher values indicating greater relationship quality.
Relationship quality with friends	Continuous scale variable: Average of responses to three survey items; each question asked students to report how they felt about their relationship with their friends, such as "In the past month, how often did you feel like you could count on your friends to be there when you needed them?" Questions were a subset of items adapted from the Parent-Adolescent Relationship Inventory (Lippman et al. 2014). Scale values range from 1 to 4, with higher values indicating greater relationship quality.

To examine how differences in teens' romantic relationship skills, knowledge, and attitudes and their changes with age relate to later relationship experiences (Research Question 3), we used data from the STREAMS three-year follow-up survey to measure six outcomes related to teens' relationship experiences and the quality of their relationships (Table 4). One of the six measures captured students' relationship status at the time of the three-year follow-up survey. Three of the measures captured the quality of their relationships at the time of the three-year follow-up survey. The last two measures captured their reported experience with sexual activity at the time of the three-year follow-up survey. For more details on the measures, see the appendix to this report.

Table 4. Measures of teens' relationship experiences

Outcome	Measure
Currently in a romantic relationship	Binary variable: Coded "1" for students who described their current relationship status as "Seriously dating" or "Casually dating," coded "0" for students who described their current relationship status as "Not currently in a relationship or dating," and coded "missing" for students who did not respond to the survey question.
Satisfaction with current relationship	Continuous scale variable for students who reported a current romantic relationship: Average of responses to three survey questions; each question asked students to report their level of agreement with a statement such as, "I can turn to my partner for advice about problems." Questions were adapted from an evaluation of the <i>Love Smarts</i> curriculum (Kerpelman et al. 2009). Scale values range from 1 to 4, with higher values indicating greater relationship satisfaction with the current relationship. Teens who reported not being in a romantic relationship were not asked this question and therefore were coded "missing" for this variable.
Happiness with current relationship	Continuous scale variable for students who reported a current romantic relationship: Scale ranges from 0 to 10, with higher values indicating that the student reported greater happiness with his or her romantic relationship. This measure was adapted from a similar one used in the Parents and Children Together study (Moore et al. 2018). Teens who reported not being in a romantic relationship were not asked this question and therefore were coded "missing" for this variable.
Currently in an unhealthy relationship	Binary variable: Coded "1" for students in a current romantic relationship who reported experiencing any of three indicators of an unhealthy relationship, such as having a partner try to keep them from seeing or talking to their friends. Coded "0" for students with no exposure to an unhealthy relationship, including students not currently in a relationship. This measure was adapted from a similar one used in the Supporting Healthy Marriage evaluation (Hsueh et al. 2012).
Ever had sex	Binary variable: Coded "1" for students who reported having ever had sexual intercourse, coded "0" for students who reported never having had sexual intercourse, and coded "missing" for students who did not respond to the question.
Had sex without condoms in last three months	Binary variable: Coded "1" for students who reported having had sexual intercourse without a condom in the past three months, coded "0" for students who reported always using condoms or not having had sexual intercourse in the past three months, and coded "missing" for students who did not respond to the question.

Analysis

For this analysis, we combined data for all 595 students and all three surveys (baseline, one-year follow-up, and three-year follow-up) into a single longitudinal data file. For most students, we had survey data for all three surveys. However, we also included data for students who responded to only one or two surveys. In the combined data file, most of the data (95 percent) captured students ages 14–18, the typical age range for high school students. However, because students were different ages when they enrolled in the study and completed the follow-up surveys, the combined file also captured some students at younger ages (12 or 13) or older ages (19 to 23). We included data for all ages in our main analysis but also

checked the robustness of our results when limiting the data to ages 14 to 18. We found that limiting the data to these ages led to no substantial difference in the results. See the appendix to this report for more detailed information.

Research Question 1: How do teens' romantic relationship skills, knowledge, and attitudes change with age?

To answer our first research question, we used data from our combined data file to examine whether and how each of our eight outcome measures (shown earlier in Table 2) changed with age. To conduct this analysis, we estimated a series of mixed-effects growth models, a type of regression model appropriate for estimating change in individual outcomes over time (Grimm et al. 2017). For each outcome, we first estimated a “no-growth” model, which assumes stability in the outcome over time. Then we estimated a linear growth model, which allows for linear change in the outcome over time. For the linear growth model, we specified time as age in years, starting from age 14 as zero on the time scale. For each outcome, we compared results from the no-growth and linear growth models to determine which provided a better fit for the data (as defined by the change in the log likelihood ratio relative to the difference in the number of estimated parameters). If this comparison showed that the linear growth model provided a better fit, we concluded that the outcome demonstrated evidence of change with age.

For these outcomes, we used findings from the linear growth model to estimate the average annual change in the outcome. We used these estimates to help interpret the magnitude of change for each outcome. We also assessed the degree to which the rate of change for individual students in our sample differed from the average. Looking only at the average rate of change could mask substantial differences across students. We checked for this possibility in the linear growth models by examining random effects for the age variable. If we found that the estimated growth model was singular with the addition of a random effect, or that the 95 percent confidence interval bound for the random effect included zero, we concluded that the estimated average annual change was generally similar across students. Conversely, if we found that the 95 percent confidence interval bound for the random effect did not include zero, we concluded that students varied in their rates of change.

Research Question 2: What predicts differences in teens' romantic relationship skills, knowledge, and attitudes, and their changes with age?

To answer our second research question about the predictors of teens' romantic relationship skills, knowledge, and attitudes, we added baseline covariates to each linear growth model estimated for Research Question 1. As shown earlier in Table 3, we included covariates for (1) gender, (2) race/ethnicity, (3) relationship status, (4) unhealthy relationship status, (5) relationship quality with parents, (6) relationship quality with friends, and (7) career planning and expectations. We conducted this analysis separately for each of the outcomes that demonstrated evidence of change with age in our analysis of Research Question 1. For these outcomes, we used the baseline covariates to predict starting levels of the outcome at age 14 and the rate of change in the outcome with age.

Research Question 3: How do differences in teens' romantic relationship skills, knowledge, and attitudes, and their changes with age, relate to later relationship experiences?

We answered our third research question following a two-step process. First, using the growth models with covariates we estimated for Research Question 2, we calculated predicted values on each outcome for each student in our sample. Specifically, we calculated predicted values for each student's starting

level on the outcome at age 14. In addition, for the outcomes that showed evidence of variation in rates of change with age, we also calculated predicted values for each student's individual rate of change. For the second step of the analysis, we then entered these predicted values into a separate set of regression models with relationship experiences as the outcome variables. Specifically, for each of the six measures of relationship experiences described earlier in Table 4, we estimated a regression model predicting relationship experiences as a function of students' relationship skills, knowledge, and attitudes (as captured by the predicted values calculated from the growth models with covariates estimated for Research Question 2). We estimated linear regression models for the continuous measures of relationship experiences (satisfaction with current relationship and happiness with current relationship) and logistic regression models for the binary measures of relationship experiences (currently in a relationship, currently in an unhealthy relationship, ever had sex, and had sex without a condom in the past three months). The regression models for relationship satisfaction and happiness included only those students who were in a relationship. We included baseline values of the outcome as an additional covariate in the models when possible.

Results

In this section, we summarize the main findings for each of our three research questions—starting with the question of how teens' relationship skills, knowledge, and attitudes change with age (Research Question 1) and then looking at the predictors of relationship skills, knowledge, and attitudes (Research Question 2), and how they relate to later relationship experiences (Research Question 3). We present more detailed results for each question in the appendix.

Many of teens' relationship skills, knowledge, and attitudes change with age

Seven of the eight outcomes we examined showed evidence of change with age. In our mixed-effects growth models, we found the model that allowed for change in the outcome provided a better fit for the data than the one that assumed stability in the outcome. The one exception was a measure of attitudes toward cohabitation, which asked youth to report their level of disagreement with the belief that living together before marriage will improve a couple's chances of remaining happily married. For this outcome, our mixed-effects growth model showed that the model allowing for change in the outcome did not provide a better fit for the data than the one that assumed stability. That is, the model indicated that teens' attitudes toward cohabitation remain relatively stable over time. Detailed comparisons of the models and model fit statistics are available in the appendix (Tables A.1, A.2).

For six of the seven outcomes that changed with age, the direction of the change aligned with the intended outcomes of common HMRE curricula. That is, the direction of the change indicates that youth were developing the relationship skills, knowledge, and attitudes taught by common HMRE curricula without having direct exposure to one of them. For instance, for our measure of perceived conflict management skills, we found that average scores on a four-point scale increased by .05 points per year (Table 5), indicating greater perceived skills. We found similar results for most of the other outcomes. The only exception to this pattern was for one of our two measures of attitudes toward sexual activity. For this measure, the youth in our sample became more (not less) accepting of sexual activity with age, a finding which is to be expected during this developmental period.

For some relationship skills, knowledge, and attitudes, teens change at different rates

For three of the eight outcomes included in our analysis, we found evidence of variation around the average annual rate of change. That is, we found that the rates at which relationship skills, knowledge, and attitudes changed over time differed across teens. Specifically, in our mixed-effects growth models, we found that the 95 percent confidence interval bound for the random effect for the age variable did not include zero—the criterion we used to test for variation around the average annual rate of change. The three measures that showed such variation were perceived conflict management skills, disagreement with the belief that feelings of love should be enough to sustain a happy marriage, and disagreement that it is okay to have sexual intercourse if using protection. For the other measures included in our analysis, we found either (1) teens' attitudes did not change with age (one measure) or (2) teens were similar to each other in the rate at which their skills, knowledge, and attitudes changed over time (four measures). Detailed tables for these findings are available in the appendix (Table A.2).

