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SEX EDUCATION, SEX COMMUNICATION, AND LONG-TERM SEXUAL HEALTH OUTCOMES: A LONGITUDINAL MODERATION ANALYSIS

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SEX EDUCATION, SEX COMMUNICATION, AND LONG-TERM SEXUAL HEALTH OUTCOMES: A LONGITUDINAL MODERATION ANALYSIS

A DISSERTATION APPROVED FOR THE
DEPARTMENT OF HEALTH AND EXERCISE SCIENCE

BY THE COMMITTEE CONSISTING OF

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Abstract

Background: Unintended pregnancy and STIs are recognized by national organizations as a critical public health concern. A strategy to decrease risk of unintended pregnancy and STIs includes consistent use of condoms. School-based sex education is intended to inform and provide sexual risk reduction strategies targeted at young populations. Parents can also be a critical influence on adolescent risky sexual behaviors. This dissertation project explored longitudinal associations between school-based sex education and young adult unintended pregnancy, STI risk, and condom use behaviors. Additionally, this dissertation explored the moderating influence of parent-adolescent sex communication. **Methods:** Measures of school-based pregnancy and HIV sex education reported by a nationally representative sample of adolescents were extracted from the National Longitudinal Study of Adolescent and Add Health's (Add Health) *Wave I In-Home* survey. *Waves II-V In-Home* surveys provided outcome variables: the intention of first reported pregnancy, diagnosis of an STI, and condom use at recent sex. Two logistic regressions were employed using Stata 17 to explore longitudinal associations. Parent-adolescent sex communication variables from the *Parent Interview* were added to the models to explore the moderating effects between school-based sex education and young adulthood sexual health outcomes and behaviors. **Results:** *Study I:* Of the 2,324 participants (53.6% female; 64.9% non-Hispanic White) that had school-based sex education, 46% reported their first pregnancy as intended, while 36.1% were unintended. Longitudinal results indicated that school-based sex education was not associated with long-term unintended pregnancy. Furthermore, parent-adolescent sex communication did not have a significant moderating influence on school-based sex education and unintended pregnancy. *Study II:* Of the 2,761 participants (47.3% female; 69.4% non-Hispanic White) that had school-based sex

education, 15.3% were diagnosed with an STI between late adolescence to young adulthood. Longitudinal results indicated that school-based sex education was not associated with long-term STI risk. Parent-adolescent sex communication significantly interacted with participant biological sex, race, and parent educational attainment. *Study III:* Of the 1,899 participants (47.9% female; 69.4% non-Hispanic White) that had school-based sex education, 84.8% did not use a condom the last time they engaged in sexual intercourse. Longitudinal results indicated that school-based sex education was not associated with condom use at recent sex. Parent-adolescent sex communication significantly interacted with participant biological sex, race, and urbanicity. **Conclusion:** School-based sex education may not influence long-term sexual risk behaviors. However, parent-adolescent sex communication can provide a foundation for positive sexual behaviors to be carried into young adulthood. Interventions focused on reducing adolescent sexual risk behavior should include parent participation. Parent-adolescent sex communication can be targeted in interventions to improve long term risk of unintended pregnancy, STI, and condom use.

Keywords: Unintended pregnancy, STI, condom use, school-based sex education, parent-adolescent sex communication.

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Chapter I.

Introduction to the Problem.

The most recent reports from the Centers for Disease Control and Prevention (CDC) show the burden of diagnosed and undiagnosed sexually transmitted infections (STIs) in the U.S, as one in five people currently have an STI. Of the STIs that go undiagnosed, additional health issues can occur, including infertility and death. [1] Human immunodeficiency virus (HIV) and acquired immunodeficiency syndrome (AIDS) are among a group of STIs that disproportionately burden subpopulations based on race and ethnicity, biological sex, sexuality, and urbanicity. [2] In fact, rates of new HIV cases increased in certain groups between 2015 and 2019, indicating an uneven distribution of a preventable STI. [3]

Overall decreases in teen and unintended pregnancy have been observed since 1991. [4] Yet, like STIs and HIV/AIDS, teen and unintended pregnancy disproportionately impacts groups based on race and ethnicity, socioeconomic status, and urbanicity. [3, 5, 6] Of the available contraceptive methods, condoms are the only method that can protect against STIs and HIV/AIDS vaginally, orally, and anally, as well as reduce risk of pregnancy. [7, 8] Conversely, reported rates of condom use during sexual intercourse have steadily declined in the United States in recent decades. [9]

Public health practitioners rely, in part, on interventions in multiple settings to prevent adverse sexual health outcomes. [10] These interventions include formal school-based sex education, which is intended to provide the skills and knowledge adolescents need to make informed decisions that serve as protective factors against adverse sexual health outcomes. [11] Parental involvement in the decisions made regarding content discussed within their child's formal school-based sex education has been well-documented [11-13], as most states require school districts to allow parental involvement in these programs. [11] Formal school-based sex

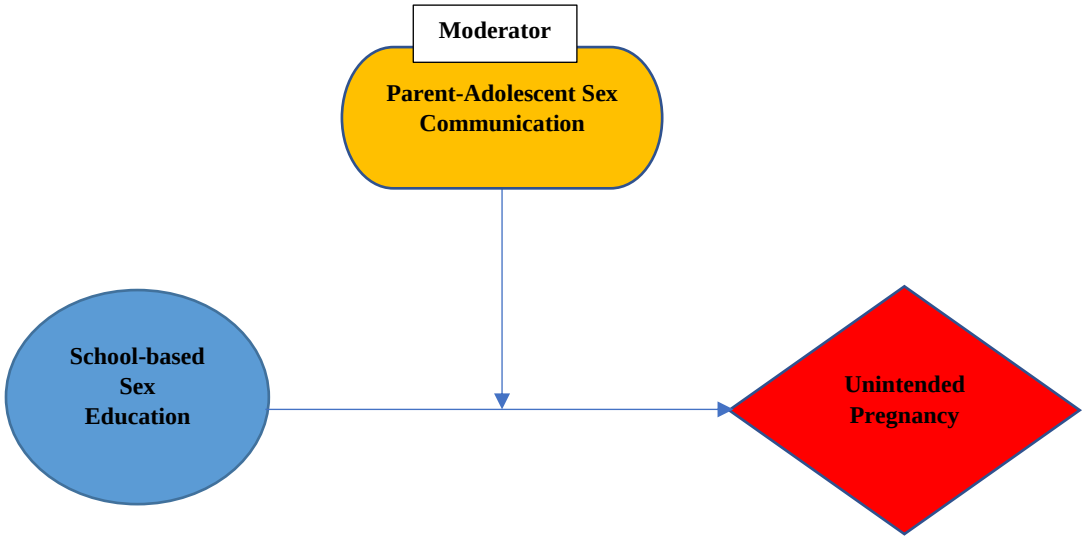
education programs have traditionally encouraged conversations between the parent and child outside of school, recognizing how these developmental years are influenced by multiple environments. [14, 15]

Despite innovative approaches that have been developed to change immediate sexual health outcomes experienced by young populations [16-18], there is limited understanding of how multiple settings that promote positive sexual decision-making impact long-term sexual health behaviors and their outcomes. Moreover, due to the disparities experienced [19-22], there is a critical need to understand how these settings differ in outcomes based on biological sex, race and ethnicity, socioeconomic status, sexuality, and urbanicity. This study, through a quantitative approach, utilized secondary data [23] collected from 1994 to 2018 to understand how sex education approaches held in school and at-home impact long-term teen and unintended pregnancy, STI and HIV/AIDS diagnosis, and condom use behaviors.

Conceptual Framework.

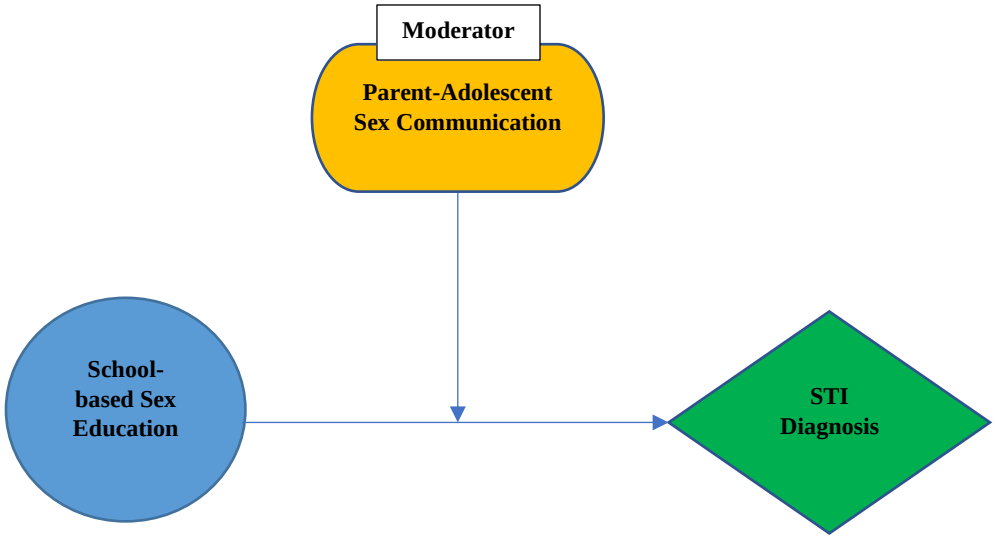
Interventions and strategies to influence sexual behaviors and ultimately the health of U.S. adolescents, young adults, and adults have had many settings. Historically, adolescents have largely been the target of strategies due their vulnerability and being a highly impressionable population. [14, 15] Public health efforts have focused interventions on settings adolescents spend much of their time: school and home. [12, 24, 25] Despite these efforts, the long-term impacts of interventions on sexual health outcomes and behaviors are not well-understood. Using two traditional sexual health intervention settings, this study examined the relationship of formal school-based sex education and contexts of parent-adolescent sex communication with long-term unintended pregnancy (Figure 1), STIs, excluding HIV (Figure 2), and condom use behavior (Figure 3).

Figure 1.
Hypothesized Moderation analysis of long-term unintended pregnancy



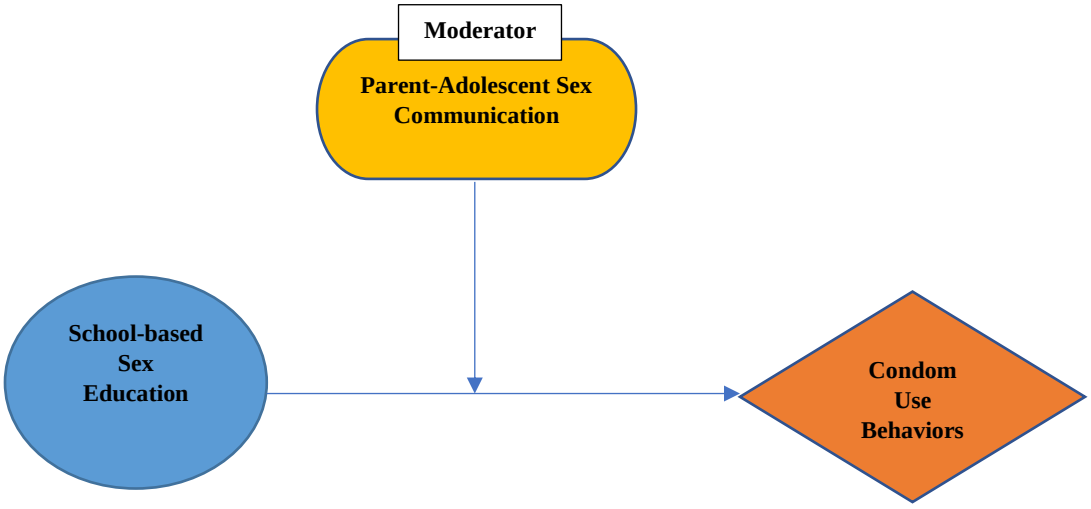
Note. Analysis includes formal school-based sex educations relationship with long-term unintended pregnancy, then moderated by early-life parent-adolescent sex communication.

Figure 2.
Hypothesized Moderation analysis of STI diagnosis



Note. Analysis includes formal school-based sex educations relationship with long-term STI diagnosis, then moderated by early-life parent-adolescent sex communication.

Figure 3.
Hypothesized Moderation analysis of condom use behaviors



Note. Analysis includes formal school-based sex educations relationship with long-term condom use behaviors, then moderated by early-life parent-adolescent sex communication.

Purpose of the Study.

The purpose of this secondary longitudinal analysis was to examine the extent to which formal school-based sex education has on long-term unintended pregnancy, STI, excluding HIV, and condom use behavior. This study also aimed to understand if these relationships were moderated by contexts of early-life parent-adolescent sex communication. It is important to understand the impacts of prevention efforts, as current trends in unintended pregnancy, STIs, and condom use continue to be a public health concern.

Manuscript I Research Questions.

Overarching research question for manuscript I. How does the amount of parent-adolescent sex communication moderate the relationship of formal school-based sex education and future unintended pregnancy?

1) How does parent-adolescent sex communication moderate the relationship between formal school-based sex education and future unintended pregnancy based on parental focus of sex communication?

- Behavior-based
- Moral-based
- Social-based

Question 1 hypotheses.

- **H1o:** As the amount of *behavior-based* parent-adolescent sex communication increases, the relationship between school-based sex education and future unintended pregnancy will not change.

- **H1a:** As the amount of *behavior-based* parent-adolescent sex communication increases, the relationship between school-based sex education and future unintended pregnancy will change.
- **H2o:** As the amount of *moral-based* parent-adolescent sex communication increases, the relationship between school-based sex education and future unintended pregnancy will not change.
- **H2a:** As the amount of *moral-based* parent-adolescent sex communication increases, the relationship between school-based sex education and future unintended pregnancy will change.
- **H3o:** As the amount of *social-based* parent-adolescent sex communication increases, the relationship between school-based sex education and future unintended pregnancy will not change.
- **H3a:** As the amount of *social-based* parent-adolescent sex communication increases, the relationship between school-based sex education and future unintended pregnancy will change.

2) How does parent-adolescent sex communication moderate the relationship between formal school-based sex education and future unintended pregnancy based on:

- Adolescent to adulthood demographics
    - Race/ethnicity
    - Biological sex
    - Urbanicity
- Parent demographics
    - Educational attainment

- Relationship to adolescent

Question 2 (participant-focused) hypotheses.

- **H4o:** As the amount of parent-adolescent sex communication increases, the relationship between being female and future unintended pregnancy will not change.
- **H4a:** As the amount of parent-adolescent sex communication increases, the relationship between being female and future unintended pregnancy will change.
- **H5o:** As the amount of parent-adolescent sex communication increases, the relationship between being male and future unintended pregnancy will not change.
- **H5a:** As the amount of parent-adolescent sex communication increases, the relationship between being male and future unintended pregnancy will change.
- **H6o:** As the amount of parent-adolescent sex communication increases, the relationship between being non-Hispanic White and future unintended pregnancy will not change.
- **H6a:** As the amount of parent-adolescent sex communication increase, the relationship between being non-Hispanic White and future unintended pregnancy will change.
- **H7o:** As the amount of parent-adolescent sex communication increases, the relationship between being Hispanic and future unintended pregnancy will not change.
- **H7a:** As the amount of parent-adolescent sex communication increases, the relationship between being Hispanic and future unintended pregnancy will change.
- **H8o**: As the amount of parent-adolescent sex communication increases, the relationship between being non-Hispanic Black and future unintended pregnancy will not change.
- **H8a:** As the amount of parent-adolescent sex communication increases, the relationship between being non-Hispanic Black and future unintended pregnancy will change.

- **H9o:** As the amount of parent-adolescent sex communication increases, the relationship between living in an urban area and future unintended pregnancy will not change.
- **H9a:** As the amount of parent-adolescent sex communication increases, the relationship between living in an urban area and future unintended pregnancy will change.
- **H10o:** As the amount of parent-adolescent sex communication increases, the relationship between living in a rural area and future unintended pregnancy will not change.
- **H10a:** As the amount of parent-adolescent sex communication increases, the relationship between living in a rural area and future unintended pregnancy will change.
- **H11o:** As the amount of parent-adolescent sex communication increases, the relationship between living in a suburban area and future unintended pregnancy will not change.
- **H11a:** As the amount of parent-adolescent sex communication increases, the relationship between living in a suburban area and future unintended pregnancy will change.

Question 2 (parent-focused) hypotheses.

- **H12o:** As the amount of parent-adolescent sex communication among parents with less than a high school education increases, the relationship between participants and future unintended pregnancy will not change.
- **H12a:** As the amount of parent-adolescent sex communication among parents with less than a high school education increases, the relationship between participants and future unintended pregnancy will change.
- **H13o:** As the amount of parent-adolescent sex communication among parents with a high school education increases, the relationship between participants and future unintended pregnancy will not change.

- **H13a:** As the amount of parent-adolescent sex communication among parents with a high school education increases, the relationship between participants and future unintended pregnancy will change.
- **H14o:** As the amount of parent-adolescent sex communication among parents with some college experience increases, the relationship between participants and future unintended pregnancy will not change.
- **H14a:** As the amount of parent-adolescent sex communication among parents with some college experience increases, the relationship between participants and future unintended pregnancy will change.
- **H15o:** As the amount of parent-adolescent sex communication among parents with at least a 4-year college degree increases, the relationship between participants and future unintended pregnancy will not change.
- **H15a:** As the amount of parent-adolescent sex communication among parents with at least a 4-year college degree increases, the relationship between participants and future unintended pregnancy will change.
- **H16o:** As the amount of parent-adolescent sex communication among biological mothers' increases, the relationship between participants and future unintended pregnancy will not change.
- **H16a**: As the amount of parent-adolescent sex communication among biological mothers' increases, the relationship between participants and future unintended pregnancy will change.

- **H17o:** As the amount of parent-adolescent sex communication among other parental figures' increases, the relationship between participants and future unintended pregnancy will not change.
- **H17a:** As the amount of parent-adolescent sex communication among other parental figures' increases, the relationship with participants and future unintended pregnancy will change.

Manuscript II Research Questions.

Overarching research question for manuscript II. How does amount of parent-adolescent sex communication moderate the relationship of formal school-based sex education and future sexually transmitted infections (STIs), excluding HIV.

1) How does parent-adolescent sex communication moderate the relationship between formal school-based sex education and future risk of STIs based on parental focus of sex communication?
    - Behavior-based
    - Moral-based
    - Social-based

Question 1 hypotheses.

- **H18o:** As the amount of *behavior-based* parent-adolescent sex communication increases, the relationship between school-based sex education and future risk of STI will not change.
- **H18a:** As the amount of *behavior-based* parent-adolescent sex communication increases, the relationship between school-based sex education and future risk of STI will change.

- **H19o:** As the amount of *moral-based* parent-adolescent sex communication increases, the relationship between school-based sex education and future risk of STI will not change.
- **H19a:** As the amount of *moral-based* parent-adolescent sex communication increases, the relationship between school-based sex education and future risk of STI will change.
- **H20o:** As the amount of *social-based* parent-adolescent sex communication increases, the relationship between school-based sex education and future risk of STI will not change.
- **H20a:** As the amount of *social-based* parent-adolescent sex communication increases, the relationship between school-based sex education and future risk of STI will change.

2) How does parent-adolescent sex communication moderate the relationship between formal school-based sex education and later-life STIs based on:

- Adolescent to adulthood demographics
    - Race/ethnicity
    - Biological sex
    - Urbanicity
- Parent demographics
    - Educational attainment
    - Relationship to adolescent

Question 2 (participant-focused) hypotheses.

- **H21o:** As the amount of parent-adolescent sex communication increases, the relationship between being female and future risk of STI will not change.

- **H21a:** As the amount of parent-adolescent sex communication increases, the relationship between being female and future risk of STI will change.
- **H22o:** As the amount of parent-adolescent sex communication increases, the relationship between being male and future risk of STI will not change.
- **H22a:** As the amount of parent-adolescent sex communication increases, the relationship between being male and future risk of STI will change.
- **H23o:** As the amount of parent-adolescent sex communication increases, the relationship between being non-Hispanic White and future risk of STI will not change.
- **H23a:** As the amount of parent-adolescent sex communication increases, the relationship between being non-Hispanic White and future risk of STI will change.
- **H24o:** As the amount of parent-adolescent sex communication increases, the relationship between being non-Hispanic Black and future risk of STI will not change.
- **H24a:** As the amount of parent-adolescent sex communication increases, the relationship between being non-Hispanic Black and future risk of STI will change.
- **H25o:** As the amount of parent-adolescent sex communication increases, the relationship between being Hispanic and future risk of STI will not change.
- **H25a:** As the amount of parent-adolescent sex communication increases, the relationship between being Hispanic and future risk of STI will change.
- **H26o:** As the amount of parent-adolescent sex communication increases, the relationship between living in an urban area and future risk of STI will not change.
- **H26a:** As the amount of parent-adolescent sex communication increases, the relationship between living in an urban area and future risk of STI will change.

- **H27o:** As the amount of parent-adolescent sex communication increases, the relationship between living in a rural area and future risk of STI will not change.
- **H27a:** As the amount of parent-adolescent sex communication increases, the relationship between living in a rural area and future risk of STI will change.
- **H28o:** As the amount of parent-adolescent sex communication increases, the relationship between living in a suburban area and future risk of STI will not change.
- **H28a:** As the amount of parent-adolescent sex communication increases, the relationship between living in a suburban area and future risk of STI will change.

Parent-focused hypotheses.

- **H29o:** As the amount of parent-adolescent sex communication among parents with less than a high school education increases, the relationship between participants and future risk of STI will not change.
- **H29a:** As the amount of parent-adolescent sex communication among parents with less than a high school education increases, the relationship between participants and future risk of STI will change.
- **H30o:** As the amount of parent-adolescent sex communication among parents with a high school education increases, the relationship between participants and future risk of STI will not change.
- **H30a:** As the amount of parent-adolescent sex communication among parents with high educational attainment increases, the relationship between participants and future risk of STI will change.

- **H31o:** As the amount of parent-adolescent sex communication among parents with some college education increases, the relationship between participants and future risk of STI will not change.
- **H31a:** As the amount of parent-adolescent sex communication among parents with some college education increases, the relationship between participants and future risk of STI will change.
- **H32o:** As the amount of parent-adolescent sex communication among parents with at least a 4-year college degree increases, the relationship between participants and future risk of STI will not change.
- **H32a:** As the amount of parent-adolescent sex communication among parents with at least a 4-year college degree increases, the relationship between participants and future risk of STI will change.
- **H33o:** As the amount of parent-adolescent sex communication among biological mothers' increase, the relationship between participants and future risk of STI will not change.
- **H33a:** As the amount of parent-adolescent sex communication among a biological mothers' increases, the relationship between participants and future risk of STI will change.
- **H34o:** As the amount of parent-adolescent sex communication among other parental figures' increases, the relationship between participants and future risk of STI will not change.

- **H34a:** As the amount of parent-adolescent sex communication among other parental figures' increases, the relationship between participants and future risk of STI will change.

Manuscript III Research Questions.

Overarching research question for manuscript III. How does amount of parent-adolescent sex communication moderate the relationship of formal school-based sex education and future condom use behaviors?

1) How does parent-adolescent sex communication moderate the relationship between formal school-based sex education and future condom use behavior based on parental focus of sex communication?
    - Behavior-based
    - Moral-based
    - Social-based

Q1 hypotheses.

- **H35o:** As the amount of *behavior-based* parent-adolescent sex communication increases, the relationship between school-based sex education and future condom use behavior will not change.
- **H35a:** As the amount of *behavior-based* parent-adolescent sex communication increases, the relationship between school-based sex education and future condom use behavior will change.
- **H36o:** As the amount of *moral-based* parent-adolescent sex communication increases, the relationship between school-based sex education and future condom use behavior will not change.

- **H36a:** As the amount of *moral-based* parent-adolescent sex communication increases, the relationship between school-based sex education and future condom use behavior will change.
- **H37o:** As the amount of *social-based* parent-adolescent sex communication increases, the relationship between school-based sex education and future condom use behavior will not change.
- **H37a:** As the amount of *social-based* parent-adolescent sex communication increases, the relationship between school-based sex education and future condom use behavior will change.

2) How does parent-adolescent sex communication moderate the relationship between formal school-based sex education and future condom use behaviors based on:

- Adolescent to adulthood demographics
    - Race/ethnicity
    - Biological sex
    - Urbanicity
- Parent demographics
    - Educational attainment
    - Relationship to adolescent

Question 2 (participant-focused) hypotheses.

- **H38o:** As the amount of parent-adolescent sex communication increases, the relationship between being female and future condom use will not change.
- **H38a:** As the amount of parent-adolescent sex communication increases, the relationship between being female and future condom use will change.

- **H39o:** As the amount of parent-adolescent sex communication increases, the relationship between being male and future condom use will not change.
- **H39a:** As the amount of parent-adolescent sex communication increases, the relationship between being male and future condom use will change.
- **H40o:** As the amount of parent-adolescent sex communication increases, the relationship between being non-Hispanic White and future condom use will not change.
- **H40a:** As the amount of parent-adolescent sex communication increases, the relationship between being non-Hispanic White and future condom use will change.
- **H41o:** As the amount of parent-adolescent sex communication increases, the relationship between being non-Hispanic Black and future condom use will not change.
- **H41a:** As the amount of parent-adolescent sex communication increases, the relationship between being non-Hispanic Black and future condom use will change.
- **H42o:** As the amount of parent-adolescent sex communication increases, the relationship between being Hispanic and future condom use will not change.
- **H42a:** As the amount of parent-adolescent sex communication increases, the relationship between being Hispanic and future condom use will change.
- **H43o:** As the amount of parent-adolescent sex communication increases, the relationship between living in an urban area and future condom use will not change.
- **H43a:** As the amount of parent-adolescent sex communication increases, the relationship between living in an urban area and future condom use will change.
- **H44o:** As the amount of parent-adolescent sex communication increases, the relationship between living in a rural area and future condom use will not change.

- **H44a:** As the amount of parent-adolescent sex communication increases, the relationship between living in a rural area and future condom use will change.
- **H45o:** As the amount of parent-adolescent sex communication increases, the relationship between living in a suburban area and future condom use will not change.
- **H45a:** As the amount of parent-adolescent sex communication increases, the relationship between living in a rural area and future condom use will change.

Question 2 (parent-focused) hypotheses.

- **H46o:** As the amount of parent-adolescent sex communication among parents with less than a high school education increases, the relationship between participants and future condom use will not change.
- **H46a:** As the amount of parent-adolescent sex communication among parents with less than a high school education increases, the relationship between participants and future condom use will change.
- **H47o:** As the amount of parent-adolescent sex communication among parents with a high school education increases, the relationship between participants and future condom use will not change.
- **H47a:** As the amount of parent-adolescent sex communication among parents with a high school education increases, the relationship between participants and future condom use will change.
- **H48o:** As the amount of parent-adolescent sex communication among parents with some college education increases, the relationship between participants and future condom use will not change.

- **H48a:** As the amount of parent-adolescent sex communication among parents with some college education increases, the relationship between participants and future condom use will change.
- **H49o:** As the amount of parent-adolescent sex communication among parents with at least a 4-year college degree increases, the relationship between participants and future condom use will not change.
- **H49a:** As the amount of parent-adolescent sex communication among parents with at least a 4-year college degree increases, the relationship between participants and future condom use will change.
- **H50a:** As the amount of parent-adolescent sex communication with biological mothers' increases, the relationship between participants and future condom use will not change.
- **H50o:** As the amount of parent-adolescent sex communication with biological mothers' increases, the relationship between participants and future condom use will change.
- **H51a:** As the amount of parent-adolescent sex communication with other parental figures' increases, the relationship between participants and future condom use will not change.
- **H51o:** As the amount of parent-adolescent sex communication with other parental figures' increases, the relationship between participants and future condom use will change.

Significance of the Study.

For the 7th consecutive year, new diagnosis of STIs have reached an all-time high, increasing overall but especially among certain subpopulations. [26] Of the 2.4 million reported cases of chlamydia, syphilis and gonorrhea in 2020, rates reported by non-Hispanic Black people

were five to eight times that of non-Hispanic White people, while rates for Hispanic people were one to two times that of non-Hispanic White people. [27] Additionally, young people made up over half (61%) of new chlamydia cases and 42% of gonorrhea cases. [27] Due to the continued increase in new diagnosis of STIs, mutations of certain strains have occurred, resulting in antibiotic resistance. [28] Antibiotic resistant STIs have become a growing threat due to reduced treatment options, potentially putting an individual at risk for developing the same health issues observed among undiagnosed STIs. [29]

Teen and unintended pregnancy rates in the U.S. are the highest compared to other industrialized countries [30], and are often associated with adverse social and economic outcomes among all populations but especially among non-Hispanic Black people and young populations ages 15 to 24. [31] It is estimated between 30 to 50 percent of teen parents graduate high school or earn a General Education Development (GED) certificate, compared to the 90 percent graduation rate for teens who do not experience a teen pregnancy. [4] Not all unintended pregnancies are reported by teens, in fact, the majority of reported unintended pregnancies in 2011 were among girls and women ages 15 to 24, with the highest rates reported among non-Hispanic Black populations regardless of income level. [32-34] Unintended pregnancy has been associated with premature birth and low birth weight [35], and maternal depression. [35, 36] It is also estimated that the direct medical cost of unintended pregnancy in the U.S. is more than $5.5 billion annually. [30]

In an effort to reduce the risk of acquiring an STI and preventing teen and unintended pregnancy, promotion of condom use has been a top priority in public health. [8] Despite efforts, reports of condom use at first-sex and consistent use thereafter have gradually declined. [8, 22] The introduction of long-acting reversable contraceptives (LARCs) are thought to be a

contributor to decreased rates of teen and unintended pregnancy [37] but increased rates of chlamydia, syphilis, and gonorrhea. [38] Despite significant strides made in pregnancy prevention, STIs have grown exponentially, further disproportionately impacting racial and ethnic minorities, women, sexual minorities, and those living in areas with reduced access to sexual health services. [39-41]

The health and economic consequences associated with acquiring an STI and experiencing a teen or unintended pregnancy continue to disproportionately impact subpopulations in the U.S. With an overall decrease in reported use of condoms in recent decades, the entire population, especially those currently being disproportionately affected, are put at increased risk for acquiring an STI, as well as experiencing an unintended pregnancy. This further highlights the importance of public health approaches to provide evidence-based information and the skills to serve as protective factors against adverse sexual health outcomes. Further, it is important to understand the long-term impact sex education in dual settings has on sexual health behaviors and outcomes as much of the current literature highlights immediate impacts on adolescent populations despite disparities being experienced by older age groups.

Definition of Terms.

Operational Definitions.

- Formal sex education: formal programs of instruction on a wide range of issues relating to human sexuality, including human anatomy, sexual reproduction, sexual intercourse, reproductive health, emotional relations, reproductive rights and responsibilities, abstinence, contraception, and other aspects of human sexual behavior; commonly within school program and public health campaigns [42]

- Formal school-based sex education: a form of formal sex education; commonly taking an abstinence-only-until-marriage or comprehensive sexuality education approach [43]
- Abstinence-only-until-marriage (AOUM): sexual health information pertaining to abstinence with additional topics like sex, sexuality, and healthy relationships. Contraceptive methods are omitted or negated from information. [44]
- Comprehensive sexuality education (CSE): sexual health information pertaining to abstinence, contraceptive methods, sex, sexuality, healthy relationships, communication, and life goals and aspirations [45]
- Moral-based sex education: stresses moral responsibility in and restraint from sexual activity; traditionally based in AOUM programs [44]
- Behavior-based sex education: stresses skill-building to help communicate and make informed decisions about sex and their sexual health; traditionally based in CSE [44]
- Unintended pregnancy: any unplanned, mistimed, or unwanted pregnancy at the time of conception [32]
- Teen pregnancy: traditionally refers to pregnancy among females ages 15 to 19 years old (unless otherwise specified) [4]
- Teen birth: traditionally refers to births among females ages 15 to 19 years old (unless otherwise specified) [46]
- Sexually transmitted infection (STI): an infection that can be contracted from having sex with someone who is infected [6]
- Protective factors: circumstances that discourage or decrease the likelihood of a negative health outcome [47]

- Risk factors: circumstances that encourage or increase the likelihood of a negative health outcome [47]
- Risk-taking: engaging in behaviors that are high in subjective desirability or excitement but can carry a potential for injury or loss [47]
- Rural: outside of a metropolitan area [48]
- Urban: within a principal city of a metropolitan area [48]
- Suburban: within a metropolitan area but not within a principal city of a metropolitan area [48]

Overview of Methods.

To answer these research questions, longitudinal data was used. The National Longitudinal Study of Adolescent and Adult Health (Add Health) has collected quantitative data over the past thirty years. Distributed in five waves, social, behavioral, and biological data across the life course has been collected. A longitudinal analysis was utilized to understand future and long-term relationships between formal school-based sex education and unintended pregnancy, STI, excluding HIV, and condom use behavior. Additionally, this study used parent-adolescent sex communication as a moderator between formal school-based sex education and sexual behaviors and outcomes to understand the interaction between these variables. This study also aimed to understand the relationship between contextual factors and sexual health behaviors and outcomes among vulnerable populations.

Chapter II.

Introduction.

This literature review will briefly discuss the developmental age groups included in the National Longitudinal Study of Adolescent and Adult Health Study (Add Health), followed by a review of the risk factors associated with sexual behaviors that can lead to adverse sexual health outcomes from adolescence to adulthood. This review will also discuss contributing factors to long-term sexual health behaviors and outcomes and concludes with an overview of the published literature using Add Health data examining the associations between formal sex education and parent-adolescent sex communication with sexual health outcomes and behaviors.

Search Strategy.

The literature reviewed for these studies came from peer-reviewed sources. To identify relevant literature, an electronic search was conducted with ERIC, PubMed, PsycINFO, EBSCOhost, and Google Scholar. The discussed literature ranged in publishing dates from 2009 to 2022. Among the three studies, the shared focus included literature on adolescent to adulthood behavioral development, school-based sex education, and parent-adolescent sex communication. Adolescent to adulthood behavioral development included search terms: *behavioral development* or *adolescent behavioral development* or *adolescent to adulthood behavioral development* or *adolescent to young adulthood behavioral development*. The search for literature related to school-based sex education included search terms: *school-based sex education* or *sex education* or *formal sex education* or *school sex education* or *sexuality education*. Types of school-based sex education were searched using terms: *comprehensive sex education* or *comprehensive-based sex education,* as well as *abstinence-only sex education* or *abstinence-based sex education*. Parent-adolescent sex communication was searched using the terms: *parent sex communication*

or *parent-adolescent sex communication* or *parent-adolescent sexual communication* or *parent-child sex communication*.

Study I focused on unintended pregnancy. Additional search terms used in Study I included: *pregnancy intention* or *unintended pregnancy* or *mistimed pregnancy*. The search terms used for Study II included: *sexually transmitted infection* or *sexually transmitted disease* or *syphilis* and *gonorrhea* and *chlamydia.* Study III focused on condom use behavior, particularly at most recent sex. The search terms included in Study III were *condom use behavior* or *condom behavior*.

Overview of Life Stages.

Adolescence is the bridge between childhood and adulthood, characterized by major transitions in physical [49], psychological, and social development. [50] The ages of 10 through 18 typically marks the period of adolescence, with changes in a young person's relationships with others [49], while developing autonomy and self-determination as they grow. [51] There is variability in how age groups are categorized in social sciences, for example, the Centers for Disease Control and Prevention (CDC) [52] defines adolescence as the years between 15 and 24, while the World Health Organization (WHO) [53] characterizes adolescence between the ages of 10 and 19. However, sexual health research traditionally focuses on average reproductive age span, beginning at the age of 15 years old. [53] Emerging or young adulthood follows adolescence and is generally defined as the years between 18 and 25 [54], however, some researchers have included up to age 29. [55] Apart from biological age, this developmental stage is characterized by normative transitions, including identity exploration, independence, risky behaviors [54], and reinforcing developmental patterns established during adolescence. [56] Young adults have gained skills in reasoning they may have previously lacked [50]; however,

skills in reasoning vary by the individual, particularly with sexual decision-making. [15] For example, exposure to formal sex education, which is generally aimed to equip adolescents and young adults with knowledge, skills, attitudes, and values to serve as a protective factor for adverse sexual health outcomes, has historically not been made available to the entire U.S. population. [57] Without the reasoning skills developed in formal sex education, populations of adolescents and young adults are being put at increased risk for adverse sexual health behaviors and outcomes. [58]

Beginning after young adulthood, adulthood or early adulthood has been roughly defined between the ages of 25 to 45 years old [59], but can vary by academic discipline. Research in sexual health defines the last year of reproductive age to be around 44 years old. [53] Physical maturation ends roughly at the beginning stages of early adulthood, and social and psychological dimensions continue to develop. [50] This developmental stage is characterized by continued self-exploration and experimentation with relationships, family, and careers. [60] The health behaviors developed during adolescence or young adulthood have been observed into adulthood and are also suggested to be a contributor to later-life health outcomes. [50, 61]

Concluding Statement.

Developmental stages are considered transitional periods that provide opportunities for development of positive or negative health behaviors. [61] Research indicates the health behaviors learned during adolescence can be maintained through emerging adulthood and beyond. [61] Further, these health behaviors have been associated with adulthood health status. [50, 61] For these reasons, intervention and prevention practices traditionally focus on younger populations. [62] In sexual and reproductive health, intervention and prevention strategies aim to decrease adverse sexual health outcomes by providing and instilling knowledge, skills, attitudes,

and values to serve as protective factors for adverse sexual health outcomes. [12, 63] The goal of the present studies is to examine prospective, longitudinal associations between exposure to sexual health information during adolescence and sexual health outcomes in adulthood, using a large, nationally representative sample of youth.

Overview of Sexual Health Behaviors and Outcomes in Adolescents and Young Adults.

Unintended Pregnancy. Since its peak in the 1990s, teen birth rates have declined by 75%, from 61.8 births per 1,000 girls and women ages 15 to 19 in 1991 to 15.3 births per 1,000 girls and women ages 15-19 in 2020. [30] Rates have also declined between 1990 (116.5 births per 1,000 women) and 2020 (62.8 births per 1,000 women) for women between the ages of 20 and 24, and among women ages 25 to 29 (from 120.2 to 90.0 births per 1,000 women). [64] Birth rates in later reproductive years have trended upwards between 1990 (80.8 births per 1,000 women ages 30 to 34; 31.7 births per 1,000 women ages 35 to 39; 5.5 births per 1,000 women ages 40 to 44; 0.2 births per 1,000 women ages 45 to 49) and 2020 (94.8; 51.7; 11.8; 0.9). [30, 64] Overall, 2019 fertility rates among girls and women ages 15 to 44 reached a record low of 58.3 births per 1,000. [30, 64] This is the sixth consecutive year that declines have been observed.

Additionally, the rate of unplanned or unintended pregnancies have declined. [30, 33] The most recent nationally representative survey indicated that nearly half (2.8 million) of the six million pregnancies among reproductive age women in 2013 were unintended, resulting in 45 unintended pregnancies per 1,000 women. [65] This is a decrease from reported unintended pregnancies in 2008 (54 unintended pregnancies per 1,000 women). [33] Despite declines, rates of unintended pregnancy in the U.S. are substantially higher compared to other industrialized

countries [9] and reducing these rates has remained a Healthy People national initiative objective since 1980. [66-68]

Despite overall decreases in unplanned pregnancies among reproductive age women, specific subgroups continue to experience significant disparities. [46, 69] Currently, girls and women ages 15 to 19 and 20 to 24 years old have the highest rates of unintended pregnancy. [65] Moreover, approximately one in four teens will become pregnant by 20 years old [33] and teens ages 18 to 19 are four times more likely to have a child than 15 to 17 year-olds. Compared to other age groups, older teens (ages 18 to 19) have experienced a slower decline in birth rates. [65] Women in their early 20s have also experienced disparities as it is estimated that one in 12 women will experience an unintended pregnancy each year from ages 20 to 24. [33]

In addition to young age, racial and ethnic minority populations have experienced disparities in unplanned pregnancies. [70] Compared to their non-Hispanic White counterpart (11 births per 1,000 women and girls ages 15 to 19), Hispanic and non-Hispanic Black teens are disproportionately affected by pregnancy and birth rates (25 births and 26 births per 1,000 women and girls ages 15 to 19). Hispanic and non-Hispanic Black teens are twice as likely to give birth before entering young adulthood compared to non-Hispanic White teens. [71] Moreover, as Hispanic and non-Hispanic Black adolescent women transition into young adulthood, the risk for unintended pregnancy increases and remains disproportionate compared to non-Hispanic White women. [70] A nationally representative sample indicated being age 20 years or older and being Hispanic or non-Hispanic Black was associated with increased odds (2.10 and 5.12 times more likely) of experiencing an unintended pregnancy compared to non-Hispanic White women. [70] Conversely, when considering additional intrapersonal-, interpersonal-, institutional-, community- and policy-level covariates, the significant differences

among unintended pregnancy experienced by this sample of Hispanic, non-Hispanic Black, and non-Hispanic White females became insignificant. [70] Among all sampled females, the factors most associated with decreased odds of unintended pregnancy were having a mother that completed high school, being religious as opposed to non-religious, and living in suburban or rural areas compared to urban areas at the time of conception [70]

The most recent nationally representative reports of male pregnancy intentions were collected between 2006 and 2010 by the National Survey of Family Growth (NSFG). [72] Results indicated out of every ten births, nearly four of them were reported as unintended by Hispanic and non-Hispanic White males. [72] Approximately one in three births among non-Hispanic Black men were reported as mistimed. [72] Additionally, non-Hispanic White men were significantly more likely to have an intended birth (66%) compared to non-Hispanic Black men (49%). [72] Overall, intentions to have a pregnancy were not significantly different between Hispanic and non-Hispanic Black men, but were significantly higher for non-Hispanic White men. [72] While this research indicates racial and ethnic differences associated with male pregnancy intentions, this area of reproductive health is not as understood compared to female pregnancy intentions. [73, 74]

The implications associated with unintended pregnancy include lower educational attainment for the mother, father, and child that ultimately limits careers and earning potential and increased risk of living in poverty. [41, 75] Additionally, experiencing an unintended pregnancy can put a mother at increased risk for health problems that are often associated with their child's health. [35, 76] For example, unintended pregnancy is a risk factor for poor maternal mental health, which has been associated with poor parent-child relationships and childhood depression. [35] As a result of unintended pregnancies experienced by young women, states

assume an additional financial burden through the cost of public assistance programs and lost tax revenue (approximately $12 billion annually). [75]

Sexually transmitted infections. Sexually transmitted infections (STIs) have been a public health concern since the 1960s [77] and are a significant cause of morbidity and mortality in the U.S. [69, 77, 78] Public health practitioners have called for urgent action to be taken from stakeholders to help control the spread of infection, as combined cases of syphilis, gonorrhea, and chlamydia have reached an all-time high for all age groups. [6] Further, contracting chlamydia, gonorrhea, or syphilis has been associated with increased risk for acquiring Human Immunodeficiency Virus (HIV). [2]

The most recent nationally representative data observed a total of 1,579,885 cases of chlamydia, which accounts for a rate of 481.3 cases of chlamydia per 100,000 population. [26] Cases of chlamydia increased by 2.8% between 2018 and 2019 [27], but in 2020 decreased by 13% compared to the prior year. [26] However, the decrease in cases of chlamydia are suggested to be a result of the COVID-19 pandemic, therefore the CDC recommends STI surveillance data collected during 2020 be interpreted with caution. [26] In 2009, overall rates of gonorrhea were at historic lows. [79] Since then, gonorrhea rates have expanded by 111%. Between 2019 and 2020, rates of gonorrhea increased by 5.7%, and accounted for 677,769 reported cases. Cases of syphilis were at historic lows in the early 2000s. Since then, yearly increases in reported syphilis cases have been observed, increasing by 6.8% between 2019 and 2020 (133,945 cases of syphilis) [26] Since historic lows were recorded in the early- and mid-2000s, rates of chlamydia, gonorrhea, and syphilis have increased every year in both males and females, in all geographic regions of the U.S., and among all racial and ethnic groups. [27, 80, 81] Further, concern over

antibiotic resistant STIs has increased, as over half of all reported STIs in 2019 and 2020 were estimated to be resistant to at least one antibiotic. [80, 82]