Table 5. Estimated changes in teens' relationship skills, knowledge, and attitudes with age

Outcomes	Average level at age 14	Average annual change
Perceived general relationship skills	2.97	0.05*
Perceived conflict management skills	2.56	0.05*
Disapproval of teen dating violence	3.49	0.04*
Disagreement with unrealistic relationship beliefs		
There is only one true love out there who is right for me to marry.	2.32	0.06*
In the end, feelings of love should be enough to sustain a happy marriage.	2.26	0.08*
Living together before marriage will improve a couple's chances of remaining happily married.	2.32	NA
Disapproval of adolescent sexual activity		
Two people who are in love do not need to use condoms/birth control.	3.16	0.04*
At my age right now, it is okay to have sexual intercourse if I use protection, like a condom, the pill, etc.	3.26	-0.24*

Note: Sample size ranged across outcomes from 592 to 594.

* Significantly different from zero at the .05 level, two-tailed test.

NA = not available. This outcome did not show evidence of change with age.

Teens' demographic and personal characteristics predict their initial relationship skills, knowledge, and attitudes

For all seven measures that showed evidence of change with age, we found at least one demographic or personal characteristic that predicted initial levels of the measure at age 14 (Table 6). For example, compared to males, females at age 14 reported lower perceived relationship and conflict management skills, and expressed greater disapproval of teen dating violence and adolescent sexual activity. As another example, youth who reported being in a verbally aggressive romantic relationship at age 14 reported lower perceived conflict management skills and expressed less disapproval of teen dating violence and adolescent sexual activity. Youth who reported higher scores on a measure of relationship quality with their parents also reported greater perceived relationship skills and expressed greater disapproval of teen dating violence and adolescent sexual activity. Youth who reported higher scores on a measure of relationship quality with friends reported greater perceived relationship and conflict management skills.

Table 6. Predictors of teens' romantic relationship skills, knowledge, and attitudes at age 14

Baseline predictors	Perceived general relationship skills (Average level = 3.09)	Perceived conflict management skills (Average level = 2.75)	Disapproval of teen dating violence (Average level = 3.29)	Disagreement with unrealistic relationship beliefs: One true love (Average level = 2.23)	Disagreement with unrealistic relationship beliefs: Love is enough (Average level = 2.21)	Disapproval of adolescent sexual activity: In love (Average level = 2.99)	Disapproval of adolescent sexual activity: At my age (Average level = 3.04)
Female gender	-0.10 [†]	-0.25*	0.27*	0.03	0.09	0.35*	0.43*
Race: other	-0.07	-0.04	0.05	0.21	-0.08	-0.15	0.46*
Race: Black	-0.10	-0.02	0.14*	0.15	0.10	0.04	0.09
Race: White	-0.31*	-0.08	0.16	0.59*	0.33	-0.00	-0.02
Currently in a relationship	-0.04	0.05	0.13	-0.26	-0.34*	0.04	-0.07
Currently in an verbally aggressive relationship	0.14	-0.30*	-0.30*	0.01	0.15	-0.09	-0.39*
Relationship quality with parents	0.07*	0.04	0.11*	0.02	-0.07	0.08*	0.14*
Relationship quality with friends	0.13*	0.13*	0.04	-0.05	-0.08	0.04	-0.00
Career planning expectations	0.16	0.14	0.34*	0.55*	0.33*	0.03	0.03
Sample size	575	576	576	576	575	576	576

Note: Sample size ranged across outcomes from 575 to 576.

[†] Significantly different from zero at the .10 level, two-tailed test.

* Significantly different from zero at the .05 level, two-tailed test.

Teens' demographic and personal characteristics do not consistently predict how their relationship skills, knowledge, and attitudes change with age

In contrast to our finding that teens' demographic and personal characteristics predict their initial relationship skills, knowledge, and attitudes, we found less evidence that these characteristics predict changes in relationship skills, knowledge, and attitudes (Table 7). For example, for our measure of perceived conflict management skills, although we found in our analysis of Research Question 1 that average scores on this measure increased with age and evidence of statistically significant variation around the average rate of change, none of the demographic and personal characteristics included in our analysis predicted the variation around the average rate of change. For the other two measures that showed statistically significant variation around the average rate of change, we found only one or two demographic and personal characteristics that predicted the variation. As discussed in the methods section, we did not interpret this analysis for the other five measures of relationship skills, attitudes, and knowledge because either (1) they did not show evidence of change with age (one measure) or (2) they did not show evidence of statistically significant variation around the average rate of change (four measures).

Table 7. Predictors of annual changes in romantic relationship skills, knowledge, and attitudes

Baseline predictors	Perceived conflict management skills (Average rate = 0.03)	Disagreement with unrealistic relationship beliefs: Love is enough (Average rate = 0.11)	Disapproval of adolescent sexual activity: At my age (Average rate = -0.19)
Female gender	0.03	0.01	-0.05 [†]
Race: other	0.01	0.03	-0.11*
Race: Black	-0.01	-0.07*	-0.03
Race: White	0.01	-0.06	-0.12
Currently in a relationship	0.04	0.07	-0.02
Currently in an aggressive relationship	0.01	-0.05	0.09
Relationship quality with parents	-0.01	0.00	-0.00
Relationship quality with friends	-0.01	0.03 [†]	-0.02
Career planning expectations	-0.03	0.05	-0.02
Sample size	576	575	576

Note: Sample size ranged across outcomes from 575-576.

[†] Significantly different from zero at the .10 level, two-tailed test.

* Significantly different from zero at the .05 level, two-tailed test.

Some but not all relationship skills, knowledge, and attitudes predict teens' subsequent relationship experiences

Of the eight measures of relationship skills, knowledge, and attitudes included in our analysis, the two most consistently associated with subsequent relationship experiences were (1) perceived conflict management skills and (2) one of two measures of attitudes toward adolescent sexual activity (Table 8). For perceived conflict management skills, we found that youth who initially reported greater perceived skills at age 14 subsequently were less likely to report having had sex without a condom and reported higher average levels of relationship happiness (among those in relationships) at the time of the study's longer-term follow-up survey (when youth were ages 16-23). Youth whose conflict management skills improved more with age were also subsequently less likely to report having had sex without a condom and reported higher average levels of relationship satisfaction (among those in relationships) at the time of the longer-term follow-up. For attitudes toward adolescent sexual activity, youth who expressed greater disapproval at age 14 were subsequently less likely to be in a relationship, to be in an unhealthy relationship, to have had sex, or to have had sex without a condom at the time of the longer-term follow-up. In addition, teens whose attitudes became more disapproving with age reported lower average levels of relationship happiness (among those in relationships) at the time of the longer-term follow-up. More detailed results are available in the appendix (Tables A.4, A.5).

Table 8. Predictors of teen’s relationship experiences

	Relationship status (Odds ratio)	Unhealthy relationship (Odds ratio)	Ever had sex (Odds ratio)	Condom use (Odds ratio)	Romantic relationship satisfaction (Difference)	Romantic relationship happiness (Difference)
Level at age 14						
Perceived general relationship skills	2.45	0.68	1.19	1.67	0.27*	0.08
Perceived conflict management skills	0.53	0.44	0.55	0.12*	0.17	0.24*
Disapproval of teen dating violence	0.77	0.49	1.20	0.96	-0.11	-0.16†
Disagreement with unrealistic relationship beliefs: One true love	0.87	0.57	1.21	1.71	-0.04	-0.04
Disagreement with unrealistic relationship beliefs: Love is enough	1.72	2.11	0.73	1.25	-0.06	-0.07
Disapproval of adolescent sexual activity: In love	0.97	1.00	1.33	1.18	0.02	0.04
Disapproval of adolescent sexual activity: At my age	0.38*	0.26*	0.13*	0.36*	-0.02	0.11
Annual change						
Perceived conflict management skills	0.06	0.02	0.14	0.00*	0.22*	0.12
Disagreement with unrealistic relationship beliefs: Love is enough	0.06	0.02	0.14	0.05	0.09	0.07
Disapproval of adolescent sexual activity: at my age	0.00	0.00	0.00	0.00	-0.14	-0.27*
Sample size	405	402	396	379	152	152

Note: Numbers in the columns labeled “odds ratio” are odds ratios from a logistic regression model. Numbers in the columns labeled “difference” are regression coefficients from a linear regression model. Models controlled for baseline values of the outcome variable when available. Some odds ratios are reported as 0.00 due to rounding.

† Significantly different from zero at the .10 level, two-tailed test.

* Significantly different from zero at the .05 level, two-tailed test.

Discussion

This study used survey data for 595 high school students to provide foundational evidence on teens’ romantic relationship skills, knowledge, and attitudes. The surveys were administered as part of an impact study of an HMRE program for high school students conducted during the 2016–2017 and 2017–2018 school years with students from two large public high schools near Atlanta, Georgia. For this study, we used data for students assigned to the study’s control group who did not receive any HMRE instruction.

We sought to examine whether and how students' relationship skills, knowledge, and attitudes change with age without receiving HMRE instruction. For the analysis, we combined data for all 595 students and from three surveys administered over a roughly three-year period. Most of the data captured youth ages 14–18, corresponding to when they were 9th through 12th grade students.