Chlamydia, gonorrhea, and syphilis are all are transmitted via the same risky sexual behaviors. [69] Anyone who is sexually active can contract an STI, particularly through unprotected vaginal, anal, or oral sex, yet some groups in the U.S. are disproportionately affected. [77] These groups include women, adolescents and young adults ages 15 to 24 years-old, Hispanics, non-Hispanic Black individuals, and men who have sex with men (MSM). [77] The disproportionate rates of infections occurring among women have been observed since the start of STI surveillance by the CDC. [27] In 2000, chlamydia in women was at a rate of 369 per 100,000, while men accounted for 99.5 per 100,000. [27]

The most recent surveillance conducted in 2019 showed rates of chlamydia in women reaching an all-time high of 698.9 cases per 100,000 women, with men also increasing to 399.9 cases per 100,000. [83] Women are particularly susceptible to STIs due to their larger genital surface area, and are also at increased risk for an untreated STI as women are more likely to be asymptomatic compared to men. [29, 77] Left untreated, STIs can cause infertility, which has been the case for at least 20,000 US women yearly. [1]

Adolescents and young adults aged 15 to 24 years account for half of the 26 million annually reported cases of STIs despite making up 25% of the sexually active population. [83] Young adults aged 20 to 24 account for most cases of chlamydia (2899.2 per 100,000) and gonorrhea (713.2 per 100,000). Among teens 15 to 19 years old, rates of chlamydia (2110.6 per 100,000) and gonorrhea (432.4 per 100,000) are projected to continue climbing. [27] Adult populations, particularly those between 25 and 29 years are responsible for the highest rates of syphilis (33.0 per 100,000) compared to teens (7.7 per 100,000) and young adults (27.8 per

100,000). [27] For all age groups, STIs are at their highest levels since the start of CDC surveillance. [27] Moreover, it is estimated that each year up to two-thirds of new infections are not reported, indicating potentially higher rates of STIs burdening these populations. [1]

In 2014, the CDC surveillance began providing STI data by race and ethnicity. [27] Non-Hispanic Black populations made up 32% of all cases of chlamydia, gonorrhea, and syphilis in 2020, despite making up 12% of the total population. Between 2014 and 2019, non-Hispanic Black populations reported the highest rates of chlamydia (1094.6 to 1233.2 per 100,000), gonorrhea (395.4 to 548.9 per 100,000), and syphilis (18.5 to 28.1 per 100,000). [27] Hispanic populations have also observed increases in the three most common STIs, with rates of chlamydia increasing from 363.8 to 392.6 per 100,000, rates of gonorrhea increasing from 69.9 to 115.9 per 100,000, and rates of syphilis increasing from 7.3 to 13.0 per 100,000. [27] Compared to Hispanics and non-Hispanic Blacks, non-Hispanic White populations have historically reported the lowest rates of chlamydia (180.5 to 212.1 per 100,000), gonorrhea (37.6 to 71.1 per 100,000) and syphilis (3.5 to 6.0 per 100,000), indicating STI disparities that may be associated with race and ethnicity. [27]

HIV/AIDS. Over the past 40 years, HIV has reached and maintained epidemic levels. The late stage of the infection, known as AIDS (Acquired Immunodeficiency Syndrome), has killed more than 700,000 people since the early 1980s. [84] While rates of HIV/AIDS have reduced by more than two-thirds since the 1980s, [77] approximately 1.2 million people in the U.S. are living with HIV, with about 13% of them not aware of their status. [85] This is particularly concerning as approximately 69% of new infections are transmitted by an individual that does not know their HIV/AIDS status. [85]Moreover, having an existing STI, like gonorrhea

or syphilis, can put an individual at increased risk of acquiring HIV due shared behaviors and circumstances that are considered risk factors for both STIs and HIV. [77]

Between 2015 and 2019, the overall annual rate of new HIV diagnoses decreased by 8% (from 37,800 to 34,800 new HIV infections), but increased in some subgroups. [86] Among individuals ages 13 to 24, 35 to 44, and 45 to 54 years old, rate of new diagnoses increased between 2015 and 2019. [86] Rates of new HIV diagnoses for groups ages 25 to 35 and 55 years and older remained stable. [86]Populations older than 50 years old are less likely to get tested for HIV compared to younger populations partly due to some of the HIV symptoms mirroring natural aging, like aching joints. [87] Conversely, adolescents with HIV are the least likely of any age group to be aware of an infection in-part due to experiencing a more suppressed viral load compared to older groups. [88] Further, about one-third of new HIV transmission are estimated to have resulted from individuals unaware of their HIV/AIDS status. [89] Additionally, those that are aware of their status but not receiving care, a commonality among youth, account for about 60% of new transmissions. [89]

Additional subgroups that are disproportionately impacted by new HIV diagnoses include non-Hispanic Black (44% of new HIV cases) and Hispanic individuals (30% of new HIV cases) despite making up just 13% and 18% of the U.S. population in 2019. [86] Being gay, bisexual, or engaging in male to male contact and being a non-Hispanic Black or Hispanic man increases risk of new HIV diagnosis; these subgroups made up 26% and 21% of new cases in 2019. [90] Further, roughly three out of four non-Hispanic Black gay and bisexual men that received an HIV diagnosis in 2018 were between the ages of 13 and 34. [91]

The only 100% effective way to avoid STIs and HIV is to not engage in vaginal, anal, or oral sex. [85] For those who are sexually active, lowering the chance of acquiring an STI and

HIV can be done through consistent and correct use of condoms [92], engaging in communication with partners about safe sex practices [93], reducing number of sexual partners [94], delayed first-sex [95], or consistently using antiretroviral treatment (strictly for HIV suppression). [96] Public health behavioral interventions that promote prevention strategies have traditionally taken place in the classroom, community, or in a physician's office. [97] Despite public health efforts, rates of STIs and HIV have posed as a substantial health challenge in the U.S., particularly among certain subgroups. [39]

Condom use behaviors. In the past decade, significant declines in reports of U.S. adolescents ever having sexual intercourse (from 46% in 2009 to 38% in 2019) have been observed. [98] Conversely, STI cases have reached epidemic levels, and HIV cases have increased in certain subgroups. [6] This is particularly concerning as the most recent National Youth Risk Behavior Survey (YRBS) [98] reported 54.3% of U.S. high school students used a condom at last intercourse, which was a decrease from 61% in 2009. Although condoms are characterized as a less effective method of pregnancy prevention compared to the implant (0.1% failure rate), IUD (0.1 to 0.8% failure rate), injectable (4% failure rate), the pill (7% failure rate), the patch (7% failure rate), and the ring (7% failure rate), condoms (13% failure rate) are vital to the prevention and control of STI, HIV, and unintended pregnancy. [99]

The YRBS examined condom use behavior by grade level, reporting higher use of condoms as a primary method for pregnancy prevention among lower grade levels (9^{th} grade, 55.3%; 10^{th} grade 47.7%) compared to higher (11^{th} grade, 45.3%; 12^{th} grade, 37.4%). [100] Additionally, differences in condom use at last sexual intercourse were found between grade levels, with those in 9^{th} grade reporting the highest rates (61.3%) of use at last sexual intercourse, followed by those in 11^{th} grade (56.3%), 10^{th} grade (55.4%), and 12^{th} grade (50.3%). [100]

Among high school students, use of IUD or implant for pregnancy prevention increased by grade level (9th grade <1.0%; 10th grade 3.3%; 11th grade 3.2%; 12th grade 8.2%), yet the prevalence of using no method was the same across grades. [100] Of the adolescents who initiated sex before age 13, lower rates of condom use (33.4%) were reported during their high school years compared to those who initiated sex after age 13 (44.8%). [22]

According to the 2017 National Survey of Family Growth [8], as age increased, reported use of condom at last intercourse and consistency of condom use in the past 12 months declined. Moreover, the males and females between the ages of 15 and 19 reported the highest use of condom during the last intercourse (78.4% and 56.8%), followed by individuals aged 20 to 24 years old reported (55.0% and 33.7%) and the lowest reported among 25- to 44-year-olds (24.1% and 18.1%). [8] Similar trends were observed among males and females reporting condom use at every-intercourse in the past 12 months, as 15 to 19 year-olds reported the highest rates (53.5% and 35.6%), followed by individuals ages 20 to 24 years-old (29.5% and 17.9%), and the lowest rates reported among 25 to 44 year-olds (13.0% and 11.9%). [8] Among the entire sample, lower rates of condom use at last intercourse and consistency of condom use in the past 12 months were observed among cohabitating, engaged, and married individuals (14.2-18.3%). [8] These findings are consistent with existing literature denoting lower rates of condom use among married and cohabitating individuals, which is more common among older populations. [101-103]

In contrast to sex and age, differences in condom and contraceptive behaviors have been observed among Hispanic, non-Hispanic Black, and non-Hispanic White adolescents in the most recent YRBS. [100] Condom use at last sex was reported highest among Hispanic adolescents (56.2%), compared to non-Hispanic Black adolescents (55.8%), and non-Hispanic White

adolescents (48.2%). [100] The highest prevalence of no pregnancy prevention method used at last sex was among non-Hispanic Black adolescents (23.2%), followed by Hispanic adolescents (12.8%), then non-Hispanic White adolescents (6.8%). [100] Condom use as a primary prevention method was higher among Hispanic adolescents (49.6%) in comparison to non-Hispanic Black (37.2%) and non-Hispanic White (42.3%) adolescents. [100] Similar to the YRBS, the NSFG observed condom use behavior differences based on race and ethnicity. [8] Of the sampled 15 to 44 year-olds, non-Hispanic Black males and females reported the highest rates of condom use during every-intercourse the past 12 months (22.1% and 20.8%), compared to Hispanic males (20.5%), non-Hispanic White males (17.2%), Hispanic females (14.9%), then non-Hispanic White females (13.3%). [8]

In sum, despite condoms being the only contraceptive method that decreases risk for both STI and pregnancy, reported use of this method has declined in recent years. [8] Moreover, the presented data indicates notable differences in condom use behaviors based on sex, race, and ethnicity. Additionally, older populations report the lowest consistent use of condoms, but have higher rates of stable relationships. Subsequent sections will include discussions on studies evaluating contributing factors associated with condom use behavior.

Contributing Factors.

Formal sex education. Formal sex education generally takes place in structured settings, with instruction traditionally held in schools, youth centers, churches, and other community-based organizations. [62] The original goal of formal sex education was to encourage adolescents to adopt healthy lifelong attitudes and behaviors that are thought to protect them from adverse sexual health outcomes. [104] Today, formal sex education is considered one of the key solutions to improve sexual health outcomes in all age groups. [15]

Formal school-based sex education in the United States was formally introduced in the 1920s, called sexual hygiene education, and primarily focused on the consequences of contracting a STI. [105] When formal school-based sex education made its debut, about 40% of public schools chose to integrate some variation of sex education into their curriculum, with more educational content reportedly being developed by the high school itself. [105] Despite educational efforts to communicate the consequences of unprotected sex, an increase in nonmarital adolescent pregnancy became a public health concern in the 1960s. [106] Furthering concern, the HIV/AIDS pandemic increased the need for evidence-based formal instruction of safe sex practices in the early 1980s [106], calling on state governments and schools for additional support. [62]

In 2017, Congress provided $176 million for evidence-based, medically accurate and age-appropriate pregnancy prevention programs for adolescents. [107] Additionally, $90 million was provided for abstinence-only-until-marriage or abstinence-based programs, in which adolescents are encouraged to voluntarily abstain from non-marital sexual activity. [107] The majority of states require HIV/AIDS education, with added components covering what legislators view as a critically important topic for young people to learn in that state. [62] Currently, the U.S. spends the most money on formal sex education than any other country. [80]

Generally, there are two types of school-based sex education offered in U.S. schools – abstinence-based and comprehensive sex education (CSE). [62, 108] Evaluations of formal school-based sex education programs have traditionally used age of first sex, number of long-term sexual partners, and condom use behaviors as outcome variables. [109] Adolescent and young adult populations have traditionally been the focus of research evaluating formal sex education efficacy, with many yielding mixed results on its effects. Additionally, group

differences of sexual outcomes based on sex, race and ethnicity have been observed [62, 110], suggesting varying efficacy of formal school-based sex education.

Despite sharing similar goals of improved sexual health outcomes among adolescents, many studies indicate outcome differences between groups that received abstinence based versus CSE. Of the handful of studies using a rigorous experimental design, evaluations of abstinence-based programs have observed little to no change in sexual behaviors. [12, 111, 112] One study on an abstinence-based program with focus on postponing first-sex, found no effects on delayed first-sex, frequency of sex, number of sexual partners, or use of condoms during sex. [12] When abstinence-based programs have been paired with curriculum on birth control, likelihood of using condoms at first-sex significantly increased compared to only an abstinence-based approach. [12] These findings are consistent with literature indicating abstinence-based programs that encourage the use of condoms or contraceptives, also called abstinence-plus, are associated with protective effects on sexual risk behaviors. [113, 114]

Despite similarities in content, abstinence-plus and CSE are different in approach. Abstinence-plus programs recognize not everyone will remain abstinent and provides additional curriculum on condoms and contraceptives, but places abstinence at the top of the hierarchy. [113] CSE does not utilize a hierarchy and presents all safer sex strategies on equal platforms. [113] Studies evaluating the sexual outcomes of populations that received CSE report more positive influence on immediate and short-term sexual behaviors and outcomes. [63, 108, 115] Kohler et al. [115] observed marginal associations with less likelihood of engaging in vaginal intercourse and a significant reduction in teen pregnancy likelihood among populations receiving CSE compared to abstinence-only. Additionally, declines in risk of acquiring an STI and HIV

have been related to CSE programs that include both abstinence and use of birth control as safer sex behaviors. [108]

Studies evaluating the inclusion of sex education, regardless of type, versus no sex education have produced similar findings. Three different studies utilizing NSFG data measured associations of adolescent sexual behaviors and the inclusion or exclusion of formal school-based sex education. Of the studies, two found significant associations between receiving sex education with delays of first-sex [95, 115], and all observed an increased likelihood of contraceptive use at first-sex compared to the group reporting no instruction. [95, 115, 116] Additionally, there is evidence that vulnerable populations are among those receiving no instruction. [95] Using the same NSFG data, one study observed the majority of adolescents and young adults reporting no receipt of sex education were Hispanic, non-Hispanic Black, or had mothers with low educational attainment. [95]

Longer-term sexual health outcomes related to formal school-based sex education are not well-understood and studies evaluating impacts vary in duration of follow-up. Of the limited studies, one used recall of sex education received among a group of 15 to 24 year-olds, comparing their experience with current sexual health outcomes. [95] Indirect relationships were observed with reduced likelihood of getting a partner pregnant, multiple partnerships at one time, recent treatment for STI, and increased likelihood of condom use among those that received some type of sex education. [95] Though, these relationships only appeared among males reporting first-sex at age 20 or older. [95] Another study evaluated knowledge on safer sex practices approximately 6- to 20-months following a HIV-focused formal school-based sex education program, resulting in significantly higher knowledge that was sustained compared to the control group. [117] While there is limited understanding of the relationship formal school-

based sex education has on later-life outcomes, there is evidence suggesting some behaviors developed during adolescence can be maintained into adulthood. [50, 54]

Currently, 39 states and the District of Columbia mandate formal school-based sex education. [118] Of the 39 states, 29 and DC mandate sex education and HIV education, two states mandate just sex education, and nine states mandate just HIV education. [118]In 35 states, abstinence must be stressed if the school chooses or is mandated to have formal school-based sex education. [118] Twenty states and DC require information on contraceptives, 19 states require curriculum that promotes sexual activity only within marriage, 19 states and DC require information on the adverse impacts of teen sex and pregnancy, and 18 states require curriculum to be medically accurate. [118] Additionally, parents are able to opt-out their child from formal school-based sex education in 37 states. [118]

Parent-adolescent sex communication. Parent-adolescent sex communication has increasingly been regarded as an effective strategy in reducing negative sexual health outcomes. This communication is bi-directional, often involving discussions prompted by both the parent and adolescent. [119] Today, nearly one-third of adolescents report not discussing sex-related topics with their parent; however, a nationally representative sample of adolescents showed that they consider their parents as the most influential figure in regards to their sexual decision making. [120] Moreover, adolescents that recall having sex-related discussions with their parent are more likely to report delayed first-sex [121, 122], and use of condoms [121-123] and contraceptives. [122] Despite these overall trends, it remains unclear how this strategy influences later-life sexual behaviors and how they differ based on contextual factors related to the adolescent and parent.

In a study observing teen differences in the topics discussed related to sex among partners, friends, and parents, teens reported most of their discussions on condom use, birth control, risk of STIs, risk of HIV/AIDS, risk of pregnancy, and abstinence more with their parent (26%) or friend (20%) compared to their partner (8%). [124] Yet, discussing all six of the mentioned topics was less common compared to discussion on individual topics, for example, abstinence (62%) was the most common topic discussed between parents and teens. [124] Sex differences were also found, as girls discussed significantly more topics with their parent compared to boys. [124]

Previous studies demonstrate the importance of understanding racial and ethnic differences of parent-adolescent sex communication and sexual behaviors. Non-Hispanic Black teens reported higher rates of discussing sex-related topics with parents compared to non-Hispanic White teens. [124] The same sample of non-Hispanic Black teens reported mostly positive attitudes regarding sex communication with their parent [124], which was consistent with another study using a similar sample of non-Hispanic Black teens. [7] Additionally, findings indicated a significantly positive association between condom use self-efficacy and parent-teen sex communication among non-Hispanic Black teens. [7]

Higher levels of family connectedness, referring to a sense of care, support, and belonging within a family [125], and open communication about sex-related topics have been positively associated with sexual health protective factors, including consistent condom and contraceptive use, and pregnancy avoidance. [126] Research has indicated family connectedness and communication about sex may also differ by race and ethnicity of the parent and adolescent. Compared to non-Hispanic Black and non-Hispanic White adolescents, a nationally representative sample of Hispanic adolescents report higher amounts of family connectedness

and sex-related conversations with their parent. In one study, a significantly positive association between high levels of Hispanic parent-adolescent sex communication and condom use was observed. [127] Two studies using Add Health data found differences between the sexual behaviors influenced by parent-adolescent sex communication. One found an association between Hispanic and non-Hispanic Black mother-adolescent sex communication and reduced frequency of intercourse and number of partners, while another observed a relationship with greater frequencies of sex communication and higher likeliness to initiate sex at a young age, specifically among Hispanic and non-Hispanic White female adolescents.

One focus of parent-adolescent sex communication research is frequency of discussions. Several studies have observed episodic or one-time discussions between parent and adolescent [128-130], while other studies report more continuous sex communication. [131, 132] The differences in these studies are based on contextual factors, for example, fathers more were likely to engage in 'spotty' sex communication with their adolescent in one study [133], and another observed progression into frequent, open dialogues regarding sex between fathers and their child as they got older. [131] These findings were consistent with another study using a national sample of college-aged young adults who reported more frequent, open and comfortable conversations about sex with their parent when they were seniors in high school compared to when they were freshman. [132] Additionally, there is evidence that higher education status, particularly among mothers, is associated with greater likelihood to engage in parent-adolescent sex communication. [134] A number of authors have recognized differences between sons and daughters, as parents report discussing sex more often with their daughters than sons [135], and another study observed higher frequency of communication regarding STIs and contraceptives among sons than daughters. [136] Finally, non-Hispanic Black adolescents report more frequent

sex communication with their parents compared to Hispanic and non-Hispanic White adolescents. [134, 135]

Studies have indicated differences in effectiveness of parent-adolescent sex communication may be based on frequency and topic discussed. In one study, parent-adolescent sex communication on sex, contraceptives, condoms, STIs, and pregnancy prevention was associated with higher likeliness to engage in safer sex behaviors, like condom and contraceptive use during adolescence. Consistent with this research, observations in another study found significant correlations between high levels of parent-adolescent sex communication and delays in first-sex, contraceptive use, and condom use at first and most recent sex. [137] Additionally, a sample of high school students reporting higher frequency of parent-adolescent sex communication were significantly negatively associated with engaging in unprotected sex. [138] These studies indicate the protective effects that parent-adolescent sex communication has on adolescent sexual behaviors, but more long-term effects are not well-understood. Further, influencers of parent decisions to engage in and how much sex communication varies, and can be based on their child's age, perceptions of their child's current sexual behaviors, and personal beliefs of contraceptive and condom efficacy. [119]

Moral implications of adolescent sexual activity has historically been part of parent-adolescent sex communication. [18] Message tone and content differ among adolescent and parent reported gender, as studies show parents are more likely to have discussions based in morality with daughters than with sons. [18, 139] According to parents, sex communication with sons revolve around taking responsibility for behaviors, while daughters receive messages about valuing oneself. [18, 139] Adolescent males have reported more conversations on how to use a condom [12], while females recalled discussions on abstaining from sex before marriage [140],

how to say no to sex [141], birth control methods, where to obtain contraceptives, and the consequences of STIs. [12] Further, when adolescent boys and girls perceived their parent having more permissive attitudes about sex, a higher likelihood of STI was found. [142]

The presented studies indicate the importance of sex communication, particularly between parents and adolescents, and in schools, but there is limited understanding of the future impacts these contributing factors have on unintended pregnancy, STI, HIV, and condom use behaviors. Additionally, with studies suggesting differences based on age, sex, educational attainment, race and ethnicity, analysis of subgroups may aid in the understanding of contributing factors of sexual health disparities experienced by these populations.

Rural, urban, and suburban health. In 1970, more than half (56%) of rural residents did not have a high school diploma. Since then, these numbers have significantly decreased to 15%. [143] There is strong evidence suggesting education is a protective factor for adverse sexual health outcomes, particularly in rural areas. An inverse relationship has been observed among women that have attained education beyond high school and rates of unintended pregnancy. Further, rural women with less than a high school degree make up the highest rate of unintended pregnancy (73 unintended pregnancies per 1,000 pregnancies). [5]

Simply living in a rural area may increase risk for unintended pregnancy. [144, 145] Rural teens making up 15% of the total population, yet account for 19% of teen births. [69] Despite overall teen pregnancy and birth rates declining since 2009, rural areas have fallen more slowly (declining 31% between 1990 and 2010) compared to urban areas (declining 50% between 1990 and 2010). [144] The most recent data provided by the National Campaign to Prevent Teen and Unplanned Pregnancy [144] indicate disproportionate rates of teen pregnancy

based on locale, with rural teens (30.9 births per 1,000) reporting higher rates compared to their urban (24.3 births per 1,000) counterparts. [144]

According to the National Campaign to Prevent Teen and Unplanned Pregnancy, reports of sexual activity are higher among 15 to 19 year-olds in rural areas compared to urban areas. [144] Compared to teen girls in urban areas, rural teens report a higher rate of ever having sex (40% versus 55%) and having sex in the last three months (29% versus 41%). [144] A non-significant difference was found among rural teens (82% reported contraceptive use) likeliness to use contraceptives in the last three months compared to their urban (86% reported contraceptive use). [144] Lastly, rural teens (4%) were more likely to report using school-based health centers as a source of contraceptive education compared to urban (2%) teens. [144]

Among women ages 18 to 44 years old who had sexual intercourse in the last year, rates of non-use of a contraceptive method were about equal for those residing in rural and urban areas. [146] Women in urban areas report a higher percentage of use of less effective (e.g., condom or withdrawal) (25.4%) or moderately effective (e.g., the pill or injectable) (23.3%) methods of birth control compared their rural counterpart. [147] Moreover, a higher rate of rural women have reported use of one of the most effective contraception methods (e.g. contraceptive sterilization or intrauterine device) (40.8%) than women in urban areas (30.4%). [147]

Research to better understand contributing factors to sexual health disparities experienced by all communities have identified multiple influences, including access to health services, access to health education, transportation barriers, and female-headed households. [144] Not all of these factors are exclusive to rural communities despite the disproportionate rates of adverse sexual health outcomes experienced by rural populations. [144] For example, the National Campaign to Prevent Teen and Unplanned Pregnancy found transportation barriers were no

different between rural and urban communities, and the percentage of female-headed households were lower in rural counties. [144] Differences in access to health services were observed between rural and urban communities, which may account for some of the disparities. [144] Further analysis is needed to understand the contextual factors related to the sexual health disparities experienced by rural populations in comparison to their urban and suburban counterparts.

National Longitudinal Study of Adolescent to Adult Health Studies.

Using the first three waves from the National Longitudinal Study of Adolescent Health, Sabia [148] compared the sexual health and behaviors (virginity status, contraceptive use, frequency of intercourse, likelihood of pregnancy, and probability of contracting a STI) of seventh, eighth, and ninth graders to formal school-based sex education received, as well as perceptions of parental disproval of sex. [148] Approximately 80% of the sampled adolescents reported their school offering sex education. [148] Consistent with the literature, the probability of intercourse and pregnancy increased with age, and one of the strongest correlates of decreased adolescent sexual activity was female adolescents' perception of parent disproval of her having sex. [148] There was a small association (2.9% higher probability) found between offered school-based sex education and age of first sex. [148] Additionally, sex education was associated with no change or an increased likelihood of engaging in unprotected sex at most recent intercourse. [148] There was significantly higher probability of pregnancy (1-3% higher probability) when formal school-based sex education was offered, but was nonsignificant with testing positive for a STI infection. [148]

Predicting risky sexual activity (i.e., number of sexual partners and contraceptive behaviors) trajectories based on fathers' and mothers' parenting (knowledge of adolescent

friends and activities) and family activities (i.e., family dinners, religious activities, having fun with family) was the focus of Coley, Votruba-Drzal, and Schindler's study. [149] Consistent with the literature, the more involved an adolescent was with their parents, the less an adolescent would engage in risky sexual behaviors compared to peers that had less involved parents. [149] In this study, adolescents' rates of risky sexual behaviors increased over time (a 41% rise per 6-month increase in age) when there was a low-level of parental involvement and less effective parenting processes. [149] This study suggests parenting processes may serve as a protective factor for adolescent risky sexual behaviors.

Recognizing the extensive literature related to sexual risk and education status among adolescent populations, Annang et al [150] explored the association of education status (i.e., high school diploma only, or enrolled in or a graduate from a four-year college as of 2001-2002) and STI status in the previous 12 months (diagnosed by a doctor with chlamydia, gonorrhea, or trichomoniasis) among a population of non-Hispanic Black and non-Hispanic White young adult females. [150] An inverse association was found between education status and STI diagnosis among both non-Hispanic Black and non-Hispanic White young adult females. [150] This association was stronger among the non-Hispanic White sample of females compared to the non-Hispanic Black sample. [150] Additionally, non-Hispanic Black women who were enrolled in a four-year college or had graduated from college had significantly higher predicted probabilities of having an STI compared to non-Hispanic White women with just a high school diploma. [150] Despite these findings, this study was limited to measurement at one time point. It is also unclear if these populations were engaging in risky sexual behaviors associated with STI risk. [150] This study suggests measurements of education status may not be sufficient in understanding its relationship with adverse sexual health outcomes, like STI.

Shafii, Stovel, and Holmes [151] compared sexual behaviors and risk of STI among adolescents who did not use a condom at first sex. Covariates in this analysis included if sex education was offered at their school during wave 1. [151] Following a sample of sexually active adolescents through *Waves I-, II-,* and *III In-Home*, adolescents who reported use of condom at first sex were half as likely to report a positive test for chlamydia and gonorrhea compared to adolescents reporting no use of condom at first sex. [151] There was no significant relationship between condom use at first sex and number of long-term sexual partners. [151] Among those who reported use of condom at first sex, 87% reported exposure to formal school-based sex education. [151] Inconsistent with existing literature, 84% of those who did not use a condom at first sex also reported exposure to formal school-based sex education. [151] With high reports of offered school-based sex education and low rates of condom use at first sex, it is unclear if adolescents had engaged in first sex prior to offered formal school-based sex education.

Summary of Findings.

The sexual risk behaviors, like inconsistent or non-use of condoms, reported by adolescent populations may be contributing to the disproportionate rates of pregnancy and STIs observed in this population, potentially influencing similar disparities observed in subgroups of young adult and adult populations. [152] In addition to sexual risk behaviors, researchers have identified protective factors that may contribute to adolescent sexual health and behaviors. [153-155] These protective factors can be communicated through health education, particularly school-based sex education. Parent communication may also play a protective role in adolescent and young adult sexual health and behaviors, as these relationships have increasingly been observed and linked to positive sexual behaviors and health outcome trajectories.

Despite studies aimed to understand parent-adolescent communication effects on adolescent and young adult sexual behaviors and health, none have specifically measured the relationship between parent-adolescent sex communication and the inclusion of school-based sex education on long term condom use behavior. Additionally, two indicators of sexual health, pregnancy and STIs disproportionately impact subgroups of adolescents and young adults. To understand the mechanisms that influence these trends, contextual data through use of explanatory variables is needed.

Without a better understanding of factors that protect adolescents from unintended pregnancy and STI as they transition into adulthood, increases in adverse sexual health outcomes are likely, particularly among Hispanics, non-Hispanic Blacks, and women. This study builds off existing Add Health literature, seeking to understand the relationship that formal school-based sex education has on future unintended pregnancy, STI, and condom use behavior, while also examining the moderating factor of sex communication between parents and their adolescent. After evaluating the literature, several questions remain unanswered:

1. How does the inclusion or absence of formal school-based sex education during adolescence impact future experiences of unintended pregnancy?
2. How does the inclusion or absence of formal school-based sex education and the amount of sex communication with parents during adolescence interact with future experiences of unintended pregnancy?
3. How does the type of parent-adolescent sex communication impact future experiences of unintended pregnancy?
4. Are there differences in unintended pregnancy based on urbanicity during adolescence?

5. How does the inclusion or absence of formal school-based sex education and the amount of sex communication with parents during adolescence impact future STI?
6. How does the type of parent-adolescent sex communication impact future STI?
7. Are there differences in future STI and HIV based on urbanicity of the adolescent?
8. How does the inclusion or absence of formal school-based sex education and the amount of sex communication with parent during adolescence impact future condom use behavior?
9. How does the type of parent-adolescent sex communication impact future condom use behavior?
10. Are there differences in future condom use behavior based on urbanicity of the adolescent?

To address the gaps remaining in available literature and examine the current sexual health and behavioral outcomes of young adults and adults, this study will aim to understand how two prevention strategies (formal school-based sex education and parent-adolescent sex communication) influence future unintended pregnancy, STI, and condom use behavior with the following research questions:

- RQ1: How does the amount of parent-adolescent sex communication moderate the relationship of formal school-based sex education and future unintended pregnancy?
    - RQ1a: How does parent-adolescent sex communication moderate the relationship between formal school-based sex education and long-term unintended pregnancy based on parent focus of sex communication?

    - RQ1b: How does parent-adolescent sex communication moderate the relationship between formal school-based sex education and future unintended pregnancy based on:
        - Adolescent race/ethnicity
        - Adolescent biological sex
        - Adolescent urbanicity
        - Parent educational attainment
        - Parent relationship to adolescent
- RQ2: How does the amount of parent-adolescent sex communication moderate the relationship of formal school-based sex education and long-term STI diagnosis?
    - RQ2a: How does parent-adolescent sex communication moderate the relationship between formal school-based sex education and future STI diagnosis based on parent focus of sex communication?
    - RQ2b: How does parent-adolescent sex communication moderate the relationship between formal school-based sex education and future STI diagnosis based on:
        - Adolescent race/ethnicity
        - Adolescent biological sex
        - Adolescent urbanicity
        - Parent educational attainment
        - Parent relationship to adolescent
- RQ3: How does the amount of parent-adolescent sex communication moderate the relationship of formal school-based sex education and future condom use behavior?

- RQ3a: How does parent-adolescent sex communication moderate the relationship between formal school-based sex education and future condom use behavior?
- RQ3b: How does parent-adolescent sex communication moderate the relationship between formal school-based sex education and future condom use behavior based on:
    - Adolescent race/ethnicity
    - Adolescent biological sex
    - Adolescent urbanicity
    - Parent educational attainment
    - Parent relationship to adolescent

The rationale for this study is to fill an important gap that highlights the power of preventive strategies that serve as a protective factor for future sexual health behaviors and outcomes. This study will further advance the public health's efforts to reduce adolescent, young adult, and adult unintended pregnancy and STI, as well as increase reported condom use, particularly in vulnerable populations.

Chapter III: Methodology

The purpose of this chapter is to discuss the research methodology for these quantitative studies regarding formal school-based sex education and parent-adolescent sex communication and their relationships with long-term unintended pregnancy, sexually transmitted infection (STI), and condom use behavior. Study I examined the relationship between formal school-based sex education and future sexual health outcome of unintended pregnancy. Study II examined the relationship between formal school-based sex education and STIs. Study III then used the same dependent variable, formal school-based sex education, to understand its relationship with long-term condom use behavior. Parent-adolescent sex communication variables were also introduced into these models as a moderator to explore if this variable strengthens or weakens the relationship. The significant interactions were then plotted to understand how parent-adolescent sex communication moderated the observed relationship. This secondary data analysis used data from *Waves I-V* from the National Longitudinal Study of Adolescent to Adult Health (Add Health). [23]

The National Survey of Adolescent and Adult Health Research Design.

The National Longitudinal Study of Adolescent to Adult Health, or Add Health, is a longitudinal study of a nationally representative sample of more than 20,000 adolescents in grades 7-12 in the United States. [23] Using a school-based design, adolescents were recruited and followed starting in 1994-95, as they transitioned into adulthood. The primary sampling frame derived from the Quality Education Database (QED), providing information on 26,666 US high schools. The Add Health study selected 80 high schools with probability of selection proportional to school size. Stratification of schools were based on region, urbanicity, school type, racial and ethnic mix, and size (schools needed to have more than 30 students and an 11th

grade). Feeder schools, typically middle schools, were selected based on the 80 high schools recruited. To make up for the possibility of dropout, replacement schools were added within each stratum until an eligible high school or high school and its feeder school were selected. Of the contacted schools, 79% agreed to participate in the study. Of the 132 schools that agreed to participate, 52 were feeder schools. School sizes varied from under 100 students to over 3,000 students.

Add Health was developed in response to a mandate from the US Congress, with aims to understand adolescent health from social, behavioral, and health perspectives. The original focus of Add Health was to understand the causes of adolescent health and health behavior while documenting multiple factors related to this developmental period, but over time, this study evolved to include determinants and consequences of development and health trajectories from adolescence into adulthood. The following section will discuss the Add Health study design by wave.

Wave I In-School Survey (1994). From 1994 to 1995, in-school questionnaires were administered to high schools and their feeder schools. High schools and feeder schools originally recruited yielded 90,118 students (a 79% response rate), with close attention focused on ethnic, racial, geographic, and school type (i.e., public, private, or charter). Students surveyed were asked about health status, nutrition, social networks, family composition and dynamics, sexual activity, criminal activities, school activities, future expectations, and other health conditions. The student-administered survey took approximately 45- to 60-minutes to complete, usually during a class period. Additionally, 98.5% of the school administrators representing the 132 schools were asked to complete a 30-minute questionnaire about school policies, health services, and additional school characteristics.

Wave I in-home survey (1995). Between 1994 and 1995, using unequal probability of selection from those that completed an in-school survey, as well as those enrolled in school rosters provided by the QED (but did not complete the in-school survey), a core sample was stratified in each school by grade and sex for the *Wave I In-Home* survey. Seventeen students were randomly chosen from each stratum to yield approximately 200 adolescents from each pair (high school and feeder school) of schools. Among the sampled were 12,105 adolescents in grades 7 to 12. Adding to the sample of 12,105, a supplemental sample was added to the *Wave I In-Home* surveys and was based on ethnicity (Cuban, Puerto Rican, and Chinese), siblings (twins, full siblings, half sibling, and unrelated adolescents living in the same household), adoption status, and disability. The Add Health Study design also oversampled non-Hispanic Black adolescents with parents that were highly educated. Additionally, adolescents from two large school and 14 small schools were recruited for in-home surveys. The large schools were purposefully selected based on race and urbanicity. One of the large schools was predominantly non-Hispanic White and located in a small town, and the other was marked with ethnic heterogeneity and located in a major metropolitan area. The small schools were in rural and urban areas, representing both public and private schools. With the addition of the supplemental samples, the In-Home Survey yielded a sample of 20,745 adolescents. Data collection in *Waves I* through *V* of the *In-Home* surveys was administered by an interviewer using computer-assisted self-interview software (CASI).

The *Wave I In-Home* survey included questions pertaining to the social environments that include school, family, romantic relationships, the neighborhood, community, and peer relationships. Questions about education, work, sexual and fertility histories, daily activities, substance use, delinquency and violence, attitudes and religion, psychology, and personality

were also part of the *Wave I In-Home* surveys. Of the biological data collected was the height, weight, and body mass index (BMI) of the adolescent.

Parent interview (1995). In addition to adolescents, the Add Health Study recruited a parent of the *Wave I In-Home* participants to participate in a *Parent Interview*. The *Parent Interview* included a 30- to 40-minute op-scan interviewer-assisted interview using CASI. Of the parents initially recruited for the study, 85% completed the *Parent Interview*, yielding a sample of 17,670. Mothers were the preferred parent in this study due to previous research indicating mothers are generally more familiar with their child's schooling, health status, and health behaviors compared to fathers. Information gathered from this portion of the Add Health Study included inheritable health conditions, marriage and marriage-like relationships, volunteer, civic, or school activities, health behaviors, education, employment, household income and governmental assistance, parent-adolescent communication and relationship, and the parent's familiarity with their adolescent's social life, and neighborhood characteristics. With the inclusion of parents in the *Parent Interview*, the Add Health Study was able to gather data about family contexts from the parent and adolescent perspective.

Wave II in-home survey (1996). In 1996, adolescents that participated in the *Wave I In-Home* survey, were followed up with to complete the *Wave II In-Home* survey. Included in this sample were adolescents in 7th through 11th grade but excluded those that were in 12th grade during the *Wave I In-Home* survey and were not part of the genetic sample. To increase the number of respondents, additional adolescents were recruited for the *Wave II In-Home* survey. The *Wave II In-Home* survey yielded a sample of 14,738 adolescents, with 13,568 originally recruited during the *Wave I In-Home* stage (an 88.6% response rate). The second wave included

similar questions as the *Wave I In-Home* surveys, with added questions regarding nutrition and sun exposure.

Wave III in-home survey (2001). The aim of the *Wave III In-Home* survey was to understand the lifestyle changes made between adolescence and early adulthood, and to understand how experiences and behaviors elicited during adolescence is related to decisions, behaviors, and health outcomes during the transition into adulthood. Conducted between 2001 and 2002, follow-up interviews with *Waves I-* and *II- In-Home* survey participants that were now between the ages of 18 and 26, were gathered through use of CASI. The *Wave III In-Home* survey yielded a sample of 15,170 young adults (a 77.4% response rate), excluding 687 cases from *Wave I In-Home* that were not part of the genetic sample. To collect longitudinal data by use of repeated measures, the *Wave III In-Home* survey included similar questions that were in previous waves. Additionally, information on height and weight, chronic disabling conditions, and other factors related to morbidity were collected. The *Wave III In-Home* survey was expanded from previous waves to include questions that focused on the multiple domains pertaining to young adulthood, including the labor-market, higher education, relationships (i.e., parent, siblings, and friends from high school), parenting, civic participation, and community involvement. Biological specimens were also collected that included samples of urine and saliva for testing of HIV and curable STIs, as well as a sample of deoxyribonucleic acid (DNA). The average length of an interview took approximately 135-minutes, with 90-minutes dedicated to the survey and the remainder used to collect biological specimens.

Wave IV in-home survey (2008). In 2008, *Wave IV In-Home* surveys were conducted. Participants ranged between the ages of 24 and 36 years old and were transitioning out of young adulthood into adulthood. Participants from the *Wave I In-Home* survey (excluding the 687 cases

not sampled at Wave III) were included in the *Wave IV In-Home* survey. *Wave IV In-Home* surveys sampled a total of 15,701, yielding an 80.3% response rate. The *Wave IV In-Home* survey included repeated measures seen in previous waves regarding physical, mental, sexual health, relationships, risky behaviors, attitudes, religion, personality. New to the Add Health Study and to the *Wave IV In-Home* survey were questions about cognitive function, psychosocial factors, substance use and abuse, and work attitudes and characteristics. Additionally, biological data included BMI, blood pressure, pulse, immune inflammation, diabetes, DNA, and genotype information was collected.

Wave V in-home survey (2016). The fifth and most recent wave took place between 2016 and 2018. Participants were then moving through their fourth decade of life, ranging between 31 and 42 years old. With a response rate of 71.8%, 12,300 adults took part in the *Wave V In-Home* survey. Different to prior waves, *Wave V In-Home* used a mixed mode survey design that included an online portal and mail-in surveys. Follow-ups interviews were done via phones, using CASI, for those that did not respond to the online or mail-in options. Building on life course history of respondents and refining measures taken in earlier waves, the *Wave V In-Home* survey asked retrospective questions about birth and early childhood, as well as repeated measures seen in previous waves that pertained to work, family, romantic relationships, their neighborhood, and community. Biological measures and specimens were also taken via venous blood draw during in-home examinations. Adding to the previous measures of height, weight, BMI, blood pressure, pulse, immune inflammation, and diabetes was a measure of kidney disease. The fifth wave did not include biological measures of DNA and genotypes.

Study I (Manuscript I)

Overarching research question for manuscript I. How does amount of parent-adolescent sex communication moderate the relationship of formal school-based sex education and future unintended pregnancy?

1) How does parent-adolescent sex communication moderate the relationship between formal school-based sex education and future unintended pregnancy based on parental focus of sex communication?
    a. Behavior-based
    b. Moral-based
    c. Social-based
2) How does parent-adolescent sex communication moderate the relationship between formal school-based sex education and future unintended pregnancy based on:

- Adolescent to adulthood demographics
    - Race/ethnicity (*Wave I In-Home*)
    - Biological sex (*Wave I In-Home*)
    - Urbanicity (*Wave I In-Home*)
- Parent demographics
    - Educational attainment (*Parent Interview*)
    - Relationship to adolescent (*Parent Interview*)

Sample.

Inclusion and exclusion criteria. Eligibility for this secondary data longitudinal analysis was limited to those that reported on formal school-based sex education during the *Wave I In-*

Home survey. Those recruited in *Wave II In-Home* that did not report on formal school-based sex education or had aged out (graduated high school/were no longer in 12th grade) of the study were be excluded from the analysis. Participants that did not have a parent that reported on sex communication in the *Parent Interview* will also be excluded. To be included, participants must have reported ever-having vaginal sexual intercourse before or at the same wave that a pregnancy was reported. Eligible participants must have reported on at least one pregnancy and the intention so that pregnancy by *Wave V In-Home* of the study.

Instrumentation and Measurement Protocols.

Demographics. Demographics of the participants were measured using the *Wave I In-Home* surveys. This study used participant race/ethnicity, biological sex, and urbanicity recorded during the *Wave I In-Home* survey as demographic variables. Additionally, parent demographics were gathered from the *Parent Interview*. From the *Parent Interview*, parent race/ethnicity, educational attainment, and relationship to participant/adolescent served as demographic variables for this population.