The first research question we examined was whether teens' romantic relationship skills, knowledge, and attitudes change with age. We answered this question using data for eight separate measures of skills, knowledge, and attitudes included on the study surveys. We found evidence of change with age for all but one measure. In addition, for six of the eight measures, we found that the direction of change aligned with the intended outcomes of common HMRE curricula. For three of the eight outcomes, we also found evidence that teens' relationship skills, knowledge, and attitudes changed at different rates. Looking only at the average rate of change masked individual variation in how these outcomes changed with age for different teens. In sum, most of the variables demonstrated change over time, meaning that adolescents' relationship skills, knowledge, and attitudes changed from when they were in middle adolescence to when they were in late adolescence. In addition, for about half of these variables, teens differed from each other in how fast or slow these changes took place between middle and late adolescence.

Our second research question examined the predictors of teens' relationship skills, knowledge, and attitudes, and their changes with age. We answered this question by using demographic and personal characteristics from the study's baseline surveys to predict students' initial relationship skills, knowledge, and attitudes at age 14. For the three outcomes that showed statistically significant variation in how they changed with age, we also used demographic and personal characteristics to predict changes in these areas. From these analyses, we found that some of the teens' baseline demographic and personal characteristics predicted their initial relationship skills, knowledge, and attitudes (refer to Table 6 for details). For example, compared to males, we found that females at age 14 reported lower perceived relationship and conflict management skills and expressed greater disapproval of teen dating violence and adolescent sexual activity. In contrast, we found that teens' baseline demographic and personal characteristics did not consistently predict changes with age.

Our third research question examined how teens' relationship skills, knowledge, and attitudes predicted their subsequent relationship experiences. We answered this question by using the same measures of relationship skills, knowledge, and experiences to predict six separate measures of relationship experiences from the study's three-year follow-up survey. The types of relationship experiences we examined included quality of relationships with family and friends, in addition to romantic relationships and two measures of adolescent sexual activity. From these analysis, we found that perceived conflict management skills and one of two measures of attitudes toward adolescent sexual activity most consistently predicted subsequent relationship experiences.

Taken together, the results indicate that teens enter adolescence with different relationship skills, knowledge, and attitudes based on their demographic and personal characteristics. However, many of these skills, knowledge, and attitudes then change in adolescence, even without intervention from an HMRE program. For some measures of these areas, our results provide evidence that teens change at different rates. However, we did not identify specific demographic or personal characteristics that predict these differences and, for most measures of these areas, teens who start off lower or higher on these measures are likely to retain their relative position when compared to their peers. As expected, our results indicate that teens' relationship skills, knowledge, and attitudes can predict their subsequent relationship experiences. However, these associations emerged for certain measures of skills, knowledge, and attitudes only.

Limitations

This study's findings should be interpreted in the context of its limitations. First, because the findings were based on a relatively small sample of 595 high school students from two high schools, we cannot say whether they generalize to students in other schools and areas. Future studies will need to establish whether and how the findings might generalize. Similarly, our analysis was limited to eight measures of skills, knowledge, and attitudes, and six measures of longer-term relationship experiences, and might not capture the full scope of the predictors and outcomes of interest. Second, these analyses focused primarily on the period of middle to late adolescence. Conducting similar analyses with a younger sample beginning in early adolescence might yield different results, such as steeper changes or more individual differences in skills, knowledge, and attitudes changes over time. Third, the analyses we conducted were not causal and therefore should not necessarily guide changes to interventions. For instance, an association we found between perceived conflict management skills and subsequent relationship experiences does not necessarily mean that improving teens' conflict management skills through an intervention would improve their relationship outcomes. Fourth, as is common with longitudinal surveys, the response rate to the study surveys declined over time. The relatively lower response rate to the study's longer-term, three-year follow up survey (72 percent) might have limited our ability to answer the study's third research question about the predictors of subsequent relationship experiences.

Implications for HMRE programming and research

For HMRE curriculum developers and program providers, these findings highlight the importance of identifying and addressing the romantic relationship skills, knowledge, and attitudes most in need of intervention. Our results suggest that even without intervention, many of teens' relationships skills, knowledge, and attitudes are likely to change with age in the direction intended by HMRE programs. Although our study design does not enable us to say exactly why it happens, it is perhaps not surprising, given the many cognitive, social, and emotional changes that happen in adolescence and the general development teens experience as they mature and have their own relationship experiences. HMRE programs can further support teens' development by (1) identifying and addressing the specific skills, knowledge, and attitudes teens are less likely to develop on their own and (2) helping teens develop their relationship skills, knowledge, and attitudes at an earlier age or faster rate than they would on their own. For example, among the eight measures of relationship skills, knowledge, and attitudes included in our study, we found that teens' attitudes toward cohabitation did not change with age absent of intervention. This finding points to cohabitation attitudes as an example of an outcome that HMRE programs might expect to change.

Results from this study also highlight the importance of accounting for teens' varying levels of relationship skills, knowledge, and attitudes. Consistent with prior research, we found that teens enter high school with different relationship skills, knowledge, and attitudes based on their demographic and personal characteristics. For some of these skill, knowledge, and attitude measures, we also found that they change at different rates. This finding raises the possibility that different types of program content might resonate with some youth more than others; youth might have different interests and needs in the education they receive; and HMRE programs might affect youth in different ways, thus making it important to account for possible variation in impacts across youth. HMRE curriculum developers and program providers must account for this possibility when they design and implement HMRE programs. For instance, the finding that females report lower initial levels of relationship and conflict management skills might prompt curriculum developers to explore possible reasons for this deficit and how HMRE program can address it. As another example, we found that youth who reported being in a verbally

aggressive romantic relationship at age 14 reported lower perceived conflict management skills and expressed less disapproval of teen dating violence and adolescent sexual activity. This finding might prompt HMRE program developers to identify and offer programming to these youth at an even earlier age, before their initial exposure to a verbally aggressive relationship. Future studies can help test whether and how accounting for such differences in teens' relationship skills, knowledge, and attitudes might enhance the effectiveness of HMRE programs for youth.

References

- Alamillo, J., and E. Doran. "Longer-Term Impacts of Relationships Smarts PLUS in Georgia." OPRE Report #2022-XXX. Washington, DC: Office of Planning, Research, and Evaluation, Administration for Children and Families, U.S. Department of Health and Human Services, 2022.
- Alamillo, Julia, and Brian Goesling. "Healthy Marriage and Relationship Education for High School Students: The One-Year Impacts of Two Versions of Relationship Smarts PLUS in Georgia." OPRE Report #2021-151. Washington, DC: Office of Planning, Research and Evaluation, Administration for Children and Families, U.S. Department of Health and Human Services, 2021.
- Albert, D., J. Chein, and L. Steinberg. "The Teenage Brain: Peer Influences on Adolescent Decision Making." *Current Directions in Psychological Science*, vol. 22, no. 2, 2013, pp. 114-120.
- Antle, B.F., D.J. Sullivan, A. Dryden, E.A. Karam, and A.P. Barbee. "Healthy Relationship Education for Dating Violence Prevention among High-Risk Youth." *Children and Youth Services Review*, vol. 33, no. 1, 2011, pp. 173-179.
- Avellar, Sarah, Alexandra Stanczyk, Nikki Aikens, Mathew Stange, and Grace Roemer. "The 2015 Cohort of Healthy Marriage and Responsible Fatherhood Grantees: Interim Report on Grantee Programs and Clients." OPRE Report #2020-67. Washington, DC: Office of Planning, Research, and Evaluation, Administration for Children and Families, U.S. Department of Health and Human Services, 2020.
- Baumgartner, Scott, and Heather Zaveri. "Implementation of Two Versions of Relationship Smarts Plus in Georgia." OPRE Report #2018-121. Washington, DC: Office of Planning, Research, and Evaluation, Administration for Children and Families, U.S. Department of Health and Human Services, 2018.
- Braithwaite, S.R., R. Delevi, and F.D. Fincham. "Romantic Relationships and the Physical and Mental Health of College Students." *Personal Relationships*, vol. 17, 2010, no. 1, pp. 1-12.
- Buhrmester, D., W. Furman, M.T. Wittenberg, and H.T. Reis. "Five Domains of Interpersonal Competence in Peer Relationships." *Journal of Personality and Social Psychology*, vol. 55, no. 6, 1988, pp. 991-1008.
- Chen, Y.H., K.K. Ferguson, J.D. Meeker, T.F. McElrath, and B. Mukherjee. "Statistical Methods for Modeling Repeated Measures of Maternal Environmental Exposure Biomarkers during Pregnancy in Association with Preterm Birth." *Environmental Health*, vol. 14, no. 9, 2015. Available at <https://doi.org/10.1186/1476-069X-14-9>. Accessed October 8, 2022.
- Cobb, Nathan P., Jeffrey H. Larson, and Wendy L. Watson. "Development of the Attitudes About Romance and Mate Selection Scale." *Family Relations*, vol. 52, no. 3, 2003, pp. 222-231.
- Copp, J.E., P.C. Giordano, M.A. Longmore, and W.D. Manning. "The Development of Attitudes toward Intimate Partner Violence: An Examination of Key Correlates among a Sample of Young Adults." *Journal of Interpersonal Violence*, vol. 34, no. 7, 2019, pp. 1357-1387.
- Dahlberg, L.L., S.B. Toal, M. Swahn, and C.B. Behrens. "Measuring Violence-Related Attitudes, Behaviors, and Influences Among Youths: A Compendium of Assessment Tools." 2nd ed. Atlanta, GA: Centers for Disease Control and Prevention, National Center for Injury Prevention and Control, 2005.