To increase the validity of this analysis, reports of ever-having vaginal sexual intercourse before or at the same wave a pregnancy intention was reported was used as an inclusion variable. *Waves I-V In-Home* surveys asked participants to report on vaginal sexual intercourse experience, using response options: 'no', 'yes', 'legitimate skip', and 'don't know'. Due to the sensitive nature of this question, adolescents over the age of 15 included in this survey question, while participants younger than age 15 were placed in the 'legitimate skip' group (See Appendix A, Section I). For this study, ever-having vaginal intercourse was measured using a dichotomous (yes, no) response, with those that responded with 'don't know' or 'legitimate skip' placed among the missing variables.

Race/ethnicity of the parent was used as a descriptive variable. Disparities in reported teen pregnancies have been observed among adolescents raised in a predominantly Hispanic or non-Hispanic Black household [156]. Similar outcomes have been observed among adolescents who are Hispanic or non-Hispanic Black themselves [134]. To avoid multicollinearity, participant race/ethnicity was used as a covariate in this study, while parent race/ethnicity served to further describe participating parents. Parent race/ethnicity options included non-Hispanic White, non-Hispanic Black, and Hispanic. Other racial categories were placed in 'other' category. Response of 'refused' and 'don't know' were transformed into missing variables (see Appendix A, Section I).

Although biological females are directly impacted by pregnancy, research has indicated decisions about whether or not to have sex, to use contraception, and to terminate a pregnancy are rarely made by just the female in partnerships [157]. Research about male pregnancy intentions is limited [72], and in an effort to increase the understanding of male pregnancy intentions into adulthood, biological sex of the adolescent during the *Wave I In-Home* surveys were used as a descriptive variable. Those that responded with 'refused' or 'don't know' to describe biological sex were transformed into missing variables (see Appendix A, Section I).

Like adolescents, differences between tone and topics discussed by fathers and mothers have been documented. [134, 149] Despite this, interviewers during the *Parent Interview* were instructed to 'ask to speak to the student's mother' and if the mother did not reside in the household, 'the appropriate respondent' would be chosen from a list that included this order: 'stepmother', 'other female guardian, such as a legal guardian or grandmother', 'father', 'stepfather', 'other male guardian, such as a legal guardian or grandfather.' [23] Interviewers were also instructed to not schedule an interview with a male respondent out of convenience.

[23] Mothers were the desired respondent to complete the survey because, according to Add Health researchers [23], mothers are generally more familiar with their adolescent's schooling, health status, and health behaviors compared to fathers. For this analysis, the relationship between the parent in the *Parent Study* and *Wave I In-Home* participants was used as a descriptive variable to define the parent population. All parents reporting themselves as the participant's 'biological mother' were grouped together, while parents reporting themselves as 'stepmother', 'other female guardian, such as legal guardian or grandmother', 'father', 'stepfather', 'other male guardian, such as legal guardian or grandmother', 'father', 'stepfather', or 'other male guardian, such as legal guardian or grandmother' were grouped together as 'other parent figure'. Those that refused were considered a missing variable (See Appendix A, Section I).

Teen pregnancy has been associated with socioeconomic disparities, including low education of the teen's family. [158] Parents in the *Parent Interview* were asked about their educational attainment. The original Add Health Study included the answer options: 'never went to school', '8th grade or less', 'more than 8th grade, but did not graduate high school', 'went to a business, trade, or vocational school instead of high school', 'graduated high school', 'completed GED', 'went to business, trade, or vocational school after high school', 'went to college, but did not graduate', 'graduated from college or a university', 'professional training beyond a 4-year college', and 'refuse' (see Appendix A, Section I).

For this study, parent educational attainment was measured using the response options: 'never went to school', '8th grade less', and 'more than 8th grade bud did not graduate high school', were transformed into a single response option: 'less than high school'. The options 'went to business, trade, or vocational school instead of high school', 'graduate high school', and

‘completed GED’ were transformed into a single response option: ‘high school graduate or completed GED’. To measure post-high school, the response options of ‘went to business, trade, or vocational school after high school’ and ‘went to college but did not graduate’ were combined into a single response option: ‘went to business, trade, or vocational school after high school, or went to college but did not grade’. The options of ‘graduated from a college or university’, and ‘professional training beyond a 4-year college or university’ were combined into a single response option: ‘graduated from college or university or professional training beyond a 4-year college or university’. Due to the documented influence of parent educational attainment [158], those that refused to respond were placed with missing data.

Covariates. Based on existing literature indicating influences of adolescent race/ethnicity, adolescent biological sex, urbanicity, parent race/ethnicity, parent educational attainment, and relationship to the adolescent were used as covariates. The use of covariates will increase the precision of this analysis by introducing a possible predictive variable to test the main and interaction effects on unintended pregnancy [159].

Exiting literature has indicated differences in reports of teen pregnancy [69] and unintended pregnancy [147] based on the urbanicity of the individual. To understand differences in reported pregnancy intentions based on urbanicity, the *Wave I In-Home* surveys were used. During the *Wave I In-Home* survey, the interviewer was responsible for defining the location the survey took place. [23] The original survey provided response options: ‘rural’, ‘suburban’, ‘urban, residential only’, ‘3 or more commercial properties, mostly retail’, ‘3 or more commercial properties, mostly wholesale or industrial’, ‘other’, ‘refused’, ‘don’t know’, and ‘not applicable’ (See Appendix A, Section II). For this study, urbanicity was measured using the

responses: ‘rural’, ‘suburban’, and ‘urban residential, commercial, and retail’. The responses of ‘other’, ‘refused’, ‘don’t know’, and ‘not applicable’ were categorized as missing variables.

Marital status was used as a control variable in this analysis as unintended pregnancy rates are lower among married women compared to their single counterpart. [33] The original Add Health survey asked for marital status in *Waves I-V In-Home,* with the structure of the question and response options differing per wave (See Appendix A, Section II). For this study, marriage at the wave the first pregnancy and intention of pregnancy was reported was measured using responses that were dependent on the wave: *Wave III In-Home* ‘yes’ and ‘no’; *Wave IV In-Home* ‘yes’ and ‘no’; *Wave V In-Home* ‘married’, ‘widowed’, ‘divorced’, ‘separated’, and ‘never married’. The responses of ‘don’t know’, ‘skip’, and ‘refused’ were categorized as ‘missing’.

In addition to marital status, age during reported pregnancy intention was used as a control variable as older age has been associated with increased intentions of getting pregnancy. The original Add Health survey asked for age in *Wave I-V In-Home* (See Appendix A, Section II). For this study, age when the reported pregnancy was experienced was measured using categorized age groups: ‘18-24 years old’; ‘25-32 years old’; ‘33-43 years old’. The responses of ‘don’t know’, ‘skip’, and ‘refused’ were categorized as ‘missing’.

Formal school-based sex education variables. Since the 1980s, the primary goal of sex education has been to provide, clear, consistent, and age-appropriate guidance on sex, reproductive health, and relationships that can protect an individual from the negative sexual health outcomes of unintended pregnancy, STIs, and/or HIV/AIDS. [160] Different school-based sex education approaches in middle and high schools, including the context discussed, have been documented. [12, 62] The implications of these different approaches have been well-documented in short-term analyses [12, 63], however, the long-term consequences of formal school-based sex

education is not well-understood. To understand the long-term impacts school-based sex education may have on reported unintended pregnancy, school-based sex education was used as a predictor in this analysis.

Measured during *Wave I In-Home*, participants were prompted to check all subjects that they had learned at their current middle or high school. The school-based sex education subjects to choose from were 'pregnancy' and 'HIV/AIDS' (See Appendix A, Section III). For this study, the two variables were kept separate. The response options were dichotomized to 'yes' or 'no'. Those that answered 'refused' or 'don't know' were considered a 'missing' variable.

Parent-adolescent sex communication variables. Parents have the potential to positively impact their adolescent's sexual health by engaging in parent-adolescent sex communication. [161] To measure parent-adolescent sex communication, responses from the *Parent Interview* were used. Interview questions asked about the amount the parent had communicated with their adolescent on behavior-, moral-, and social-based topics related to sexual intercourse.

Using a 4-point Likert scale (not at all, somewhat, a moderate amount, a great deal), parents reported on how much they engaged in sex communication regarding topics of pregnancy, birth control, STIs, and the moral and social implications of sexual intercourse (See Appendix A, Section IV). For this study, the 4-point Likert scale answer options will remain as is, using the responses 'not at all', 'somewhat', 'a moderate amount', and 'a great deal' when describing how often they had spoken to their adolescent about pregnancy, birth control, and STIs. These three variables were combined for a mean score to represent frequency of *behavior-based* sex communication. In addition to *behavior-based* sex communication, one variable measuring the moral implications of sexual intercourse was used to measure *moral-based* sex

communication and one variable measuring the *social implications* of having sexual intercourse was used to represent how often *social-based* communication occurred. Those that refused to respond were placed with the 'missing' group.

Unintended pregnancy variables. Experienced pregnancies were measured between *Waves I-V In-Home*. If a participant reported a pregnancy, the intent of the pregnancy was then asked, also during *Waves I-V In-Home*. However, pregnancy intention differed in question structure and response options in *Waves I* and *II In-Home*. For this reason, pregnancy intentions of reported pregnancy for the main analysis were measured starting at *Wave III*- to *V In-Home*.

Waves III-V In-Home surveys offered a dichotomized (yes, no) response option as it pertained to the intention of the reported pregnancy. Additionally. *Waves III* and *IV In-Home* surveys allowed up to three pregnancies for participants to report intentions on and *Wave V In-Home* gave participants up to six pregnancies to report intentions on (see Appendix A, Section V). For this study, *Waves III-V In-Home* used the original Add Health survey responses (yes, no), for intentions of reported pregnancy. Those that responded with 'not sure', 'don't know', 'refused', or 'skip' were categorized with missing variables. Due to existing research indicating differing risk factors associated with number of unintended pregnancies experienced [147], this study quantified the intentions of the <u>first</u> reported pregnancy between *Waves III-V In-Home* to represent long-term pregnancy intention among study participants.

Data Analysis.

All data was analyzed using Stata 17 software. [162] Due to stratified sampling employed for the Add Health Study [23], appropriate adjustments through use of weights provided by Add Health were used. [23] Of the weights used, longitudinal and population weights were used to

understand the relationship between *Wave I In-Home* reports of school-based sex education and *Waves III-V* reports pregnancy intentions for the first reported pregnancy. [23]

Once the appropriate weights and control variables are added, basic frequencies were obtained to help define the participants of this study. The basic frequencies from *Wave I In-Home* surveys included: biological sex, race/ethnicity, urbanicity, marital status, age, and school-based sex education experience. Basic frequencies from the *Parent Interview* included: race/ethnicity, relationship to adolescent, educational attainment, and frequencies of sex communication.

Chi-square analysis was used to understand if the main predictor variable, school-based sex education, differed by covariates (participant biological sex, race/ethnicity, urbanicity, parent race/ethnicity, parent educational attainment, and parent relationship to adolescent). Additionally, linear regressions were used to understand the influence of study covariates on reported parent-adolescent *behavior-*, *moral-*, and *social-based* se communication.

Covariates, marital status and age during first report of pregnancy and their intention between *Waves III-V In-Home,* were added to the regression to understand the relationship between the independent variable (school-based sex education) and covariates, with the dependent (pregnancy intention of first reported pregnancy) variables. Due to the explanatory variable of school-based sex education subject, pregnancy, being dichotomous, a logistic regression was the most appropriate statistical method used to understand the relationship between these variables. [163]

The moderating variables measuring amount of parent-adolescent behavior-based sex communication was each added to a logistic regression model to further explain and understand

how the strength of the relationship between school-based sex education and pregnancy intention of the first reported pregnancy were impacted. [164] Amount of parent-adolescent sex communication was reported by parent in the *Parent Interview* and for the purpose of this study, these variables were split into three topics: *behavior-*, *moral-*, and *social-based* sex communication. Parent-adolescent sex communication variables were then centered to ensure that zero was a meaningful value for the three moderators. [165] Each moderator was added to a regression model to understand its interactions with the main study variable, school-based sex education, and covariates.

Study II (Manuscript II)

Overarching research question for manuscript II. How does amount of parent-adolescent sex communication moderate the relationship of school-based sex education and future sexually transmitted infections (STIs).

3) How does parent-adolescent sex communication moderate the relationship between school-based sex education and future STIs based on parental focus of sex communication?

1) Behavior-based
2) Moral-based
3) Social-based

2) How does parent-adolescent sex communication moderate the relationship between school-based sex education and future STIs based on:

- Adolescent to adulthood demographics
    - Race/ethnicity (*Wave I In-Home*)
    - Biological sex (*Wave I In-Home*)
    - Urbanicity (*Wave I In-Home*)
- Parent demographics
    - Educational attainment (*Wave I In-Home*)
    - Relationship to adolescent (*Wave I In-Home*)

Sample.

Inclusion and exclusion criteria. Eligibility for this secondary data longitudinal analysis was be limited to those that reported on school-based sex education, particularly school-based

HIV sex education, during *Wave I In-Home.* Participants recruited during *Wave II In-Home* that did not report on school-based sex education in *Wave I In-Home* or aged out of the study (graduated high school/were no longer in 12th grade) were excluded from the analysis. Additionally, participants that did not have parents participating in the *Parent Interview* and didn't report on sex communication were excluded. Participants must have also answer questions in at least one wave about diagnostic history of chlamydia (up to *Wave IV In-Home*), gonorrhea (up to *Wave IV In-Home*), or syphilis (up to *Wave IV In-Home*).

Instrumentation and Measurement Protocols.

Demographics. Participant demographics were measured using the *Wave I In-Home* surveys (adolescent and parent). Participant race/ethnicity, biological sex, and urbanicity were used to describe the study population. The demographics of parents from the *Parent Interview* included race/ethnicity, educational attainment, and relationship to the adolescent.

To increase the validity of this analysis, reports of ever-having vaginal sexual intercourse before of at the same wave an STI was reported was used as an inclusion variable. *Waves I-V In-Home* surveys asked participants to report on ever engaging in vaginal sexual intercourse, and measured with response options: 'no', 'yes', 'legitimate skip', and 'don't know'. Due to the sensitive nature of this question, the Add Health study only included adolescents over the age of 15, while participants younger than age 15 were placed in the 'legitimate skip' group.

Race/ethnicity of participating parents in the *Parent Interview* was used to describe the parent population. Parent responses of 'refused' and 'don't know' in reference to race/ethnicity questions were transformed into missing variables. Additionally, parent relationship to participating adolescent was used as a descriptive variable in this study. Interviewers during the *Parent Interview* were instructed to 'ask to speak to the student's mother' and if the mother did

not reside in the household, 'the appropriate respondent' would be chosen from a list that included this order: 'stepmother', 'other female guardian, such as a legal guardian or grandmother', 'father', 'stepfather', 'other male guardian, such as a legal guardian or grandfather.' [23] Interviewers were also instructed to not schedule an interview with a male respondent out of convenience. [23] Mothers were the desired respondent to complete the survey because, according to Add Health researchers [23], mothers are generally more familiar with their adolescent's schooling, health status, and health behaviors compared to fathers. Parent relationship to adolescent/participant included response options: 'biological mother', 'step-mother', 'adoptive mother', 'foster mother', 'grandmother', 'aunt', 'other female relative', 'other female non-relative', 'biological father', step-father', 'adoptive father', 'foster father', 'grandfather', 'uncle', 'other male relative', 'other male non-relative', and 'refused'. [23] Due to small numbers of parent participant that were not the biological mother, this study used two categories of parent-adolescent relationship, biological mother, and other parental figure. These variables were used to describe the parent population. (See Appendix A, Section I).

Parent educational attainment was used as a descriptive and covariate to define the populations and understand differences in long-term STI diagnosis based on the education status of the parent. Existing literature has observed a relationship between parents with low education status and increased risk for acquiring STIs. [166, 167] During the *Parent Interview,* parents were asked about their educational attainment. The original survey included the answer options: 'never went to school', '8^{th} grade or less', 'more than 8^{th} grade, but did not graduate high school', 'went to a business, trade, or vocational school instead of high school', 'graduated high school', 'completed GED', 'went to business, trade, or vocational school after high school',

‘went to college, but did not graduate’, ‘graduated from college or a university’, ‘professional training beyond a 4-year college’, and ‘refuse’ (see Appendix A, Section I).

For this study, parent educational attainment was measured using the response options: ‘never went to school’, ‘8th grade less’, and ‘more than 8th grade bud did not graduate high school’, will be transformed into a single response option: ‘less than high school’. The options ‘went to business, trade, or vocational school instead of high school’, ‘graduate high school’, and ‘completed GED’ were transformed into a single response option: ‘high school graduate or completed GED’. To measure post-high school, the response options of ‘went to business, trade, or vocational school after high school’ and ‘went to college but did not graduate’ were combined into a single response option: ‘went to business, trade, or vocational school after high school, or went to college but did not grade’. The options of ‘graduated from a college or university’, and ‘professional training beyond a 4-year college or university’ were combined into a single response option: ‘graduated from college or university or professional training beyond a 4-year college or university’. Due to the documented influence of parent educational attainment [158], those that refused to respond were placed with missing data.

Covariates. Based on existing literature indicating influences of adolescent race/ethnicity [39], adolescent biological sex [168], urbanicity [145, 169], marital status [27], parent educational attainment [147, 167], and relationship to the adolescent, these variables were included in this analysis as covariates [149]. The purpose of these covariates were to increase the precision of this analysis by introducing possible predictive variables to test the main and interaction effects on STI diagnosis [159].

To understand differences in reported STI and HIV diagnoses based on urbanicity, the *Wave I In-Home* surveys were used. During the *Wave I In-home* survey, the interviewer was

responsible for defining the location the survey took place in. [23] The original survey provided response options: ‘rural’, ‘suburban’, ‘urban, residential only’, ‘3 or more commercial properties, mostly retail’, ‘3 or more commercial properties, mostly wholesale or industrial’, ‘other’, ‘refused’, ‘don’t know’, and ‘not applicable’ (See Appendix A, Section II). For this study, urbanicity was measured using the responses: ‘rural’, ‘suburban’, and ‘urban residential, commercial, and retail’. The responses of ‘other’, ‘refused’, ‘don’t know’, and ‘not applicable’ were placed with missing variables.

Marital status was used as a control variable in this analysis due to studies confirming lower reported rates of STIs among married individuals compared to their single counterpart. [33] The original Add Health survey asked for marital status in *Waves I-V In-Home*, with the structure of the question and response options differing per wave (See Appendix A, Section II). For this study, marriage at wave in which the first STI diagnosis was reported was used as a control variable. Response options from the Add Health Study came from *Wave II In-Home* (yes, no), *Wave III In-Home* (yes, no), and *Wave IV In-Home* (yes, no). This study dichotomized marital status response options (yes, no) from each wave. The responses of ‘don’t know’, ‘skip’, and ‘refused’ were be categorized as missing variables.

In addition to marital status, age during STI diagnosis was used as a control variable as younger age is associated with increased risk of STI. The original Add Health survey asked for age in *Wave I-V In-Home* (See Appendix A, Section II). For this study, age when the reported STI diagnosis was experienced was measured using categorized age groups:‘15-18 years old’; ‘19-24 years old’; ‘25-32 years old’. The responses of ‘don’t know’, ‘skip’, and ‘refused’ were categorized as ‘missing’.

Formal school-based sex education variables. Since the 1980s, the primary goal of sex education has been to provide, clear, consistent, and age-appropriate guidance on sex, reproductive health, and relationships that can protect an individual from the negative sexual health outcomes of unintended pregnancy, STIs, and/or HIV/AIDS. [160] Different school-based sex education approaches in middle and high schools, including the context discussed, have been documented. [12, 62] The implications of these different approaches have been well-documented in short-term analyses [12, 63], however, the long-term consequences of school-based sex education is not well-understood. To understand the long-term impacts sex education may have on reported unintended pregnancy, school-based sex education was used as a predictor in this analysis.

Measured during the *Wave I In-Home* survey, participants were prompted to check all subjects that they had learned at their current middle or high school. The sex education subjects included were pregnancy and HIV/AIDS (See Appendix A, Section III). For this study, school-based HIV sex education was used, using a dichotomized response option (yes, no). Participants reporting 'yes' were considered a group that received school-based HIV sex education, while participants reporting 'no' were defined as not having school-based HIV sex education. Those that answered 'refused' or 'don't know' were placed into missing data.

Parent-adolescent sex communication variables. Parents have the potential to positively impact their adolescent's sexual health by engaging in parent-adolescent sex communication. [161] To measure parent-adolescent sex communication, results from the *Parent Interview* were used. Survey questions asked about the amount the parent had communicated with their adolescent on *behavior-*, *moral-*, and *social-based* topics related to sexual intercourse.

Using a 4-point Likert scale, the *Parent Interview* included parent reports of how often they engaged in sex communication regarding topics of pregnancy, birth control STIs, and the

moral and social implications of sexual intercourse (See Appendix A, Section IV). For this study, the 4-point Likert scale answer options remained as is, using the responses 'not at all', 'somewhat', 'a moderate amount', and 'a great deal' when describing how often they had spoken to their adolescent about pregnancy, birth control, and STIs. These three variables were combined for a mean score to represent frequency of *behavior-based* sex communication. In addition to *behavior-based* sex communication, one variable measuring the moral implications of sexual intercourse was used to measure *moral-based* sex communication and one variable measuring the social implications of having sexual intercourse was included to represent how often *social-based* communication occurred.