- Davila, J., J. Mattanah, V. Bhatia, J.A. Latack, B.A. Feinstein, N.R., Eaton, J.S. Daks, et al. "Romantic Competence, Healthy Relationship Functioning, and Well-Being in Emerging Adults." *Personal Relationships*, vol. 24, no. 1, 2017, pp. 162–184. Available at <https://doi.org/10.1111/per.12175>. Accessed October 8, 2022.
- Flood, M., and B. Pease. "Factors Influencing Attitudes to Violence Against Women." *Trauma, Violence, & Abuse*, vol. 10, no. 2, 2009, pp. 125–142.
- Grimm, K.J., N. Ram, and R. Estabrook. *Growth Modeling: Structural Equation and Multilevel Modeling Approaches*. New York, NY: Guilford Press, 2017.
- Goesling, Brian, and Julia Alamillo. "Research to Practice Brief: Five Tips for Teaching Healthy Marriage and Relationship Education in Schools." OPRE Report #2018-101. Washington, DC: Office of Planning, Research, and Evaluation, Administration for Children and Families, U.S. Department of Health and Human Services, 2018.
- Gómez-López, M., C. Viejo, and R. Ortega-Ruiz, R. "Well-Being and Romantic Relationships: A Systematic Review in Adolescence and Emerging Adulthood." *International Journal of Environmental Research and Public Health*, vol. 16, no. 13, 2019. Available at <https://doi.org/10.3390/ijerph16132415>. Accessed October 8, 2022.
- Guzzo, K.B., and S.R. Hayford. "Adolescent Reproductive and Contraceptive Knowledge and Attitudes and Adult Contraceptive Behavior." *Maternal and Child Health Journal*, vol. 22, no. 1, Jan 2018, pp. 32–40. doi: 10.1007/s10995-017-2351-7. PMID: 28755044; PMCID: PMC5764783.
- Hsueh, JoAnn, Desiree Principe Alderson, Erika Lundquist, Charles Michalopoulos, Daniel Gubits, David Fein, and Virginia Knox. "The Supporting Healthy Marriage Evaluation: Early Impacts on Low-Income Families." OPRE Report #2012-11. Washington, DC: Office of Planning, Research, and Evaluation, Administration for Children and Families, U.S. Department of Health and Human Services, 2012.
- Karlsson, M.E., M. Calvert, J.H. Rodriguez, R. Weston, and J.R. Temple. "Changes in Acceptance of Dating Violence and Physical Dating Violence Victimization in a Longitudinal Study with Teens." *Child Abuse and Neglect*, vol. 86, 2018, pp. 123–135.
- Kerpelman, J.L., J.F. Pittman, F. Adler-Baeder, S. Eryigit, and A. Paulk. "Evaluation of a Statewide Youth-Focused Relationships Education Curriculum." *Journal of Adolescence*, vol. 32, no. 6, 2009, pp. 1359–1370.
- Kerpelman, J.L., J.F. Pittman, F. Adler-Baeder, K.J. Stringer, S. Eryigit, H.S. Cadely, and M.K. Harrell-Levy. "What Adolescents Bring to and Learn from Relationship Education Classes: Does Social Address Matter?" *Journal of Couple and Relationship Therapy*, vol. 9, no. 2, 2010, pp. 95–112.
- La Greca, A.M., and E.R. Mackey. "Adolescents' Anxiety in Dating Situations: The Potential Role of Friends and Romantic Partners." *Journal of Clinical Child and Adolescent Psychology*, vol. 36, no. 4, 2007, pp. 522–533.
- Lesure-Lester, G.E. "Dating Competence, Social Assertion and Social Anxiety Among College Students." *College Student Journal*, vol. 35, no. 2, 2001, pp. 317–320.
- Lindstrom Johnson, S., R.W. Blum, and T.L. Cheng. "Future Orientation: A Construct with Implications for Adolescent Health and Wellbeing." *International Journal of Adolescent Medicine and Health*, vol. 26, no. 4, 2014, pp. 459–468. Available at <https://doi.org/10.1515/ijamh-2013-0333>. Accessed October 8, 2022.
- Lippman, L., K. Moore, L. Guzman, R. Ryber, H. McIntosh, M. Ramos, M. Caal, et al. *Flourishing Children: Defining and Testing Indicators of Positive Development*. New York, NY: Springer, 2014.

- McElwain, A., J. McGill, and R. Savasuk-Luxton. "Youth Relationship Education: A Meta-Analysis." *Children and Youth Services Review*, vol. 82, 2017, pp. 499–507.
- McNeish, D. and T. Matta. "Differentiating Between Mixed Effects and Latent Curve Approaches to Growth Modeling." *Behavior Research Methods*, vol. 50, 2017, pp. 1398-1414.
- Miech, Richard A., Lloyd D. Johnston, Jerald G. Bachman, Patrick M. O'Malley, John E. Schulenberg, and Megan E. Patrick. "Monitoring the Future: A Continuing Study of American Youth, 12th-Grade Survey, 2021." Ann Arbor, Michigan: Inter-university Consortium for Political and Social Research, 2022.
- Moore, Quinn, Sarah Avellar, Ankita Patnaik, Reginald Covington, and April Wu. "Parents and Children Together: Effects of Two Healthy Marriage Programs for Low-Income Couples." OPRE Report #2018-58. Washington, DC: Office of Planning, Research, and Evaluation, Administration for Children and Families, U.S. Department of Health and Human Services, 2018.
- Orpinas, P., H.L. Hsieh, X. Song, K. Holland, and L. Nahapetyan. "Trajectories of Physical Dating Violence from Middle to High School: Association with Relationship Quality and Acceptability of Aggression." *Journal of Youth and Adolescence*, vol. 42, no. 4, 2013, pp. 551–565.
- R Core Team. R: A Language and Environment for Statistical Computing. Vienna, Austria: R Foundation for Statistical Computing, 2020. Available at <https://www.R-project.org/>. Accessed October 8, 2022.
- Schacter H.L., L.M. Lessard, and J. Juvonen. "Peer Rejection as a Precursor of Romantic Dysfunction in Adolescence: Can Friendships Protect?" *Journal of Adolescence*, vol. 77, 2019, pp. 70–80. doi:10.1016/j.adolescence.2019.10.004.
- Scott, Mindy E., and Ilana Huz. "An Overview of Healthy Marriage and Relationship Education Curricula." Bethesda, MD: Marriage Strengthening Research and Dissemination Center, June 2020.
- Scott, Mindy E., Elizabeth Karberg, Ilana Huz, and Maryjo Oster. "Healthy Marriage and Relationship Education Programs for Youth: An In-Depth Study of Federally Funded Programs." OPRE Report #2017-74. Washington, DC: Office of Planning, Research and Evaluation, Administration for Children and Families, U.S. Department of Health and Human Services, 2017.
- Shneyderman Y., and S.J. Schwartz. "Contextual and Intrapersonal Predictors of Adolescent Risky Sexual Behavior and Outcomes." *Health Education & Behavior*, vol. 40, no. 4, 2013, pp. 400-414. doi:10.1177/1090198112447800.
- Simpson, David M., Nathan D. Leonhardt, and Alan J. Hawkins. "Learning About Love: A Meta-Analytic Study of Individually-Oriented Relationship Education Programs for Adolescents and Emerging Adults." *Journal of Youth and Adolescence*, vol. 47, no. 3, 2018, pp. 477–489.
- Straus, M.A., S.L. Hambley, S. Boney-McCoy, and D.B. Sugarman. "The Revised Conflict Tactics Scales (CTS2): Development and Preliminary Psychometric Data." *Journal of Family Issues*, vol. 17, no. 3, 1996, pp. 283–316. doi:10.1177/019251396017003001.
- Vennum, Amber, and Frank D. Fincham. "Assessing Decision Making in Young Adult Romantic Relationships." *Psychological Assessment*, vol. 23, no. 3, 2011, p. 739.
- Wood, Robert G., Sarah A. Avellar, and Brian J. Goesling. "Pathways to Adulthood and Marriage: Teenagers' Attitudes, Expectations, and Relationship Patterns." Washington, DC: U.S. Department of Health and Human Services, Office of the Assistant Secretary for Planning and Evaluation, 2008.
- Wood, Robert G., Brian Goesling, Susan Zief, and Jean Knab. "Design for an Impact Study of Four PREP Programs." OPRE Report #2015-01. Washington, DC: Office of Planning, Research and Evaluation, Administration for Children and Families, U.S. Department of Health and Human Services, 2015.

Technical Appendix

This technical appendix supplements the descriptive study of how teens' relationship skills, knowledge, and attitudes change with age, which was conducted by Mathematica as part of the Strengthening Relationship Education and Marriage Services (STREAMS) evaluation. The first section of the appendix provides additional detail on the study sample. The remaining sections provide additional detail on the methods and findings for each of the study's three research questions.

Study sample

To conduct this analysis, we used longitudinal survey data collected from 595 high school students who were randomly assigned to the control group of a randomized controlled trial (RCT) of a school-based healthy marriage and relationship education (HMRE) program. To conduct the RCT, Mathematica and its partner, Public Strategies, collaborated with More Than Conquerors Inc. (MTCI), a nonprofit social service agency near Atlanta, Georgia. In 2015, MTCI received a federal grant from the Office of Family Assistance in the U.S. Department of Health and Human Services to deliver a widely implemented HMRE curriculum, *Relationship Smarts PLUS (RQ+)* Version 3.0, to youth in high school. For the RCT, MTCI delivered two different versions of *RQ+* in two Atlanta-area high schools. Students in one group were offered the full 12-lesson *RQ+* curriculum. Students in a second group were offered the shortened 8-lesson version of *RQ+* delivered for the study. Students in a third research group, the control group, were not offered any HMRE programming.