STI and HIV/AIDS variables. STI and HIV/AIDS variables were measured using questions regarding past 12-month or ever diagnosis of syphilis, chlamydia, gonorrhea, and HIV/AIDS. The Add Health Study varied in question structure and waves in which all syphilis, chlamydia, gonorrhea, and HIV diagnosis were measured. Past 12-month diagnosis of syphilis, chlamydia, and gonorrhea were measured in *Waves II-* and *III- In-Home*, while ever diagnosis of syphilis, chlamydia, and gonorrhea were measured in *Waves I-IV In-Home*. Past 12-month diagnosis of HIV/AIDS was measured in *Waves II-* and *III- In-Home*, while ever diagnosis of HIV/AIDS was measured in *Waves I-V In-Home* (See Appendix A, Section V). For this study, ever diagnosis of STI (syphilis, chlamydia, and gonorrhea) was used from the *Waves II-IV In-Home* surveys. Due to the wording of survey questions, the first report of diagnosis experience between *Waves II-IV In-Home* were used. The *Wave I In-Home* reports of STI diagnosis were used a control variable in this study. Additionally, diagnosis of HIV/AIDS was used from *Waves II-V In-Home* for descriptive purposes. Like STI diagnosis, HIV/AIDS diagnosis survey wording

made it difficult to identify a timeline of diagnosis, therefore, the first report of HIV/AIDS diagnosis was used for this study.

The original Add Health Study used response options for STIs and HIV/AIDS in all waves: 'no', 'yes', 'refused', legitimate skip', and 'don't know'. This study dichotomized response options (yes, no) for diagnosis responses of STI and HIV/AIDS.

Changes to study protocol. Following the proposal of this present study, analysis of variables revealed an inadequate sample size for the HIV/AIDS diagnosis variable. Due to the small sample size, the primary researcher was advised to use HIV/AIDS diagnosis as a descriptive variable rather than an outcome variable.

Data Analysis.

All data was analyzed using Stata 17. [162] Due to stratified sampling employed for the Add Health Study [23], appropriate adjustments made for sample selection and participants was necessary for this analysis. This study used sampling weights provided by Add Health to make the adjustments required in order to obtain unbiased results. [23] Longitudinal weights were used in for ever-diagnosis of STI between *Waves II-IV In-Home* as it relates to school-based HIV sex education, as well as moderation of parent-adolescent sex communication.

Once the appropriate weights were added, basic frequencies were obtained to help define the participants of this study. Basic frequencies included in this analysis were captured at *Wave I In-Home* depicting participant: biological sex, race/ethnicity, urbanicity, marital status, school-based HIV sex education *Wave I In-Home* diagnosis of STI. Age during *Waves II-IV In-Home* diagnosis of STI (syphilis, chlamydia, or gonorrhea) was used to further describe the population. Additionally, the diagnosis of STI and HIV/AIDS during *Waves II-IV In-Home* were included as descriptive variables. Parent demographics were captured during the *Parent Wave* and included

parent: race/ethnicity, relationship to adolescent, educational attainment, and sex communication frequency.

Following calculations of basic frequencies, a chi-square analysis was employed to understand the relationships between the main predictor variable, school-based HIV sex education, and the study's covariates (participant biological sex, race/ethnicity, urbanicity, parent educational attainment, parent-adolescent relationship). First diagnosis of HIV/AIDS reported between *Waves I-IV In-Home* was compared to covariates in a chi-square analysis, and first diagnosis of HIV/AIDS reported between *Waves II-IV In-Home* was compared with school-based HIV sex education in a chi-square analysis. Additionally, to understand the variations of influence that study covariates have on parent-adolescent sex communication topics, *behavior-*, *moral-*, and *social-based* sex communication this study utilized a linear regression.

To understand the relationship between the independent and dependent variables, a logistic regression analysis was be employed while controlling for marital status, age, and *Wave I In-Home* STI diagnosis. Considering this study used a dichotomized dependent variable, a logistic regression was the most appropriate statistical method used to understand the relationship between school-based HIV sex education and first report of STI diagnosis. [163] This regression also included covariates to further understand relationships STI diagnosis.

The next step in this analysis introduced the moderating variable, parent-adolescent sex communication, to understand the interaction between school-based HIV sex education and long-term STI diagnosis. [165] Additionally, interactions were observed with the study's covariates. The frequency of parent-adolescent sex communication was measured during the *Parent Interview* and grouped by topic: *behavior-*, *moral-*, and *social-based* sex communication. Interaction terms were centered to ensure that zero was a meaningful value for the three

moderating variables. Parent adolescent sex communication frequency measured during the Wave I In-Home Parent Surveys will be used as a moderator in this analysis. [165] Each moderator was analyzed independently using a logistic regression analysis that included the study's main predictor variable, school-based HIV sex education, and covariates. All significant interactions with then plotted to understand the direction of the moderating relationships observed.

Study III (Manuscript III)

Overarching research question for manuscript III. How does amount of parent-adolescent sex communication moderate the relationship of formal school-based sex education and future condom use behavior?

4) How does parent-adolescent sex communication moderate the relationship between formal school-based sex education and future condom use behavior based on parental focus of sex communication?

4) Behavior-based

5) Moral-based

6) Social-based

2) How does parent-adolescent sex communication moderate the relationship between formal school-based sex education and future condom use behavior based on:

- Adolescent to adulthood demographics
    - Race/ethnicity (*Wave I In-Home*)
    - Biological sex (*Wave I In-Home*)
    - Urbanicity (*Wave I In-Home*)
- Parent demographics
    - Educational attainment (*Wave I In-Home*)
    - Relationship to adolescent (*Wave I In-Home*)

Sample.

Inclusion and exclusion criteria. Eligibility for this secondary data longitudinal analysis will be limited to those that reported on school-based sex education during the *Wave I In-Home* survey. Participants at the start of the *Wave II In-Home* survey that did not report on school-

based sex education or aged out of the study (graduated high school/were no longer in 12th grade) were excluded from the analysis. Additionally, participants that did not have a participating parent report on sex communication in the *Parent Interview* were excluded. Participants must have reported on condom use at most recent sexual intercourse by or within the *Wave III In-Home* survey.

Instrumentation and Measurement Protocols.

Demographics. Demographics of participants were taken from the *Wave I In-Home* surveys and included adolescent race/ethnicity, biological sex, and urbanicity. Parent demographics from the *Parent Interview* included race/ethnicity, educational attainment, and parent-adolescent relationship.

According to existing literature, adolescent race is a risk factor for condom use behaviors. [134] Thus, this study will use participant race/ethnicity as a descriptive variable and covariate. This study used non-Hispanic White, non-Hispanic Black, and Hispanic subpopulations. Due to the small size of respondents in other racial/ethnic categories, additional reported races/ethnicities were grouped together representing 'other'. Responses of 'refused' and 'don't know' in reference to race and ethnicity questions were transformed into missing variables (see Appendix A, Section I).

Due to significant differences in condom use behaviors based on biological sex, condom use behaviors based on biological sex was necessary for this study. [170, 171] Participants were grouped as 'male' or 'female' based on their response to the *Wave I In-Home* survey. Those that responded with 'refused' or 'don't know' to describe biological sex were transformed into missing variables (see Appendix A, Section I).

Despite documented differences regarding the tone and topics of sex communication between fathers and mothers [134, 149], the Add Health Study focused recruitment for *Parent Interview* on mothers. [23] Interviewers conducting the *Parent Interview* instructed to 'ask to speak to the student's mother' and if the mother did not reside in the household, 'the appropriate respondent' would be chosen from a list that included this order: 'stepmother', 'other female guardian, such as a legal guardian or grandmother', 'father', 'stepfather', 'other male guardian, such as a legal guardian or grandfather.' [23] Interviewers were also instructed to not schedule an interview with a male respondent out of convenience. [23] Mothers were the desired respondent to complete the survey because, according to Add Health researchers [23], mothers are generally more familiar with their adolescent's schooling, health status, and health behaviors compared to fathers. Parent-adolescent relationship measured during the *Parent Interview* included response options: 'biological mother', 'step-mother', 'adoptive mother', 'foster mother', 'grandmother', 'aunt', 'other female relative', 'other female non-relative', 'biological father', step-father', 'adoptive father', 'foster father', 'grandfather', 'uncle', 'other male relative', 'other male non-relative', and 'refused'. [23] Due to *Parent Interview* recruitment primarily focused on mothers, this study included biological mothers as subpopulation. To provide comparable study populations, this study grouped additional parents together to represent 'other parent figures' (See Appendix A, Section I).

Previous literature indicates an existing relationship between parent education status and adolescent sexual behaviors. [137, 158, 166] Due to this, parent educational attainment was used as a descriptive and covariate to define the populations and understand differences in long-term condom use behavior based on the education status of the parent. During the *Parent Interview*, parents were asked about their educational attainment. [23] The original survey included the

answer options: ‘never went to school’, ‘8th grade or less’, ‘more than 8th grade, but did not graduate high school’, ‘went to a business, trade, or vocational school instead of high school’, ‘graduated high school’, ‘completed GED’, ‘went to business, trade, or vocational school after high school’, ‘went to college, but did not graduate’, ‘graduated from college or a university’, ‘professional training beyond a 4-year college’, and ‘refuse’ (see Appendix A, Section I). [23] For the purpose of this study, parent educational attainment was measured using the response options: ‘never went to school’, ‘8th grade less’, and ‘more than 8th grade bud did not graduate high school’, will be transformed into a single response option: ‘less than high school’. The options ‘went to business, trade, or vocational school instead of high school’, ‘graduate high school’, and ‘completed GED’ was transformed into a single response option: ‘high school graduate or completed GED’. To measure post-high school, the response options of ‘went to business, trade, or vocational school after high school’ and ‘went to college but did not graduate’ were combined into a single response option: ‘went to business, trade, or vocational school after high school, or went to college but did not grade’. The options of ‘graduated from a college or university’, and ‘professional training beyond a 4-year college or university’ were combined into a single response option: ‘graduated from college or university or professional training beyond a 4-year college or university’. Due to the documented influence of parent educational attainment [137, 158, 166], those that refused to respond were placed with missing data.

Covariates. Based on existing literature indicating influences of adolescent race/ethnicity, adolescent biological sex, urbanicity, marital status, parent educational attainment, and relationship to the adolescent, these variables were included as covariates.

To understand differences in reported condom use behavior based on urbanicity, the *Wave I In-Home* survey responses were used. *Wave I In-Home* interviewers were responsible for

defining the location the survey took place. [23] The original survey provided response options: ‘rural’, ‘suburban’, ‘urban, residential only’, ‘3 or more commercial properties, mostly retail’, ‘3 or more commercial properties, mostly wholesale or industrial’, ‘other’, ‘refused’, ‘don’t know’, and ‘not applicable’ (See Appendix A, Section II). [23] For the purpose of this study, urbanicity was be measured using the responses: ‘rural’, ‘suburban’, and ‘urban residential, commercial, and retail’. The responses of ‘other’, ‘refused’, ‘don’t know’, and ‘not applicable’ were categorized as missing variables.

Marital status and age during reported recent sex condom use was used as control variables in this study due to being married and older age being associated with less overall use of condoms during sex [33] The original Add Health survey asked for marital status in *Waves I-V In-Home*, with the structure of the question and response options differing per wave (See Appendix A, Section II). [23] For the purpose of this study, marital during reported condom use behavior was measured using responses that are dependent on the wave: *Wave II In-Home* (yes, no) and *Wave III In-Home* (yes, no). The responses of ‘don’t know’, ‘skip’, and ‘refused’ were categorized as missing variables.

For this study, age when the reported condom use behavior occurred was included as a control variable using categorized age groups: ‘15-18 years old’ and ‘19-26 years old’. The responses of ‘don’t know’, ‘skip’, and ‘refused’ were categorized as ‘missing’.

Formal school-based sex education variables. Since the 1980s, the primary goal of sex education has been to provide, clear, consistent, and age-appropriate guidance on sex that can protect an individual from the negative sexual health outcomes of unintended pregnancy, STIs, and/or HIV/AIDS. [160] Different types of school-based sex education approaches, as well the outcomes differences among adolescent-aged population are well-documented [12, 63], however,

the long-term behaviors related to school-based sex education are not well-understood. To understand the long-term impacts sex education may have on condom use behaviors, school-based sex education was used as the main predictor variable in this study.

Measured during the *Wave I In-Home* survey, participants were prompted to check all subjects that they had learned at their current middle or high school. [23] The sex education subjects included pregnancy and HIV/AIDS (See Appendix A, Section III). [23] For the purpose of this study, school-based HIV sex education was used as the main predictor variable.

Parent-adolescent sex communication variables. Parents have the potential to positively impact their adolescent's sexual health by engaging in parent-adolescent sex communication. [161] To measure parent-adolescent sex communication, *Parent Interview* responses were used. [23] Survey questions asked about the amount the parent had communicated with their adolescent on *behavior-*, *moral-*, and *social-based* topics related to sexual intercourse. [23]

Using a 4-point Likert scale, the *Parent Interview* had parents report on how often they engaged in sex communication with their adolescent regarding pregnancy, birth control, STIs, and the moral and social implication of sexual intercourse (See Appendix A, Section IV). [23] For the purpose of this study, the 4-point Likert scale answer options remained as is, using the responses 'not at all', 'somewhat', 'a moderate amount', and 'a great deal' when describing how often they had spoken to their adolescent about pregnancy, birth control, and STIs. These three variables were combined for a mean score to represent frequency of *behavior-based* sex communication. In addition to *behavior-based* sex communication, one variable measuring the moral implications of sexual intercourse will be used to measure *moral-based* sex communication and one variable measuring the social implications of having sexual intercourse

will be used to represent how often *social-based* communication occurred. Those that refused to respond will placed with missing variables.

Condom use behavior variables. This analysis included one question about condom use behavior. The Add Health Study obtained responses in *Waves I-III In-Home* about contraceptive use, including condoms, at most recent sex (See Appendix A, Section V). [23]

To measure most recent condom use (measured in *Waves I-III In-Home*), the Add Health Survey used a list of birth control options consisting of response options: 'condoms (rubbers)', 'withdrawal', 'rhythm (safe time)', 'birth control pills', 'vaginal sponge', 'foam, jelly, crème, suppositories', 'diaphragm, with or without jelly', 'IUD (intrauterine device)', 'Norplant', 'ring', 'Depo Provera', 'contraceptive film', 'some other method', refused', 'legitimate skip', 'don't know', and 'not applicable'. [23] If necessary, additional response options were given to participants to report a second and third method of birth control that was used most recently (See Appendix A, Section V). [23] For the purpose of this study, the first, second, and third method survey questions were transformed into one variable to measure all methods used. Those that responded with 'condom (rubbers)' used in the first, second, or third method were coded as 'yes'. The response options: 'withdrawal', 'rhythm (safe time)', 'birth control pills', 'vaginal sponge', 'foam, jelly, crème, suppositories', 'diaphragm, with or without jelly', 'IUD (intrauterine device)', 'Norplant', 'ring', 'Depo Provera', 'contraceptive film', 'refused', and 'don't know' were coded as 'no'. Therefore, the response options for condom use at recent sex were dichotomized (yes, no), representing if the participant did (yes) or did not (no) use a condom at most recent sex. Those that answered 'legitimate skip' and 'not applicable' were placed with missing variables. Additionally, due to one wave of condom use at most recent sex being reported at the same time of school-based HIV sex education (*Wave I In-Home*), *Wave I*

In-Home reports of condom use at recent sex were excluded from this study due to the unknown timeline of these two variables. The first report of recent sex condom use between *Waves II-* and *III-In-Home* was used for this analysis.

Changes to study protocol. Following the proposal of this present study, analysis of variables revealed an inadequate understanding of timelines as it related to reports of condom use at first sex and school-based HIV sex education. Thus, condom use at first sex was not included in the final study. Additionally, proportion of condom use was partner-specific, meaning surveys questions were directed to a specific sexual partner. The partner-specific focus of this survey question included a sample outside of the proposed study's demographics. Therefore, proportion of condom use was not used as an outcome variable in this study. The final study focused on reported condom use at most recent sex as the behavioral outcome.

Data Analysis.

All data was analyzed using Stata 17. [162] Due to stratified sampling employed for the Add Health Study [23], appropriate adjustments made for sample selection and participants was necessary for this study. The Add Health Study provided sampling weights to adjust for sample selection. [23]

Basic frequencies were obtained to help define study participants. From the *Wave I In-Home* survey, basic frequencies obtained included: biological sex, race/ethnicity, urbanicity, marital status, and age. Basic frequencies from the *Parent Interview* included parent: race/ethnicity, educational attainment, relationship with adolescent, and reports of parent-adolescent *behavior-*, *moral-*, and *social-based* sex communication. [23]. To understand the study population's condom use at most recent sex behaviors, basic frequency of the first report of condom use at most recent sex between *Waves II-* and *III- In-Home* were also obtained. [23]

Following calculations of basic frequencies, a chi-square analysis was employed to understand the relationships between the main predictor variable, school-based HIV sex education, and the study's covariates (participant biological sex, race/ethnicity, urbanicity, parent educational attainment, parent-adolescent relationship). First report of condom use at recent sex reported between *Waves II*- and *III- In-Home* was compared to covariates in a chi-square analysis, and first report of condom use at recent sex reported between *Waves II*- and *III- In-Home* was compared with school-based HIV sex education in a chi-square analysis. Additionally, to understand the variations of influence that study covariates have on parent-adolescent sex communication topics, *behavior-*, *moral-*, and *social-based* sex communication this study utilized a linear regression.

To understand the relationship between the independent and dependent variables, a logistic regression analysis was employed while controlling for marital status and age. Considering this study used a dichotomized dependent variable, a logistic regression was the most appropriate statistical method used to understand the relationship between school-based HIV sex education and first report of condom use at recent sex. [163] This regression also included covariates to further understand relationships to this condom use behavior.

The next step in this analysis introduced moderating variables to understand how the strength of the relationship between school-based HIV sex education and condom use at recent sex is influenced by amount of parent-adolescent sex communication. [164, 165] Split into three topics, *behavior-*, *moral-*, and *social-based* parent-adolescent sex communication variables were centered to ensure that zero was a meaningful value for the three interaction terms. [165] Each moderator was analyzed independently through use of a logistic regression with the study's main predictor variable (school-based HIV sex education) and covariates (behavior-, moral-, and

social-based sex communication variables). Significant interactions from each model were then plotted to further describe the moderating relationship observed.

Human Subjects Protection.

An IRB-approved protocol was followed by the Add Health interviewers when surveying participants. [23] This protocol protected participant identities over the five waves of data collection. [23] Approval from the IRB came from the University of Virginia before beginning the study. [23] Steps to ensure participant identities were followed by interviewers and data analyzers. [23] The public use data sets provided by Add Health was held in a password protected external drive that is locked in its own drawer. The key to open the drawer was in a password protected lockbox. The location that the external drive, drawer, key, lockbox, and computer are in a locked room.

Chapter IV (Study I)

Introduction.

Since its peak in 1991, the United States teen and unintended pregnancy rates have declined by 72% [33, 172], however women still experience comparatively higher amounts of unintended pregnancies than in other industrialized countries. [34, 173] Today, approximately 45% of U.S. pregnancies are unintended. [33] Older teens (aged 18-19) [174] and young adults (aged 20-24) [175], rural populations [70, 147], unmarried women [175], low-income groups, and racial/ethnic minorities disproportionately experience unintended pregnancies compared to their counterparts. [33]

Collected between 2008-2011, the most up-to-date nationally representative sample of teens aged 18 to 19 indicate slower declines in unintended pregnancy rates compared to all other age groups. [33, 172] From the age of 20 until 24, one in 12 women will have an unintended pregnancy. [34, 176] In addition to age, Hispanic and non-Hispanic Black females experience significantly higher unintended birth rates (25 births and 26 births per 1,000 aged 15 to 19) than their non-Hispanic White counterparts (11 births per 1,000). [70, 177] Further, Hispanic and non-Hispanic Black teens are twice as likely to give birth before entering young adulthood, with the risk of unintended pregnancy increasing by up to five times once into young adulthood. [33, 70] Among all females, the factors most associated with decreased odds of unintended pregnancy are being non-Hispanic White, having a mother who completed high school, and living in suburban or rural at the time of conception. [33, 70, 147]

Unintended pregnancy is associated with lower educational attainment for the mother, father, and child, ultimately limiting career and earning potential, and increased risk of poverty. [31, 178] Despite evidence of adverse outcomes for all family members, existing research

focuses on females. The limited literature shows differences in pregnancy intention based on male race and ethnicity. [179] Nearly four out of 10 births reported as unintended are among Hispanic and non-Hispanic White males, and one in three are unintended among non-Hispanic Blacks. [172, 179]

Reducing teen and unintended pregnancy are objectives of the Healthy People 2030 Initiative. [42] Strategies to reduce teen pregnancy rates traditionally take form through governmental policy [12], which largely relies on school-based sex education to intervene and prevent negative sexual behaviors. [12, 95] School-based sex education is commonly employed between grades 6 and 12, or during adolescence (ages 10-18). [180] This developmental period is considered highly impressionable [181], with researchers observing learned behaviors during adolescence being sustained into adulthood. [181, 182] Generally, U.S. secondary schools provide abstinence-based or comprehensive sex education (CSE). [12, 180] While these school-based sex education approaches are broad in content and methods, abstinence-based sex education commonly teaches abstaining from sex as the only morally acceptable option to prevent unintended pregnancy. [12] CSE generally includes medically accurate, evidence-based education on abstinence, contraceptives, and condoms. [12, 180] Research evaluating pregnancy outcome differences and safer sex behaviors based on the type of school-based sex education received has yielded mixed results. [95, 180, 183] However, evaluations of experiencing any sex education have shown promising findings. [45, 184] Three studies using the National Survey of Family Growth data observed significant associations between receiving sex education and delayed first sex and increased likelihood of contraceptive use at first sex compared to the group reporting no instruction. [95, 115, 185]

In addition to school, studies have recognized parents as an influential factor in their adolescent's sexual behaviors. [186, 187] However, nearly one-third of adolescents report not discussing sex-related topics with their parents. [9] Adolescents who recall having at-home sex-related discussions are more likely to report delayed first sex [188] and use of condoms [187] and contraceptives. [187, 189] Within this dynamic, a higher frequency of sex communication can increase the likelihood of engaging in safer-sex practices. [188, 189] These studies highlight the protective effects of parent-adolescent sex communication on adolescent sexual behaviors. However, in the after-years of adolescence, the long-term impact of parent-adolescent sex communication is not well-understood.