For the original RCT, Mathematica staff enrolled students from the health classes of two public high schools in Gwinnett County, Georgia. Across the two schools, students from 61 health classes participated over two consecutive school years (2016–2017 and 2017–2018). A total of 1,836 students received permission from a parent or guardian to participate in the study, representing about 92 percent of all eligible students: 604 in the full *RQ+* group, 658 in the shortened *RQ+* group, and 600 in the control group. Permission rates were similar across the three research groups (92 percent for the full *RQ+* group, 94 percent for the shortened *RQ+* group, and 93 percent for the control group).

For the present analysis of changes in teens' relationship skills, knowledge, and attitudes, we used data only for the subset of students assigned to the study's control group ($n = 600$). We also excluded a small number of students ($n = 5$) who reported conflicting information on their ages on different rounds of the study surveys. Therefore, the final sample used for this analysis included 595 students. As part of the original RCT, students in this group did not receive any HMRE programming but instead received alternative programming on career planning and readiness from a curriculum called 12 Pluses for Work Readiness and Career Success. The programming on career planning and readiness did not overlap with any of the measures of relationship skills, knowledge, and attitudes included in the present analysis. Therefore, we do not have reason to believe that any changes we observed in teens' romantic relationship skills, knowledge, or attitudes reflect information or services from this alternative programming received by students in the control group.

As discussed in the report, for each of the 595 students included in our analysis, we used data from up to three surveys administered as part of the original RCT. Most of the data captured students at the typical age range for high school students (14 to 18). However, because students were different ages when they enrolled in the study and completed the study surveys, our analytic file also captured some students who were older than 18 (19 to 23). We included data for all ages in our main analysis but also conducted a robustness check of the age range of the sample by limiting the data to ages 14 to 18. We found that limiting the data to those ages led to no substantial difference in the results.

Details of analysis for Research Question 1

For our first research question, we examined how teens' romantic relationship skills, knowledge, and attitudes change with age, and the extent to which these changes vary among teens. In the remainder of this section, we provide additional detail on the measures and methods we used to answer this question.

Measures of romantic relationship skills, knowledge, and attitudes

In selecting outcome measures for the first research question, we sought to include measures that correspond to HMRE program goals and curriculum content. We included two measures of general relationship and conflict management skills, one measure of disapproval of teen dating violence, three measures of disagreement with unrealistic relationship beliefs, and two measures of attitudes toward adolescent sexual activity.

Perceived general relationship skills

We measured teens' perceived general relationship skills with a subset of items from the Relationship Deciding Scale, which was developed using a sample of college-age students (Vennum and Fincham 2011). For these items, the survey asked teens to report their level of agreement with each of the following statements:

- I believe I will be able to effectively deal with conflicts that arise in my relationship.
- I feel good about my ability to make a romantic relationship last.
- I am very confident when I think of having a stable, long-term relationship.
- I have the skills needed for a lasting, stable romantic relationship.
- I am able to recognize the warning signs of a bad relationship.
- I know what to do when I recognize the warning signs of a bad relationship.

For each statement, the survey asked teens to report their level of agreement on a four-point scale, ranging from strongly agree to strongly disagree. For teens who responded to at least four of the six questions, we calculated a scale score by taking the average value of the student's responses across the different questions. The resulting scale ranged from 1 to 4, with higher values indicating greater perceived relationship skills. Reliability for this scale was $\alpha = 0.80\text{--}0.82$ across the three study surveys.

Perceived conflict management skills

We measured teens' perceptions of their own conflict management skills with a subset of items adapted from the Conflict Management Subscale of the Interpersonal Competence Scale (Buhrmester et al. 1988). This scale was used in a prior evaluation of *RQ+* for high school students (Kerpelman et al. 2009; Kerpelman et al. 2010). For these items, the survey asked teens to report their level of perceived skill for each of the following five conflict management skills:

1. Admitting that you might be wrong during a disagreement
2. Avoiding saying things that could turn a disagreement into a big fight
3. Accepting another person's point of view even if you don't agree with it
4. Listening to another person's opinion during a disagreement

5. Working through problems without arguing

For each item, the survey asked teens to report their level of perceived skill based on the following four response options: (1) I am extremely good at this, (2) I am good at this, (3) I am OK at this, or (4) I am bad at this. For teens who responded to at least four of the five items, we calculated a scale score by taking the average value of the student's responses across the different items. The resulting scale ranged from 1 to 4, with higher values indicating greater perceived communication skills. Reliability for this scale was $\alpha = 0.74\text{--}0.80$ across the three study surveys.

Disapproval of teen dating violence

We measured disapproval of teen dating violence with the complete set of 12 items from the Acceptance of Couple Violence Scale (Dahlberg et al. 2005). This scale was used in a prior study of an HMRE program for high school-age youth (Antle et al. 2011). For these items, the survey asked teens to report their level of disagreement with each of the following 12 statements about dating violence:

1. A boy angry enough to hit his girlfriend must love her very much.
2. Girls sometimes deserve to be hit by the boys they date.
3. A girl who makes her boyfriend jealous on purpose deserves to be hit.
4. A girl angry enough to hit her boyfriend must love him very much.
5. Boys sometimes deserve to be hit by the girls they date.
6. A boy who makes his girlfriend jealous on purpose deserves to be hit.
7. Violence between dating partners can improve the relationship.
8. There are times when violence between dating partners is okay.
9. It's okay to stay in a relationship even if you're afraid of your dating partner.
10. Sometimes violence is the only way to express your feelings.
11. Some couples must use violence to solve their problems.
12. Violence between dating partners is a personal matter and people should not interfere.

For each item, the survey asked teens to report their level of disagreement on a four-point scale, ranging from strongly agree to strongly disagree. For teens who responded to at least 8 of the 12 items, we calculated a scale score by taking the average value of the student's responses across the different items. The resulting scale ranged from 1 to 4, with higher values indicating greater disapproval of teen dating violence. Reliability for this scale was $\alpha = 0.74\text{--}0.80$ across the three study surveys.

Disagreement with unrealistic relationship beliefs

We measured disagreement with unrealistic relationship beliefs by using a subset of items from the Attitudes About Romance and Mate Selection Scale (Cobb et al. 2003). A prior evaluation of RQ+ for high school students used the same items (Kerpelman et al. 2009). For these items, the survey asked teens to report their level of disagreement with the following three statements:

1. There is only one true love out there who is right for me to marry.
2. In the end, feelings of love should be enough to sustain a happy marriage.
3. Living together before marriage will improve a couple's chances of remaining happily married.

For each item, the survey asked teens to respond on a four-point scale, ranging from strongly agree to strongly disagree. We assigned each response category a number ranging from 1 to 4, with higher values indicating stronger disagreement. We analyzed the items separately rather than as a scale for two reasons. First, each item comes from a different subscale of the Attitudes About Romance and Mate Selection Scale (Cobb et al. 2003). Second, the prior evaluation of RQ+ by Kerpelman and colleagues (2009) analyzed each item separately.

Disapproval of adolescent sexual activity

We measured attitudes toward adolescent sexual activity using two items from the Child Trends 3M project. For these items, the survey asked teens to report their level of disagreement with the following two statements:

1. Two people who are in love do not need to use condoms/birth control.
2. At my age right now, it is okay to have sexual intercourse if I use protection, like a condom, the pill, etc.

For each item, the survey asked teens to respond on a four-point scale, ranging from strongly agree to strongly disagree. We assigned each response category a number ranging from 1 to 4, with higher values indicating stronger disagreement. We analyzed the items separately rather than as a scale because the two-item scale had low reliability, indicating the outcomes are relatively distinct.

Analysis methods

To examine whether and how each outcome changed with age, we conducted a series of longitudinal analyses using mixed-effects growth models (Grimm et al. 2017) in R (R Core Team 2020). Mixed-effects growth models require specifying equations at two levels of analysis. The first (level 1) equation assesses the extent of change or stability in an outcome over time for each sample member. The second (level 2) equation assesses differences between sample members in the extent of change or stability over time. Mixed-effects models are flexible, so we could include teens for whom data are partially missing (due to either survey or item nonresponse). The models also allowed for unequal spacing between surveys (that is, a smaller time gap from baseline to the one-year follow-up than from the one-year follow-up to the longer-term follow-up) and differences in the exact timing of survey administration for different teens (McNeish and Matta 2017).

We took a staged approach to model selection, beginning with the simplest form of the model and then adding parameters to it and comparing model fit. First, for each outcome, we estimated a no-growth model that assumed stability in the outcome with age. For this model, a sample level-1 equation is specified as follows:

$$y_{it} = b_{1i} + u_{it}$$

where y_{it} is the repeatedly measured score (for example, perceived general relationship skills) for individual i at time t , b_{1i} is the random intercept (intercept for individual i), and u_{it} is the time-specific residual score.

For a no-growth model, a sample level-2 equation is specified as follows:

$$y_{ii} = \beta_1 + d_{1i}$$

where β_1 is the sample mean for the intercept and d_{1i} is individual i 's deviation from the sample mean.