All women of reproductive age, race, ethnicity, urbanicity, and socioeconomic status are at risk of unintended pregnancy, but subpopulations are disproportionately at risk for unintended pregnancy. [33, 70, 190] Additionally, male experience with unintended pregnancy is not well-understood. Exploring longitudinal links between school-based sex education and parent-adolescent sex communication on pregnancy intention can assist public health practitioners creating inclusive strategies to reduce the burden of unintended pregnancy in at risk populations disproportionately impacted by unintended pregnancy. The objective of this study is to identify long-term associations between school-based sex education and parent-adolescent sex communication on intended pregnancy.

Methods

Add Health Study. The National Longitudinal Study of Adolescent and Adult Health (Add Health) [191] is a school- and home-based longitudinal study collected in five waves and is focused on health, development, and social factors for young people (https://addhealth.cpc.unc.edu/home/). The first wave, *Wave I,* was collected in 1994-1995, while

follow-up waves were conducted in 1996, 2001-2002, 2008, and 2016-2018. [191] Of the eligible *Wave I In-School* participants, a randomly selected core sample of 12,105 adolescents were recruited for the *In-Home* survey. [191] Supplemental groups comprised of oversampled non-Hispanic Black adolescents with highly educated parents and adolescents from urban and rural settings were added to the in-home sample, making up 20,745 adolescents ages 12-19 years old. [191] All *Wave I In-Home* participants in 7-11th grade were eligible to be interviewed for *Wave II In-Home* one year later (*n* = 14,738; 88.6% retention rate). By *Wave III In-Home*, participants were aged 18-26 (*n* = 15,197; 77.4% retention rate) and by *Wave IV In-Home*, they were aged 24-32 (*n* = 15,701; 80.3% retention rate). In the most recent wave, *Wave V In-Home*, participants were aged 32-42 (*n* = 12,300; 71.8%). Additionally, the Add Health Study recruited a subset of parents (*n* = 17,670) of the *Wave I In-Home* participants to take part in a *Parent Interview*. The purpose of the *Parent Interview* was to provide context of parent-adolescent perspectives relative to the Add Health Study focus on health, development, and social factors. [191] For a complete list of Add Health question and answer options, see Appendix A.

Table 1.
Study variables used and corresponding Add Health wave

Variables	*W1* 1995-96 (grade 7-12)	*Parent Interview* 1994-95	*W3* 2001-02 (age 18-26)	*W4* 2008 (age 24-32)	*W5* 2016-18 (age 32-42)
Adolescent Demographic					
Biological Sex	x				
Race/Ethnicity	x				
Urbanicity	x				
Parent Demographic					
Parent Race/Ethnicity		x			
Parent Educational Attainment		x			
Parent-Adolescent Relationship		x			
Inclusion Criteria					
School-Based Sex Education	x				
Ever Sex	x		x	x	x
Pregnancy			x	x	x
Pregnancy Intention			x	x	x
Behavior-Based		x			
Social-Based		x			
Moral-Based		x			
Control Variables					
Marital Status			**x**	x	x
Age			**x**	x	x

Sample

Participants. This study used Add Health data from *Waves I, III, IV,* and *V In-Home* and *Parent Interviews* (See Table 1). [191] The Add Health Study asked participants to report their complete pregnancy history between *Waves I-V In-Home* surveys. During the *Wave I In-Home* survey, only female participants were asked about experienced pregnancies, while male participants were not. School-based pregnancy sex education experience and experienced pregnancies were asked within the same *Wave I In-Home* survey, making it unclear about the timeline of these events. Additionally, differences in risk factors associated with experiencing one unintended pregnancy compared to more than one unintended pregnancy exist. Therefore, the first report of pregnancy among participants between *Waves III-V In-Home* were used for

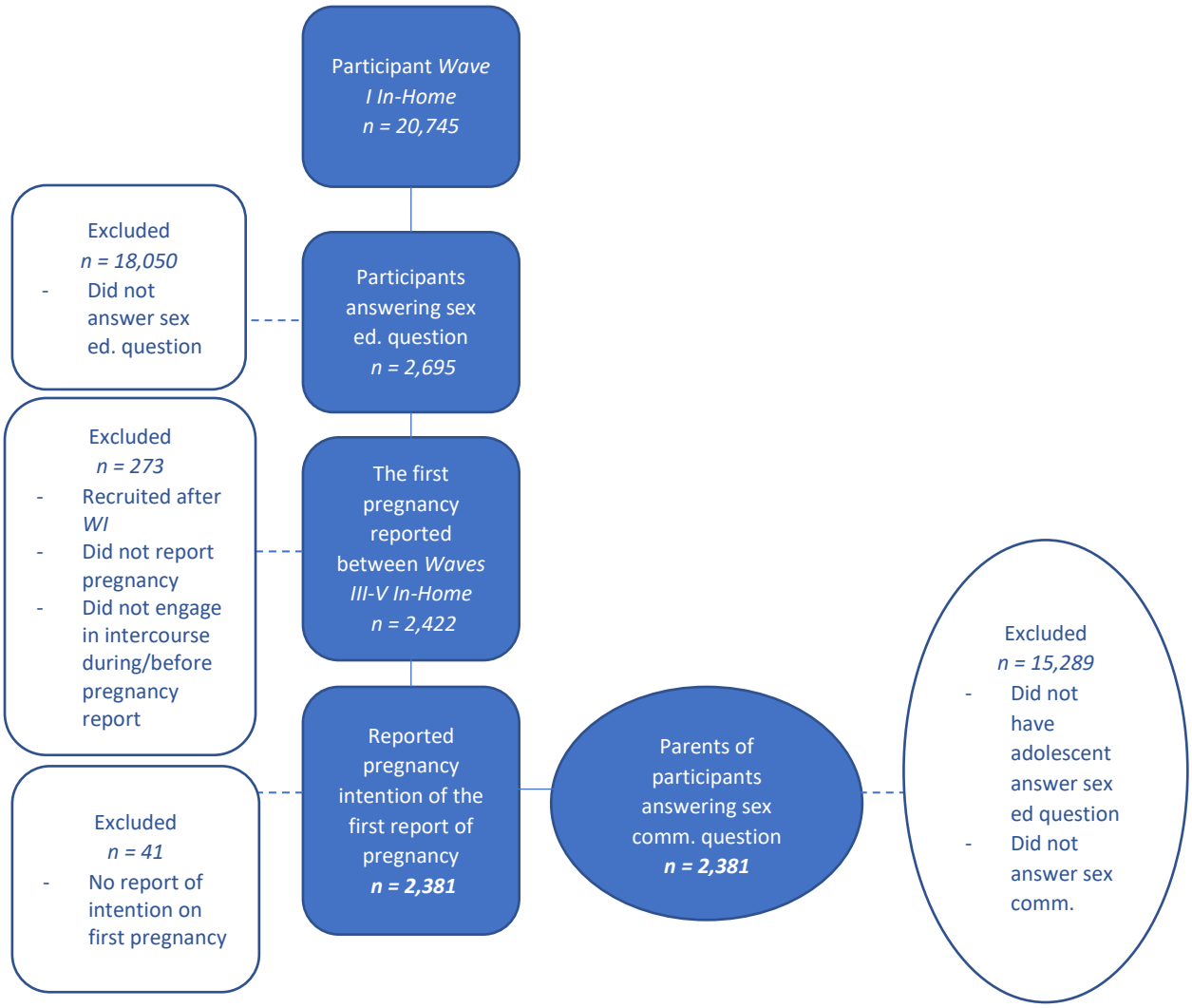
identification of pregnancy intentions (See Figure 4). *Wave II In-Home* was excluded from this analysis due underreporting of pregnancies and pregnancy intention.

For this analysis, to be eligible participants must have:

- Reported on school-based pregnancy sex education at *Wave I In-Home*.
- Reported ever-having vaginal intercourse before or at the same wave a pregnancy and pregnancy intention was reported between *Waves III-V In-Home*.
- Had a parent take part in the *Parent Interview* in 1994-1995 that also reported on sex communication between them and their participating adolescent (See Table 1). [191]

With the inclusion criteria, the final sample used for this analysis was 2,381 participants and 2,381 of their participating parents (See Figure 4).

Figure 4.
Flow chart of inclusion criteria by Add Health wave



Note: Wave II In-Home not used in this study
WI = Wave I In-Home, WIII-V = Waves III-V In-Home
Sex ed. = school-based pregnancy sex education
Sex comm. = parent-adolescent sex communication

Demographics. At *W*ave *I In-Home*, participant sex (male, female), race/ethnicity (non-Hispanic White, non-Hispanic Black, Hispanic), and urbanicity (rural, suburban, urban) were used as covariates. This analysis used three categories of race/ethnicity, with non-Hispanic Whites as the reference group. Additional racial groups too small in sample size were excluded

to provide an accurate comparison to the reference group. Excluded participant racial groups included Native American/Indigenous person (*n* = 42) and Asian or Pacific Islander (*n* = 162) populations (See Table 2).

Within the *Parental Interview* educational attainment for the parent that was interviewed (no high school, high school graduate, some college, college graduate or higher), and parent-adolescent relationship (biological mother, other relationship) were included as covariates. Parent race/ethnicity (non-Hispanic White, non-Hispanic Black, and Hispanic) were used as descriptive variables. Excluded racial parent groups included Native American/Indigenous person (*n* = 59) and Asian or Pacific Islander (*n* = 145) populations (See Table 2).
Waves III-V In-Home: Participant age during first reported pregnancy between *Waves III-V In-Home* (ages 18-24-, 25-32-, 33-44-years old) and marital status (married, not married) were used as control variables (See Table 2).

Instrumentation and Measurement Protocols

School-Based Pregnancy Sex Education. The primary predictor variable, school-based sex education, was assessed at *Wave I In-Home using:*

"Have you learned about the following in a class at school (check all that apply)" [191] Wave I In-Home participants were prompted to use a dichotomized response option (yes, no) to state if they had experienced school-based pregnancy sex education at their current middle or high school (See Table 3).

Parent-Adolescent Sex Communication. This analysis used three centered variables as moderators measuring amount of behavior-, moral-, and social-based parent-adolescent sex communication as reported by a parent in the *Parent Study*. Using a 4-point Likert scale (not at all, somewhat, a moderate amount, a great deal), parents reported the amount of *moral-*,*social-*,

and *behavior-based* sex communication they engaged in with their adolescent (See Table 3). [191]

Moral-based parent-adolescent sex communication was measured using responses from one variable (See Table 3).

- "How much have you and [NAME] talked about (his/her) having sexual intercourse and the moral issues of not having sexual intercourse?" [191]

Social-based parent-adolescent sex communication was measured using responses from one variable (See Table 3).

- "How much have you and [NAME] talked about (his/her) having sexual intercourse and the negative or bad impact on (his/her) social life because (he/she) would lose the respect of others?" [191]

Behavior-based parent-adolescent sex communication was measured using an average score of responses from four variables (See Table 3).

- "How much have you and [NAME] talked about (his/her) having sexual intercourse and the dangers of getting a sexually transmitted disease?"
- "How much have you and [NAME]talked about (his/her) having sexual intercourse and the negative or and things that would happen if [he got someone/she got] pregnant?"
- "How much have you and [NAME] talked about birth control?"
- "How much have you and [NAME] talked about sex"? [191]

Pregnancy Intention. The outcome variable for this analysis measured pregnancy intention for the first reported pregnancy between *Waves III* to *V In-Home* using (See Table 3):

- "Thinking back to the time just before this pregnancy, did you want to have a baby then?" [191]

Participants were able to report on the history of up to two pregnancies in *Wave III In-Home*, one pregnancy in *Wave IV In-Home*, and up to six pregnancies in *Wave V In-Home.* Due to existing studies indicating differing risk factors associated with experiencing one unintended pregnancy compared to more than one [176, 192, 193], this analysis only used the first pregnancy reported between *Waves III-V In-Home* as the outcome variable. The Add Health Study [191] allowed for responses of "yes", "no", "refused", "don't know", and "not applicable". For this analysis, responses were dichotomized (yes, no) with remaining answers recoded as missing (See Table 3). [191]

Table 2.
Participant demographics

Variables	*N(%)*
Wave I In-Home Study Variables	
Biological Sex	
Male	956 (46.4%)
Female	1427 (53.6%)
Race/Ethnicity	
Non-Hispanic White	1547 (64.9%)
Non-Hispanic Black	291 (12.2%)
Hispanic	341 (14.3%)
Other	204 (8.6%)
Urbanicity	
Rural	524 (21.8%)
Suburban	1011 (42.0%)
Urban	814 (36.2%)
Control Variables	
Marital Status for those diagnosed with an STI from Wave II-IV In-Home	
Married	864 (33.2%)
Not Married	1810 (66.8%)
Age at first pregnancy reported from Wave III-V In-Home	
18-24	466 (18.4%)
25-32	1227 (55.0%)
33-43	688 (26.6%)
Parent Variables	
Relationship to Adolescent	
Biological Mother	2118 (89.2%)
All Other Figures	266 (10.8%)
Race/Ethnicity	
Non-Hispanic White	1594 (66.9%)
Non-Hispanic Black	259 (10.9%)
Hispanic	292 (12.3%)
Other	238 (10.0%)
Educational Attainment	
No HS	299 (15.7%)
HS Graduate	667 (30.3%)
Some College	737 (30.3%)
College+	626 (23.7%)

Note: Numbers of cases (*N*s) are weighted to adjust for complex sampling design of Add Health and for nonresponse

Table 3.

Participant sex education, pregnancy intention, and sex communication

Variable	*N* (%)				
School-Based Sex Education					
Pregnancy Sex Ed (Y)	2094 (84.2%)				
Pregnancy Sex Ed (N)	287 (15.8%)				
Pregnancy Intention					
Intended	1351 (55.5%)				
Not Intended	1032 (44.5%)				
Parent-Adolescent Sex Communication	**Not at all (1)**	**Somewhat (2)**	**A moderate amount (3)**	**A great deal (4)**	***M* (SD)**
Behavior-Based					
How much have you and [NAME] talked about (his/her) having sexual intercourse and the dangers of getting a STD?	198 (7.8%)	478 (18.2%)	759 (30.7%)	965 (43.0%)	3.09 (0.05)
How much have you and [NAME] talked about (his/her) having sexual intercourse and the negative or bad things that would happen if [he got someone/she got] pregnant?	259 (10.2%)	539 (20.9%)	832 (33.6%)	763 (35.3%)	2.94 (0.06)
How much have you and [name] talked about birth control?	436 (17.8%)	660 (25.3%)	703 (29.3%)	593 (27.6%)	2.67 (0.06)
How much have you and [NAME] talked about sex?	190 (3.9%)	573 (21.4%)	900 (38.9%)	728 (32.8%)	2.98 (0.04)
Grand Frequency (%)	270 (11.2%)	562 (23.4%)	799 (33.4%)	762 (32.0%)	**Grand *M* = 2.84 (0.05)**
Moral-Based					
How much have you and [NAME] talked about (his/her) having sexual intercourse and the moral issues of not having sexual intercourse?	307 (14.0%)	489 (18.0%)	758 (31.5%)	838 (36.5%)	**Grand *M*= 2.90 (0.05)**
Social-Based					
How much have you and [NAME] talked about (his/her) having sexual intercourse and the negative or bad impact on (his/her) social life because (he/she) would lose the respect of others?	502 (21.0%)	593 (24.8%)	668 (28.0%)	625 (26.2%)	**Grand *M* = 2.59 (0.05)**

Note: All means are weighted by sampling weights that account for Add Health's sampling design. Numbers of cases (*N*s) are unweighted.

Data Analysis.

To ensure this analysis' sample was nationally representative, Add Health survey responses were weighted to adjust for stratification and over-sampling of underrepresented groups. All data was analyzed using Stata 17 software. [162] The first step in this analysis examined variable means, standard deviations, basic frequencies, and weighted percentages. Pearson chi-square analysis was used to understand whether school-based pregnancy sex education differed by study covariates. Multiple linear regressions were used to determine the effect of demographic variables with topics of parent-adolescent sex communication. Next, a logistic regression was employed to examine associations between school-based pregnancy sex education and first reported pregnancy intention based on the pregnancy reported within *Waves III-V In-Home* surveys. Collinearity among independent variables were explored using VIF. The VIF was less than 10 for all independent variables, meaning it is unlikely multicollinearity exists among the analysis variables. The final steps utilized three separate logistic regressions with use of centered *behavior-*, *moral-*, and *social- based* parent-adolescent sex communication moderators to understand the interaction between school-based pregnancy sex education and pregnancy intention.

Results.

This section includes weighted results presented in basic frequencies, as well as the results of analyses conducted in three stages: 1) Pearson chi-square analyses, 2) linear regression analyses, and 3) logistic regression analyses.

Basic Frequencies. More than half of *Wave I In-Home* adolescent respondents were female (53.6%). The largest racial/ethnic subgroup was non-Hispanic White (64.9%) and mainly resided in suburban areas (42%). Of the parents that reported on engaging in parent-adolescent

sex, the majority were the biological mother (89.2%) of the adolescent or non-Hispanic White (66.9%). Most parents graduated high school (30.3%) or attended some college but did not graduate (30.3%) from high school (see Table 2).

Of the eligible adolescents, 84.2% received school-based pregnancy sex education by the time the Add Health Study conducted the *Wave I In-Home* Survey. By race, 64.9% of non-Hispanic White adolescents received school-based pregnancy sex education, compared to 10.9% non-Hispanic Black, and 12.3% Hispanic. About 42% of participants living in a suburban area had school-based pregnancy education (See Table 3).

When considering the participants that reported having school-based sex education, 25.9% of them had a participating parent with some college experience, and 12.9% with a participating parent that did not graduate high school. Most participating biological mothers (74.5%) had an adolescent report receiving school-based pregnancy sex education (See Table 4).

Of the reported experienced pregnancies in *Waves III-V In-Home* surveys, 55.5% of pregnancies were considered intentional (See Table 3). Females reported slightly more pregnancies as intentional compared to males. Broken down by race/ethnicity, 43.4% of non-Hispanic White participants agreed that their reported pregnancy was intended, as well as 5.5% of non-Hispanic Black and 7.1% of Hispanic participants. Based on urbanicity, 642 participants residing in a suburban area (23.4%) during the *Wave I In-Home* survey reported their later life pregnancy as intentional.

When considering the group of participants reporting their pregnancy as intended, 17.6% had a parent participate in the *Parent Interview* with an educational attainment of some college but did not graduate. Less than 8% of participants with a parent holding an educational attainment of less than high school reported their pregnancy as intended. Based on parent-

adolescent relationship, 50.6% of participants with a biological mother in the *Parent Interview* reported their pregnancy as intended.

Chi-Square Analyses. This analysis used Pearson chi-square analysis to understand the bivariate relationships between analysis variables. Significant differences based on biological sex and school-based pregnancy sex education were observed $\chi^2 = (1, n = 2{,}381) = 4.6$, $p<.03$, as well as school-based pregnancy sex education and urbanicity $\chi^2 = (1, n = 2{,}381) = 6.03$, $p<.01$. No other statistical significance between school-based pregnancy sex education and participant demographic characteristics were observed.

The intention of the first reported pregnancy and participant characteristics were included in chi-square analyses. No significance based on participant biological sex, race/ethnicity, or urbanicity with intention of reported first pregnancy were observed. (See Table 4).

Among characteristics of parents in the *Parent Interview,* a statistically significant association between school-based pregnancy sex education and parent relationship with adolescent (biological mother or other parent figure) was observed $\chi^2 = (1, n = 2{,}381) = 4.54$, $p<.05$, meaning school-based pregnancy sex education and the relationship between parent and adolescent are not independent from each other. No other statistical significance was observed between school-based pregnancy sex education and characteristics of parents within the *Parent Interview.*

Pregnancy intention and participating parents from the *Parent Interview* were included in chi-square analysis to evaluate the relationship between these two variables. No statistical significance was observed among pregnancy intention of first reported pregnancy and parent educational attainment or parent-adolescent relationship (See Table 4).

Multivariate Linear Regressions for Parent-Adolescent Sex Communication. Parent-adolescent sex communication was broken down into three topics: *behavior-*, *social-*, and *moral-based* communication. Using the average of the 4-point Likert scale responses to amount of sex communication engaged in with their adolescent (1: not at all, 2: somewhat, 3: a moderate amount, 4: a great deal) the average reported amount of parent-adolescent sex communication was between somewhat to a moderate amount for behavior- , moral-, and social-based topics. behavior- (M = 2.84, SD = 0.05), moral- (M = 2.90, SD = 0.05), and social-based (M = 2.59, SD = 0.05) sex communication with their adolescent (see Table 4). Multiple linear regressions were carried out to determine the effect of adolescent biological sex, race/ethnicity, urbanicity, parent educational attainment, and relationship with reports of parent-adolescent sex communication.

The *behavior-based* sex communication model was statistically significant, F (5,124) = 9.12, $p < .01$) indicating these results were unlikely to have arisen by chance. Adjusted R-squared indicated 2.5% of the variance in amount of *behavior-based* communication can be explained by variances in the descriptive variables. Of the descriptive variables, the only significant predictor of *behavior-based* sex communication was urbanicity during *Wave I In-Home* (β =.14, t = 2.42, $p < .05$), indicating urbanicity and parent-adolescent *behavior-based* sex communication are not independent from each other.

The *moral-based* sex communication model was statistically significant (F(5,124)=5.13, p<.01). Adjusted R-squared indicated 5.0% of variances were based on descriptive variables. The analysis suggests that biological sex (β = .14, t=3.90, p<.001), race/ethnicity (β = -.14, t=-1.98, p<.05), parent educational attainment (β = .22, t=-2.05, p<.05), and parent relationship with adolescent (β = .35, t=2.28, p<.05) were significant predictors of level of parent-adolescent *moral-based* sex communication.