This no-growth model served as a comparison model for the subsequent linear growth model. This model allowed for individual scores to change linearly over time and permitted individuals to differ in their rates of change. We estimated a separate linear growth model for each outcome measure. For this model, a sample level-1 equation is specified as follows:

$$y_{ii} = b_{1i} + b_{2i} * \frac{t - k_1}{k_2} + u_{ii}$$

where y_{ii} is the repeatedly measured variable (for example, perceived general relationship skills) at time t for individual i , b_{1i} is the random intercept or predicted score for individual i when $t = 0$, b_{2i} is the random slope or annual change for individual i for a one-unit change in t , t represents age (in years) at assessment, u_{ii} is the time-specific residual score, and k_1 and k_2 are constants that center the intercept and scale the slope. We set k_1 to 0 to center the intercept at the first occasion, assuming t begins with 0 (that is, age 14), and set k_2 to 1 to scale the linear slope so that a one-unit increment in the slope reflects annual change. For the linear growth model, a sample level-2 equation is specified as follows:

$$b_{1i} = \beta_1 + d_{1i}$$

$$b_{2i} = \beta_2 + d_{2i}$$

where β_1 and β_2 are sample-level means for the intercept and slope, respectively, and d_{1i} and d_{2i} are individual deviations from the sample-level means of the intercept and slope, respectively.

We used comparative fit criteria to determine whether the growth model fit the data better than the no-growth model. Specifically, for each outcome measure, we compared the no-growth and linear growth model fit statistics to complete model selection. We compared the models' Akaike information criterion (AIC; lower is better), Bayesian information criterion (BIC; lower is better), and the Log likelihood (LL). The change in $-2*LL$ can be used to compare nested models (the no-growth and linear growth models are nested). The $-2*LL$ is distributed as a chi-square statistic with three degrees of freedom, which are equal to the difference in the number of estimated parameters in each model. We conducted likelihood ratio testing under the null hypothesis that models fit equally well to confirm whether each linear growth model fits significantly better than the no-growth models.

Table A.1. Model fit comparisons for no-growth and linear growth models

Perceived general relationship skills				
Model	AIC	BIC	Log likelihood	LRT test <i>p</i> -value
No-growth model	2422	2438	-1208	< .05
Linear growth model	2394	2426	-1191	
Perceived conflict management skills				
Model	AIC	BIC	Log likelihood	LRT test <i>p</i> -value
No-growth model	2628	2644	-1208	< .05
Linear growth model	2595	2627	-1191	
Disapproval of teen dating violence				
Model	AIC	BIC	Log likelihood	LRT test <i>p</i> -value
No-growth model	1825	1841	-909	< .05
Linear growth model	1783	1814	-885	
Disagreement with unrealistic relationship beliefs: One true love				
Model	AIC	BIC	Log likelihood	LRT test <i>p</i> -value
No-growth model	3798	3814	-1896	< .05
Linear growth model	3785	3817	-1887	
Disagreement with unrealistic relationship beliefs: Love should be enough				
Model	AIC	BIC	Log likelihood	LRT test <i>p</i> -value
No-growth model	3598	3614	-1796	< .05
Linear growth model	3563	3595	-1776	
Disagreement with unrealistic relationship beliefs: Living together improves chances				
Model	AIC	BIC	Log likelihood	LRT test <i>p</i> -value
No-growth model	3245	3261	-1619	0.36
Linear growth model	3248	3280	-1618	
Disapproval of adolescent sexual activity: In love				
Model	AIC	BIC	Log likelihood	LRT test <i>p</i> -value
No-growth model	3261	3277	-1627	< .05
Linear growth model	3249	3281	-1619	
Disapproval of adolescent sexual activity: At my age				
Model	AIC	BIC	Log likelihood	LRT test <i>p</i> -value
No-growth model	4005	4021	-2000	< .05
Linear growth model	3761	3793	-1875	

AIC = Akaike information criterion; BIC = Bayesian information criterion; LRT = Likelihood ratio test.

For all but one outcome measure, youth report of their level of disagreement with the belief that living together before marriage will improve a couple's chances of remaining happily married, the likelihood ratio test was significant (Table A.1), indicating that the linear growth model fit significantly better than the no-growth model. We concluded from this test that seven of the eight outcomes demonstrated evidence of change with age. For these seven outcomes, we then used regression coefficients and variance statistics from the linear growth models to assess (1) the direction and magnitude of change in the outcome with age and (2) the degree to which the rate of change for individual teens in our sample differed from the average. These regression coefficient and variance statistics are displayed in Table A.2.

Table A.2. Detailed regression coefficient and variance statistics from linear growth models

	General relationship skills	Conflict management skills	Disapproval of teen dating violence	Disagreement with unrealistic relationship beliefs: One true love	Disagreement with unrealistic relationship beliefs: Love is enough	Disagreement with unrealistic relationship beliefs: Living together improves chances	Disapproval of adolescent sexual activity: In love	Disapproval of adolescent sexual activity: At my age
	Estimate (SE)	Estimate (SE)	Estimate (SE)	Estimate (SE)	Estimate (SE)	Estimate (SE)	Estimate (SE)	Estimate (SE)
Fixed effects								
Intercept	2.97* (0.03)	2.56* (0.03)	3.49* (0.02)	2.32* (0.04)	2.26* (0.04)	2.32* (0.04)	3.16* (0.04)	3.26* (0.04)
Slope	0.05* (0.01)	0.05* (0.01)	0.04* (0.01)	0.06* (0.01)	0.08* (0.01)	-0.01 (0.01)	0.04* (0.01)	-0.24* (0.01)
Random effects								
Variance of intercept	0.13	0.22	0.14	0.28	0.22	0.22	0.22	0.41
Variance of slope	0.00	0.01	0.00	0.00	0.02	0.01	0.00	0.01
Correlation of intercept, slope variance	-0.82	-0.67	-0.82	1.00	-0.36	-0.17	-1.00	-0.43
Residual variance	0.21	0.21	0.12	0.51	0.42	0.33	0.39	0.45

* Significantly different from zero at the .05 level, two-tailed test.

SE = standard error.

Details of analysis for Research Question 2

For our second research question, we used demographic and personal characteristics from the study's baseline survey to predict differences in teens' relationship skills, attitudes, and knowledge, and their changes with age. In the remainder of this section, we provide additional detail on the measures and methods we used to answer this question.

Measures of baseline demographic and personal characteristics

In selecting predictors for the second research question, we sought to capture baseline variables that have been theorized or previously evidenced to be related to romantic relationship skills, knowledge, and attitudes. We included demographic characteristics, prior experience in romantic relationships and unhealthy relationships, relationship quality with family and friends, and career planning expectations.

Gender

We measured teens' gender with one item:

- Are you male or female?

Teens were coded as 1 if they identified as female, 0 if they identified as male, and missing if they did not respond or selected "don't know" to this survey question.

Race/ethnicity

We measured teens' race and ethnicity with two items:

- What is your ethnicity?
- Which one best describes your race?

The survey asked teens to select one of two response options for the first item (Hispanic or Latino or Not Hispanic or Latino), and one or more of six response options for the second item (American Indian or Alaska Native, Asian, Black or African American, Native Hawaiian or other Pacific Islander, White, or Other). Teens were coded as 0 if they responded Hispanic or Latino to the first question; they were coded as 1 if they responded Not Hispanic or Latino and American Indian or Alaska Native, Asian, Native Hawaiian or other Pacific Islander, or Other; they were coded as 2 if they responded Not Hispanic or Latino and Black or African American; and they were coded as 3 if they responded Not Hispanic or Latino and White.

Currently in a romantic relationship

We measured teens' current romantic relationship status with a single item:

- How would you define your current relationship status?

The survey asked teens to select one of three response options: seriously dating, casually dating, or not currently in a relationship or dating. We coded teens who selected seriously dating or casually dating as 1, currently in a romantic relationship. We coded teens who selected not currently in a dating relationship as 0, not currently in a romantic relationship.

Currently in a verbally aggressive romantic relationship

We measured teens' current romantic relationship aggression with six items adapted from prior surveys of relationship aggression, including the Conflict Tactics Scale (Straus et al. 1996):

3. How often does your partner criticize your ideas?
4. How often does your partner insult or swear at you?
5. How often does your partner destroy things belonging to you?
6. When you have a serious disagreement with your partner, how often do you end up throwing things or hitting something?
7. How often do you insult or swear at your partner?
8. How often do you destroy things belonging to your partner?

For each item, the survey asked teens to respond on a five-point scale, ranging from none of the time to all of the time. We calculated a binary variable to reflect whether teens were currently in a verbally aggressive relationship. If teens responded some of the time, half of the time, most of the time, or all of the time to at least one of six items, we coded them as 1. If they reported not currently being in a relationship or responded none of the time to all six items, we coded them as 0.

Relationship quality with parents

We measured teens' reported relationship quality with their parents with a subset of items from the Parent-Adolescent Relationship Inventory (Lippman et al. 2014). For these items, the survey asked teens the following:

- In the past month, how often did you feel like you could count on at least one of your parents to be there when you needed them?
- In the past month, how often did you feel like you could talk with your parent(s) about things that really matter?
- In the past month, how often did you feel like you could share your thoughts and feelings with your parent(s)?

For each statement, the survey asked teens to respond on a four-point scale, ranging from none of the time to all of the time. For teens who responded to at least two of the three questions, we calculated a scale score by taking the average value of the student's responses across the different questions. The resulting scale ranged from 1 to 4, with higher values indicating greater relationship quality with parents.

Reliability for this scale was $\alpha = 0.87$.

Relationship quality with friends

We measured teens' reported relationship quality with their friends with a subset of items adapted from the Parent-Adolescent Relationship Inventory (Lippman et al. 2014). For these items, the survey asked teens the following:

- In the past month, how often did you feel like you could count on your friends to be there when you needed them?

- In the past month, how often did you feel like you could talk with your friends about things that really matter?
- In the past month, how often did you feel like you could share your thoughts and feelings with your friends?

For each statement, the survey asked teens to respond on a four-point scale, ranging from none of the time to all of the time. For teens who responded to at least two of the three questions, we calculated a scale score by taking the average value of the student's responses across the different questions. The resulting scale ranged from 1 to 4, with higher values indicating greater relationship quality with friends. Reliability for this scale was $\alpha = 0.90$.

Career planning and expectations

We measured teens' career planning and expectations with a subset of items adapted from the Personal Responsibility Education Program (PREP) Multi-Component Evaluation (Wood et al. 2015). For these items, the survey asked teens the following:

- I have specific goals for my career (reverse-coded).
- I have a plan for reaching my future career goals (reverse-coded).
- Planning a career is not worth the effort.
- If I have a career, I won't be able to enjoy other things in life.
- Going to college is important for getting a good job (reverse-coded).

For each item, the survey asked teens to report their level of agreement on a four-point scale, ranging from strongly agree to strongly disagree. For teens who responded to at least four of the six questions, we calculated a scale score by taking the average value of the student's responses across the different questions. The resulting scale ranged from 1 to 4, with higher values indicating greater career planning and expectations. Reliability for this scale was $\alpha = 0.69$.

Analysis methods

To examine whether and how each of these baseline characteristics predicted initial differences in teens' relationship skills, attitudes, and knowledge, and their changes with age, we added them as covariates to the linear growth models from the analysis of Research Question 1. In the model with covariates, the level-1 equation was the same as the one estimated for Research Question 1. However, we expanded the level-2 model to account for covariates, as follows:

$$b_{1i} = \beta_{01} + \beta_{11} * X_{1i} + \beta_{21} * X_{2i} + \beta_{31} * X_{3i} + \dots + \beta_{81} * X_{8i} + d_{1i}$$

$$b_{2i} = \beta_{02} + \beta_{12} * X_{1i} + \beta_{22} * X_{2i} + \beta_{32} * X_{3i} + \dots + \beta_{82} * X_{8i} + d_{2i}$$

where β_{01} and β_{02} are sample-level parameters indicating the expected intercept and slope when X_{1i} through X_{8i} equal 0; and $\beta_{11}, \beta_{21}, \dots, \beta_{81}$ and $\beta_{12}, \beta_{22}, \dots, \beta_{82}$ are level-2 regression parameters indicating the relation between the time-invariant covariates and the individual-level intercepts and slopes, respectively. The final two components, d_{1i} and d_{2i} , are residual scores that capture between-person differences in the intercept and slope that are not explained by the time-invariant covariates. The

level-2 parameters indicate the expected difference in the intercept or slope of the romantic relationship skills, knowledge, and attitudes variables for a one-unit difference in the baseline characteristics and experiences variables. We present the model results in Table A.3 below.

Table A.3. Baseline predictors of romantic relationship skills, knowledge, and attitudes at age 14 and over time

	Perceived general relationship skills ^a	Perceived conflict management skills	Disapproval of teen dating violence ^a	Disagreement with unrealistic relationship beliefs: One true love ^a	Disagreement with unrealistic relationship beliefs: Love is enough	Disapproval of adolescent sexual activity: In love ^a	Disapproval of adolescent sexual activity: At my age
	Estimate (SE)	Estimate (SE)	Estimate (SE)	Estimate (SE)	Estimate (SE)	Estimate (SE)	Estimate (SE)
Fixed effects							
Mean intercept	3.09* (0.06)	2.75* (0.07)	3.29* (0.05)	2.23* (0.10)	2.21* (0.09)	2.99* (0.09)	3.04* (0.10)
Covariates: main effects							
Female gender	-0.10 [†] (0.06)	-0.25* (0.06)	0.27* (0.04)	0.03 (0.09)	0.09 (0.08)	0.35* (0.07)	0.43* (0.09)
Race: other	-0.07 (0.10)	-0.04 (0.11)	0.05 (0.08)	0.21 (0.15)	-0.08 (0.14)	-0.15 (0.13)	0.46* (0.15)
Race: Black	-0.10 (0.06)	-0.02 (0.07)	0.14* (0.05)	0.15 (0.10)	0.10 (0.09)	0.04 (0.09)	0.09 (0.10)
Race: White	-0.31* (0.14)	-0.08 (0.16)	0.16 (0.12)	0.59* (0.22)	0.33 (0.20)	-0.00 (0.19)	-0.02 (0.22)
Currently in a relationship	-0.04 (0.10)	0.05 (0.11)	0.13* (0.08)	-0.26 [†] (0.16)	-0.34* (0.14)	0.04 (0.13)	-0.07 (0.16)
Currently in an aggressive relationship	0.14 (0.11)	-0.30* (0.13)	-0.30* (0.09)	0.01 (0.17)	0.15 (0.16)	-0.09 (0.15)	-0.39* (0.18)
Relationship quality with parents	0.07* (0.03)	0.04 (0.03)	0.11* (0.02)	0.02 (0.05)	-0.07 (0.04)	0.08 [†] (0.04)	0.14* (0.05)
Relationship quality with friends	0.13* (0.03)	0.13* (0.04)	0.04 (0.03)	-0.05 (0.05)	-0.08 [†] (0.05)	0.04 (0.04)	-0.00 (0.05)
Career planning expectations	0.16 [†] (0.10)	0.14 (0.11)	0.34* (0.08)	0.55* (0.15)	0.33* (0.14)	0.03 (0.13)	0.03 (0.15)
Mean slope	0.02 (0.02)	0.03 (0.03)	0.07* (0.02)	0.08* (0.04)	0.11* (0.04)	0.07* (0.03)	-0.19* (0.03)
Covariates: covariate by time interactions							
Female gender	0.02 (0.02)	0.03 (0.02)	-0.01 (0.01)	0.00 (0.03)	0.01 (0.03)	-0.04 (0.02)	-0.05 [†] (0.03)
Race: other	0.03 (0.03)	0.01 (0.04)	-0.02 (0.03)	-0.05 (0.05)	0.03 (0.05)	0.05 (0.04)	-0.11* (0.05)
Race: Black	0.03 (0.02)	-0.01 (0.03)	-0.03 [†] (0.02)	-0.02 (0.04)	-0.07* (0.04)	-0.01 (0.03)	-0.03 (0.04)
Race: White	0.05 (0.05)	0.01 (0.06)	-0.05 (0.04)	-0.18* (0.08)	-0.06 (0.08)	0.01 (0.07)	-0.12 (0.08)

	Perceived general relationship skills ^a	Perceived conflict management skills	Disapproval of teen dating violence ^a	Disagreement with unrealistic relationship beliefs: One true love ^a	Disagreement with unrealistic relationship beliefs: Love is enough	Disapproval of adolescent sexual activity: In love ^a	Disapproval of adolescent sexual activity: At my age
	Estimate (SE)	Estimate (SE)	Estimate (SE)	Estimate (SE)	Estimate (SE)	Estimate (SE)	Estimate (SE)
Currently in a relationship	0.06 (0.03)	0.04 (0.04)	-0.05* (0.03)	0.00 (0.05)	0.07 (0.05)	-0.05 (0.04)	-0.02 (0.05)
Currently in an aggressive relationship	-0.07 [†] (0.04)	0.01 (0.04)	0.08* (0.03)	0.04 (0.06)	-0.05 (0.06)	0.04 (0.05)	0.09 (0.06)
Relationship quality with parents	-0.01 (0.01)	-0.01 (0.01)	-0.02* (0.01)	-0.02 (0.02)	0.00 (0.02)	-0.01 (0.01)	-0.00 (0.02)
Relationship quality with friends	-0.02 (0.01)	-0.01 (0.01)	-0.01 (0.01)	0.05* (0.02)	0.03 [†] (0.02)	0.00 (0.02)	-0.02 (0.02)
Career planning expectations	-0.04 (0.03)	-0.03 (0.04)	-0.04 (0.02)	0.04 (0.05)	0.05 (0.05)	0.04 (0.04)	-0.02 (0.05)
Random effects							
Variance of intercept	0.10	0.17	0.09	0.24	0.19	0.20	0.27
Variance of slope	0.00	0.01	0.00	0.00	0.01	0.00	0.00
Correlation between intercept and slope	-1.00	-0.63	-1.00	-1.00	-0.40	-1.00	-0.22
Residual variance	0.21	0.21	0.12	0.50	0.42	0.38	0.47

^a For these outcomes, we do not present the predictors of slope in the report because we found that the slope generally was similar across sample members in our analysis of Research Question 1.

[†] Significantly different from zero at the .10 level, two-tailed test.

* Significantly different from zero at the .05 level, two-tailed test.

SE = standard error.

Details of analysis for Research Question 3

For our third research question, we used the covariate-adjusted regression models from the analysis of Research Question 2 to calculate predicted values of teens' relationship skills, attitudes, and knowledge. We then entered these predicted values into a separate set of regression models with relationship experiences as the outcome variables. In the remainder of this section, we provide additional detail on the measures of relationship experiences and analysis methods we used to answer this research question.

Measures of relationship experiences

To answer this research question, we sought to include variables that captured youths' experiences of romantic relationships during late adolescence. We included measures of relationship status, satisfaction and happiness, unhealthy relationship status, sexual initiation, and engagement in sex without condoms. We measured all of these outcomes with data from the study's three-year follow-up survey.

Currently in a romantic relationship

We measured teens' current romantic relationship status with the following item:

- How would you define your current relationship status?

The survey asked teens to select one of three response options: seriously dating, casually dating, or not currently in a relationship or dating. We coded teens who selected seriously dating or casually dating as 1, currently in a romantic relationship. We coded teens who selected not currently in a dating relationship as 0, not currently in a romantic relationship.

Satisfaction with current relationship

For teens who reported being in a current relationship, we measured relationship satisfaction with items adapted from an evaluation of the Love Smarts HMRE program (Kerpelman et al. 2009). For these items, the survey asked teens to rate their agreement with the following statements:

- I am very satisfied with how my partner and I talk with each other.
- I am very satisfied with how my partner and I treat each other.
- I can turn to my partner for advice about problems.

For each statement, the survey asked teens to respond on a four-point scale, ranging from strongly disagree to strongly agree. For teens who responded to at least two of the three questions, we calculated a scale score by taking the average value of the student's responses across the different questions. The resulting scale ranged from 1 to 4, with higher values indicating greater satisfaction with their current relationship. Teens who reported not being in a romantic relationship ($n = 256$) were not asked this question and therefore were coded as missing for this variable. Reliability for this scale was $\alpha = 0.79$.

Happiness with current relationship

For teens who reported being in a current relationship, we measured relationship happiness with the following item, adapted from the Parenting and Children Together (PACT) HMRE study (Moore et al. 2018). For this item, the survey asked teens the following:

- On a scale of 0–10, where 0 is not at all happy and 10 is completely happy, how happy would you say your current relationship is?

The survey asked teens to respond on an 11-point scale ranging from not at all happy to completely happy. Teens who reported not being in a romantic relationship ($n = 256$) were not asked this question and therefore were coded as missing for this variable.

Currently in an unhealthy relationship

We measured whether teens were currently in an unhealthy relationship with three survey items adapted from questions used on the Supporting Healthy Marriage 12-month survey (Hsueh et al. 2012):

1. Has your partner ever tried to keep you from seeing or talking with your friends?
2. Has your partner ever made you feel stupid?
3. Has your partner ever made you feel afraid that they might hurt you?

The survey asked to teens to select either yes or no in response to each item. We coded teens as currently being in an unhealthy relationship, 1, if they responded yes to any of the three questions; we coded teens as not currently being in an unhealthy relationship, 0, if (1) they responded no to all three questions or (2) if they were not asked the questions because they reported not being in a romantic relationship.

Ever had sex

We measured whether teens had ever had sex with the following item:

- Have you ever had sexual intercourse?

The survey asked teens to select either yes or no. We coded teens who selected yes as 1 and no as 0.

Had sex without a condom in last three months

We measured whether teens had had sex without a condom in the last three months with the following item:

- In the past three months, have you ever had sexual intercourse without using a condom?

The survey asked to teens to select either yes or no. We coded teens as 1 if they responded yes to this item and 0 if they (1) reported no to this item, or (2) reported not having had sexual intercourse in the last three months.

Analysis methods

We conducted this analysis using two-stage mixed-effect models (Chen 2015). First, from the covariate-adjusted regression models used for the analysis of Research Question 2, we extracted the random effects for intercept and slope from the final adjusted models. Each student had a random effect for intercept and slope for the three variables that showed individual differences in growth: (1) conflict management skills; (2) disagreement with the belief that in the end, feelings of love should be enough to sustain a happy marriage; and (3) one of two measures of attitudes toward adolescent sexual activity. Each student had a

random effect for intercept only for the other four variables included in our analysis of Research Question 2. Next, we included these random effects in regression models as continuous predictors.¹

We ran six regression models—one for each of the six measures of relationship experiences. We conducted logistic regression with the four binary measures and ordinary least squares (OLS) linear regression for the two continuous measures. An example of the logistic regression model equation is as follows:

$$\text{logit}(Y_i) = \beta_0 + \beta_1 X_i + \beta_2 X_i + \beta_3 X_i + \beta_4 X_i + \beta_5 X_i \dots \beta_n X_i + \varepsilon_i$$

where $\text{logit}(Y_i)$ is the log (odds) of the predicted value for the measure of relationship experiences, β_0 is the average or predicted value for the outcome when the individual random effect for that variable is equal to 0, $\beta_1 X_i$ is the estimate for baseline level of the outcome variable, $\beta_2 X_i$ is each individual's (reflected by X_i) intercept for relationship skills, $\beta_3 X_i$ is each individual's intercept for conflict management skills, $\beta_4 X_i$ is each individual's slope for conflict management skills, and so on. ε_i is the residual term that accounts for the variance in the predicted value that the predictors included in the model do not account for. The exponentiated beta coefficients are equivalent to adjusted odds ratios.

An example of the linear regression model equation is as follows:

$$Y_i = \beta_0 + \beta_1 X_i + \beta_2 X_i + \beta_3 X_i + \beta_4 X_i + \beta_5 X_i \dots \beta_n X_i + \varepsilon_i$$

where Y_i is the predicted value for the measure of relationship experiences, β_0 is the average or predicted value for that outcome's regression line when the individual random effect for that variable is equal to 0, $\beta_1 X_i$ is the estimate for the baseline level of the outcome variable, $\beta_2 X_i$ is the subject-specific intercept for relationship skills, $\beta_3 X_i$ is the subject-specific intercept for conflict management skills, $\beta_4 X_i$ is the subject-specific slope for conflict management skills, and so on. ε_i is the residual term that accounts for the variance in the predicted value that the predictors included in the model do not account for. The model estimates for the logistic regressions and linear regressions are displayed in Tables A.4 and A.5, respectively.

¹ We ran each model in a series of ways to ensure that including both the individual slopes and intercepts did not conceal or amplify effects. First, we assessed only the individual intercepts as predictors. We then assessed the individual slopes as predictors. Finally, we assessed individuals' pairs of slopes and intercepts for the three measures of relationship skills, attitudes, and knowledge that had both slopes and intercepts. The pattern of results was consistent across all models and with the final model presented in this report.

Table A.4. Logistic regression results

	Relationship status			Unhealthy relationship			Ever had sex			Condom use		
	Estimate (SE)	p-value	Odds ratio	Estimate (SE)	p-value	Odds ratio	Estimate (SE)	p-value	Odds ratio	Estimate (SE)	p-value	Odds ratio
Outcome at baseline	1.13 (0.23)	0.00	3.10	NA	NA	NA	1.87 (0.48)	0.00	6.51	1.42 (0.58)	0.02	4.12
Individual intercepts												
Relationship skills	0.89 (0.61)	0.14	2.45	-0.38 (1.00)	0.70	0.68	0.17 (0.63)	0.78	1.19	0.51 (0.85)	0.54	1.67
Conflict management skills	-0.64 (0.49)	0.20	0.53	-0.81 (0.79)	0.30	0.44	-0.60 (0.52)	0.25	0.55	-2.10 (0.71)	0.00	0.12
Teen dating violence disapproval	-0.27 (0.58)	0.64	0.77	-0.72 (0.91)	0.43	0.49	0.18 (0.62)	0.77	1.20	-0.04 (0.80)	0.96	0.96
One and only	-0.14 (0.33)	0.67	0.87	-0.57 (0.54)	0.29	0.57	0.19 (0.36)	0.60	1.21	0.54 (0.49)	0.28	1.71
Love is enough	0.54 (0.44)	0.22	1.72	0.75 (0.72)	0.30	2.11	-0.32 (0.47)	0.50	0.73	0.22 (0.62)	0.72	1.25
BC in love	-0.03 (0.56)	0.96	0.97	-0.00 (0.91)	1.0	1.00	0.29 (0.58)	0.62	1.33	0.16 (0.76)	0.83	1.18
BC age	-0.96 (0.33)	0.00	0.38	-1.34 (0.57)	0.02	0.26	-2.05 (0.36)	0.00	0.13	-1.02 (0.47)	0.03	0.36
Individual slopes												
Conflict management skills	-2.79 (3.63)	0.44	0.06	-3.90 (6.06)	0.52	0.02	-1.96 (3.81)	0.61	0.14	-10.80 (5.12)	0.03	0.00
Love is enough	-2.79 (3.63)	0.44	0.06	-3.90 (6.06)	0.52	0.02	-1.96 (3.81)	0.61	0.14	-10.80 (5.12)	0.03	0.00
BC age	-42.17 (30.33)	0.16	0.00	-27.47 (50.09)	0.58	0.00	-36.15 (31.70)	0.25	0.00	30.41 (42.25)	0.47	0.00

BC = birth control; NA = not available; SE = standard error.

Table A.5. Linear regression results

	Romantic relationship satisfaction		Romantic relationship happiness	
	Estimate	<i>p</i> -value	Estimate	<i>p</i> -value
Individual intercepts				
Relationship skills	0.27	0.00	0.08	0.36
One and only	-0.04	0.67	-0.04	0.67
BC in love	0.02	0.85	0.04	0.64
IPV disapproval	-0.11	0.22	-0.16	0.08
Conflict management skills	0.17	0.13	0.24	0.02
Love is enough	-0.06	0.48	-0.07	0.38
BC age	-0.02	0.83	0.11	0.24
Individual slopes				
Conflict management skills	0.22	0.03	0.12	0.22
Love is enough	0.09	0.31	0.07	0.39
BC age	-0.14	0.15	-0.27	0.00

BC = birth control; IPV = intimate partner violence.

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