The regression model for *social-based* communication was statistically significant ($F(11,118)=8.91$, $p<.01$). Adjusted R-squared indicated 7.0% of the variance in *social-based* sex communication was explained by variances in descriptive variables. Biological sex ($\beta = .12$, $t=4.75$, $p<.01$), urbanicity ($\beta = .22$, $t=3.78$, $p<.01$), parent educational attainment ($\beta = -.13$, $t=-2.71$, $p<.01$), and parent relationship with adolescent ($\beta = .41$, $t=3.01$, $p<.01$) female ($\beta = .12$, $t=4.51$, $p<.001$), living in a rural area ($t=2.91$, $p=.01$). The results suggest parent-adolescent *social-based* sex communication is not independent from parent relationship with adolescent and parent educational attainment.

Logistic Regression. To understand the relationship between pregnancy intention at the first reported pregnancy between *Waves III-V In-Home*, school-based pregnancy sex education, and covariates, a logistic regression was run. Marital status and age at the time the participant became or caused the first report of pregnancy were added control variables. This model was statistically significant ($F(12,117)=5.65$, $p<.01$). Holding all other predictors constant, participants who received school-based pregnancy sex education (AOR: 0.5, 95%CI: .29-.88, $p<.02$) had a decreased odds of having an intended first pregnancy compared to participants that did not have school-based pregnancy sex education. Additionally, compared to their non-Hispanic White counterpart, being non-Hispanic Black (AOR: 0.2, 95%CI: .07-.85, $p<.03$) was associated with a decreased odds of having an intended first pregnancy (See Table 4).

Logistic Regression with Moderation. Three centered moderating variables measuring *behavior-*, *moral-*, and *social-based* sex communication between parent and adolescent were added into three separate logistic regressions to understand parent-adolescent sex communication's interaction with school-based pregnancy sex education pregnancy sex education and covariates on later life pregnancy intention. The results of the *behavior-*

(*F*(21,108) = 6.84, p<.01), *moral-* (*F*(21,108) = 5.93, p<.01), and *social-based* (*F*(21,108) = 8.91, p<.01) models were statistically significant, however, no significant interactions were observed (See Table 5).

Table 4.
School-based pregnancy sex education and pregnancy intention

Variable	Received School-Based Sex Ed N(%)	Did Not Receive School-Based Sex Ed N(%)	Reported Intended Pregnancy N(%)	Reported Not Intended Pregnancy N(%)	*p***	AOR (95%CI)
School-Based Sex Ed (N)			190 (9.3%)	129 (6.6%)		(Ref)
School-Based Sex Ed (Y)			1296 (46.0%)	1028 (38.1%)	**.02**	0.5 (.28,.88)
Adolescent Sex						
Male	926(37.8%)	152(8.9%)	599(24.5%)	479(22.2%)		(Ref)
Female	1398(46.4%)	167(6.9%)	887(30.8%)	678(22.5%)	.49	1.1 (.85,1.4)
Adolescent Race						
Non-Hispanic White	1445(64.5%)	198(9.5%)	942(43.4%)	701(33.6%)		(Ref)
Non-Hispanic Black	298(10.1%)	30(0.9%)	168(5.5%)	161(5.5%)	**.03**	0.2 (.07,.85)
Hispanic	337(12.5%)	59(2.5%)	229(7.1%)	167(5.0%)	.88	0.9 (.41,2.2)
Adolescent Urbanicity						
Rural	494(18.0%)	60(3.1%)	312(12.4%)	242(8.9%)		(Ref)
Suburban	958(33.6%)	157(9.0%)	642(23.4%)	473(18.6%)	.72	0.9 (.67,1.3)
Urban	833(33.0%)	93(3.3%)	513(19.9%)	413(16.7%)	.89	0.9 (.66,1.4)
Parent Education						
No HS	276(12.9%)	34(3.0%)	16 (7.5%)	148(8.4%)		(Ref)
HS Grad	603(25.6%)	75(4.2%)	393(16.7%)	285(12.7%)	.80	1.1 (.61,1.9)
Some College	666(25.9%)	82(4.3%)	422(17.6%)	326(13.3%)	.85	.95 (.52,1.7)
College+	544(20.2%)	97(4.6%)	374(13.7%)	267(10.1%)	.98	1.1 (.58,1.8)
Parent Relationship						
Other Parent/Guardian	239(9.7%)	28(1.0%)	139(5.0%)	128(5.7%)		(Ref)
Biological Mother	1884(74.5%)	267(14.8%)	1233(50.6%)	918(38.7%)	.28	1.3 (.83-1.9)

CI = confidence interval; AOR = adjusted odds ratio.
AOR significant at *$p < .05$
AOR represents increase in odds of reporting a later-life pregnancy as intentional
Adjusted for age, marital status, and Add Health sampling design

Table 5.
Parent-adolescent sex communication moderation

Variable	*Behavior-Based*		*Moral-Based*		*Social-Based*	
Pregnancy Intent						
	p*	**AOR(95%CI)**	***p****	**AOR(95%CI)**	***p****	**AOR(95%CI)**
School-Based Sex Ed	.94	.98 (.54,1.8)	.78	.93 (.56,1.6)	.21	.7 (.74,1.2)
Adolescent Biological Sex						
Male		(Ref)		(Ref)		
Female	.68	1.1 (.77,1.5)	.84	.99 (.92,1.1)	.76	1.0 (.93,1.1)
Adolescent Race/Ethnicity						
Non-Hispanic White		(Ref)		(Ref)		
Non-Hispanic Black	.91	.24 (.01,350.1)	.13	.71 (.46,1.1)	.09	.7 (.40,1.1)
Hispanic	.21	.44 (.12,1.6)	.97	.99 (.73,1.4)	.84	.9 (.69,1.4)
Adolescent Urbanicity						
Rural		(Ref)		(Ref)		
Suburban	.91	1.0 (.68,1.5)	.83	1.0 (.92,1.1)	.88	1.0 (.88,1.2)
Urban	.96	1.0 (.69,1.5)	.45	1.0 (.93,1.2)	.60	1.0 (.92,1.2)
Parent Education						
No HS		(Ref)		(Ref)		(Ref)
HS Grad	.75	.91 (.50,1.6)	.97	1.0 (.86,1.2)	.88	1.0 (.85,1.2)
Some College	.33	.78 (.47,1.3)	.57	.95 (.79,1.1)	.62	.95 (.78,1.2)
College+	.53	.82 (.43,1.5)	.71	.97 (.82,1.1)	.89	.99 (.81,1.2)
Parent Relationship						
Other Parent Figure		(Ref)		(Ref)		(Ref)
Biological Mom	.83	.95 (.59,1.5)	.61	1.0 (.90,1.2)	.55	1.0 (.90,1.2)

CI = confidence interval; AOR = adjusted odds ratio.
AOR significant at *$p < .05$
AOR represents increase in odds of reporting a later-life pregnancy as intentional
Adjusted for age, marital status, and the Add Health sampling design

Discussion.

Unintended pregnancy is considered a public health issue in the U.S., disproportionately impacting groups based on race/ethnicity, urbanicity, income, and age. [192] Many studies have

examined the independent relationships of school-based sex education in reducing risk of teen pregnancy [45, 183, 185] and the influence parents have on teen pregnancy. [189, 190] However, our understanding of school-based pregnancy sex education and unintended pregnancy among groups older than 18 is limited, despite young people aged 18-24 having the highest rates of unintended pregnancy compared to all other age groups. [175] Identifying the moderating influence of parent-adolescent sex communication on school-based pregnancy sex education and young adult- to adulthood unintended pregnancy can provide insight into how traditional approaches of pregnancy prevention influence pregnancies and their intention following adolescence.

This analysis aimed to identify the moderating influence of amount of parent-adolescent sex communication on school-based pregnancy sex education employed during adolescence and later-life unintended pregnancy. Through separate logistic regressions using three topics of moderating variables – *behavior-, moral-, social-based*, this analysis did not observe a significant interaction based on amount and category of parent-adolescent sex communication. Significant relationships were observed in a logistic regression without moderation, specifically among school-based pregnancy sex education, non-Hispanic Black participants, and non-Hispanic Black parents.

The lack of significant moderation of parent-adolescent sex communication in this study may have several explanations. First, despite existing research indicating protective effects of parent-adolescent sex communication on teen pregnancy [189, 190], these studies did not use parent-adolescent sex communication as a moderator with other prevention approaches traditionally employed during adolescence. Additionally, our understanding of parent-adolescent

sex communication's relationship with pregnancy is primarily limited to pregnancies experienced by teens [189], while this analysis focused on young adult and adulthood unintended pregnancy. Parent-adolescent sex communication is most effective in reducing teen pregnancy rates when employed before an adolescent's sexual debut. [188, 189] This analysis was unable to investigate the timing of parent-adolescent sex communication as it relates to sexual debut, but it did occur before the first reported pregnancy.

Having school-based pregnancy sex education during adolescence was associated with an increased odds of having an unintended first pregnancy. While existing research indicates a mix of outcomes related to teen pregnancy based on type of school-based sex education, analyses suggest having any school-based sex education, regardless of type, reduces rates of teen pregnancy compared to no school-based sex education. [95, 183] School-based sex education can protect adolescent populations from unintended pregnancies [95, 185], however the results of this analysis indicate a possible issue with sustained protective effects following adolescence. Due to the lack of research on long-term influences of school-based sex education, further investigations regarding the sustainability of school-based sex education on reduced risk of unintended pregnancy is warranted.

Of the risk factors associated with unintended pregnancy, the most significant indicators include being non-Hispanic Black, Hispanic, or between 18-24 years old. [31, 70] After controlling for age, this analysis observed a significant negative relationship with non-Hispanic Black participants and unintended pregnancy and is consistent with our current understanding of the racial/ethnic unintended pregnancy disparities experienced in the U.S. [70] Despite finding an increased odds of having an unintended first pregnancy if non-Hispanic Black, some

researchers argue this disparity is a result of misunderstanding this population's pregnancy desires. [194, 195] Kemet et al. [194] suggests societal stigmatization of Black motherhood may lead non-Hispanic Black women to inaccurately report their pregnancy intention. In contrast, this analysis did not observe significant associations with being Hispanic and first pregnancy intention. Previous studies have identified being U.S.-born and education status as significant determinants of unintended pregnancy experienced by Hispanic women compared to non-Hispanic White women. [31, 196] Despite the lack of relationship observed between Hispanic participants and unintended pregnancy, these findings suggest differences in determinants of unintended pregnancy among different racial/ethnic groups.

Existing literature recognizes urbanicity as a significant predictor of teen and unintended pregnancy [31, 147], as rural adolescents account for about 19% of all teen births despite making up 15% of the population. This public health issue may be due to limited use or access to reproductive health services among rural populations. [147] Additionally, rural, and urban differences in approaches to school-based sex education is well-documented [45, 180], as well as differences in parental influence on school-based sex education content between rural and urban populations. [138, 190] This analysis, however, did not produce findings consistent with the literature. This may be explained by the use the predictor variable of urbanicity measured at *Wave I In-Home*, during adolescence, and pregnancy intention measured during young adult- to adulthood. It is likely participants moved urbanicities as they transitioned out of adolescence.

This project recognizes the limitations of secondary data, including the inability to identify detailed components of the provided school-based pregnancy sex education curriculum. The Add Health Study was not designed to focus on school-based sex education factors beyond

the one question. [191] Additionally, school-based pregnancy sex education was surveyed in just the *Wave I In-Home* portion. It is possible participants that reported not having school-based pregnancy intention by the *Wave I In-Home* survey could have had it by the time the *Wave III In-Home* survey was collected. Without further details of the content provided in the school-based pregnancy sex education and multi-waves measuring school-based pregnancy sex education experience, it is difficult to conclude that school-based pregnancy sex education is ineffective in preventing young adult and adulthood unintended pregnancy.

Other limitations in the present analysis that are related to the Add Health Study design include capturing a sample made mostly of biological mothers. [191] Existing evidence suggests mothers are the primary sex educator and engage in more frequent parent-adolescent sex communication compared to fathers. [186, 188] However, there is considerable uncertainty about the dynamics of father-adolescent sex communication due to lack of research. Further, family structures are evolving, as rates of two-parent households are declining, and more mothers than ever have transitioned from the home to the workplace. [197] Due to the changing landscape of home and family environments, it is critical to include all household parental figures in future studies. Additionally, as survey questions were retrospective and based on sensitive topics, including reproductive health, sex education, and sex communication, it is appropriate to recognize the possibility of recall and social desirability bias. Efforts to reduce socially desirable responses were made by Add Health interviewers by assuring participants confidentiality and anonymity throughout the study. [191]

When reporting pregnancy intention, participants were given a dichotomized (yes, no) response option. Maxon and Miranda (2011) suggest use of three categories to describe

intention- unwanted, mistimed, and wanted. They argue the feelings that come with getting pregnant earlier than anticipated are different than becoming pregnant when planned or no desire for pregnancy at all. [198] By dichotomizing pregnancy intention, we fail to understand differences of unwanted and mistimed groups. [194, 198] To address this bias, future research should consider the spectrum of intentions related to pregnancy by use of response options beyond yes or no.

This analysis used logistic regressions to understand the interaction of parent-adolescent *behavior-, moral-,* and *social-based* sex communication on the relationship between school-based pregnancy sex education and intentions of first pregnancy. Additional covariates in the model represented participant biological sex, race/ethnicity, urbanicity, parent educational attainment, and parent-adolescent relationship. Following the results of this study, the researcher will test the existing models based on the hypotheses. By generating a best-fitting model with this project's predictor variables, the ability to generalize results will be strengthened.

The current analysis provides additional evidence of the unintended pregnancy disparities experienced by non-Hispanic Black populations regardless of age and marital status, highlighting the continued need for tailored public health programming to reduce unintended pregnancy rate disparities. This analysis did not observe parent-adolescent sex communication as a significant influence between the relationship of school-based sex education and pregnancy intention. These results emphasize the need for further exploration of parent-adolescent relationships as they related to unintended pregnancy into young adult- and adulthood. Lastly, school-based pregnancy sex education does not appear to protect against unintended pregnancy beyond

adolescence, indicating a need for continued prevention efforts beyond middle and high school.

Conclusion.

Critical to reproductive health, unintended pregnancy leads to social and economic consequences experienced by the entire family. This project focuses on the long-term relationships of common public health approaches aimed to reduce teen and unintended pregnancy. Particularly among non-Hispanic Black populations, reproductive needs are not being met, widening health, social, and economic disparities in the U.S. Overall, school-based sex education and parent-adolescent sex communication are perhaps not tied to unintended pregnancy experienced after adolescence. Public health efforts should be focused on continued prevention of unintended pregnancy beyond adolescence, including tailored programming for populations carrying the largest burden.

Chapter V (Study II)

Introduction.

For the eighth consecutive year, sexually transmitted infections (STIs) have risen, breaking records set by the prior year. [199] Syphilis, gonorrhea, and chlamydia are the top three most reported treatable infections. However, half of all treatable STIs diagnosed last year were resistant to the current standard of care. [82, 199] Gonorrhea is the first of the three major bacterial STIs to see antibiotic resistance, making up half of the 1.14 million cases of gonorrhea in 2019. [82, 200] Predicted to follow with antibiotic resistance are syphilis and chlamydia. [201] Antibiotic resistance is particularly concerning as one in five people currently has an STI, and annual cases of syphilis, gonorrhea, and chlamydia have risen since 2015. [199, 202] However, the most significant STI disparities are among young populations [203, 204], women, non-Hispanic Blacks [205], Hispanics [205, 206], and urban and rural populations. [204]

The Healthy People 2030 objectives include overall prevention of STIs, with specific aims to reduce rates of syphilis among females and gonorrhea among adolescent and young adult males. [42] Despite making up 25% of the sexually active population, adolescents and young adults account for half of the 20 million newly reported cases of STIs each year. [203, 207] Most chlamydia (2899.2 per 100,000 aged 20-24) and gonorrhea cases (713.2 per 100,000) are among populations aged 20-24. [199] Adolescent and young adult populations are not the only age groups disproportionately impacted by STIs, as the highest rates of syphilis are among adults aged 25-29 (33.0 per 100,000). [199, 208] Historically, public health efforts to reduce the burden of STIs focus primarily on adolescents and young adults [209, 210]; however, all sexually active populations risk acquiring an STI. [199, 211]

The Centers for Disease Control and Prevention (CDC) STI surveillance system started in 2000, and since then, there has been evidence of disproportionate rates of STIs among women.

[9] Due to anatomical differences in genital surface area and hormonal makeup relative to their male counterpart, women are particularly susceptible to acquiring an STI. [199, 212] Additionally, the presentation of STI symptoms differs by biological sex, as women are more likely to be asymptomatic for chlamydia and gonorrhea than men. [212] Due to an estimated two-thirds of infections going undiagnosed [213], at least 20,000 cases of infertility occur yearly. [202, 214] Infertility cases are expected to increase as STIs continue to burden this population. [202, 214]

Following women, racial and ethnic subgroups entered the CDC's STI surveillance system in 2014. [9] Since then, evidence of significant disparities in STIs attributed to being non-Hispanic Black or Hispanic has been at the forefront of public health concerns. [42, 215] Compared to their non-Hispanic White counterparts, non-Hispanic Black populations are five to eight times more likely to report a case of chlamydia, gonorrhea, or syphilis, with this population making up 30% of these three infections in 2020. [79, 199] Additionally, Hispanics are one to two times more likely to report an STI than their non-Hispanic White counterparts. [215] As overall STI rates grow, disparities experienced by non-Hispanic Blacks and Hispanics are expected to widen. [6, 216]

Historically, STI rates in urban populations have been higher than in rural populations. [202, 205] However, recent surveillance has observed a rise in newly diagnosed syphilis, chlamydia, and gonorrhea among rural communities. [217, 218] This rise has led to an equal distribution of STIs among these populations. Due to this rise, researchers have begun to focus on STI rates based on urbanicity, finding differences in risk factors. [218, 219] For example, urban populations are more likely to have an STI screening than their rural counterparts. [219] Researchers have attributed these differences, in part, to screening accessibility. [9, 217, 219]

Additionally, recent studies indicate that rural adolescents engage in earlier sexual debut, more sexual activity, and lower use of contraceptives than their urban counterparts. [9, 220] The increase in STI rates among rural populations highlights a critical need for public health interventions tailored based on urbanicity.

STIs can have serious short- and long-term health consequences related to economic, emotional, psychological, and social well-being. [1, 221] The direct medical costs associated with new cases of STIs is $16 billion, with young populations aged 15-24 responsible for 26% of the total cost and women of all ages with 25% of the total cost. [1] Acquiring syphilis, gonorrhea, or chlamydia can also increase the risk of Human Immunodeficiency Virus (HIV) infection, increase the chance of transmitting HIV [2], infertility, severe pregnancy, and infant death [222]. In 2018, the CDC directly attributed over 1,800 new cases of HIV to initially having syphilis, gonorrhea, or chlamydia, costing the newly diagnosed an estimated $800 million in lifetime medical expenses. [1]

To reduce the burden of STIs, Healthy People 2030 aims to increase the proportion of young people receiving formal sex education before 18 years old. [42] Young populations, particularly adolescents, are considered highly impressionable [181], and health behaviors formed during this developmental stage often follow them into young adulthood. [181, 223] Due to this, school-based sex education has been traditionally offered between grades six through twelve. [45] The most up-to-date data show that 54.5% of adolescents in 2017-2019 received formal sex education on delayed first sex, birth control methods, and HIV and STI prevention. [9] This data adds to the overall decrease in experience with formal school-based sex education among adolescent populations since 1994. [12]

Approaches to formal sex education traditionally take form in schools and are based on government policy. [45, 185] School-based sex education historically provides abstinence-based or comprehensive sex education (CSE). [45] Content and methods in school-based sex education can be broad; however, it generally aims to intervene and prevent negative sexual behaviors and outcomes by providing safer sex knowledge and skills. [45] Abstinence-based sex education traditionally approaches prevention by promoting abstaining from sex based on morals. [115, 183] CSE also includes abstinence-based sex education and instruction on contraceptives and condoms. [45] Evaluations of school-based sex education and outcomes of STIs and HIV have indicated a defined gap in prevention approaches, as young populations continue to have unprotected sex regardless of the school-based sex education provided. [9, 12] Some researchers agree that school-based sex education should also involve parents to reinforce prevention messages. [187-189]

Adolescent populations have frequently cited their parents as the most influence on their sexual decision-making. [9, 188] Research indicates that effective parent-adolescent sex communication can be a protective factor against acquiring an STI. [138, 187] The mechanisms that create effective parent-adolescent sex communication include frequency, as a higher amount of sex communication is associated with decreased risky sexual behaviors. [138] Despite the protective factors related to parent-adolescent sex communication and STI risk, just one-third of adolescents' report discussing sex-related topics with parents. [9] Additionally, there is limited understanding of how school-based sex education and parent-adolescent sex communication influence STI risk.

Adolescence is an opportune time to prevent STIs and HIV through parental communication regarding sex. [189] During this developmental stage, adolescents develop

behaviors that often follow them into adulthood. [181, 223] Due to the impressionability of this age group and current understandings of school-based sex education, as well as parent-adolescent sex communication on reduced risk of STI, it is essential to study the interaction of both interventions and their impacts on these adverse sexual health outcomes. Further, limited understanding exists regarding the long-term impacts of school-based sex education and parent-adolescent sex communication on young adult and adulthood STI diagnoses, despite these sexual health outcomes having the potential to affect all sexually active populations. By use of school-based sex education and parent-adolescent sex communication, this study will provide public health practitioners with a baseline understanding of the sustainability of two commonly used sex education approaches on the risk of STIs and HIV during individuals' most high-risk years. Focusing on current disproportionately impacted subpopulations can assist with inclusive strategies public health practitioners use to reduce the burden of STIs.

Methods.

Add Health Study. The National Longitudinal Study of Adolescent to Adult Health (Add Health) is an ongoing nationally representative longitudinal study starting in 1994 (https://addhealth.cpc.unc.edu/home/). [191] Collected in five waves, the Add Health Study is focused on health and health-related behaviors of adolescents and subsequent outcomes into adulthood. [191] This longitudinal study started with an in-school sample at *Wave I* made up of 12,105 adolescents and also followed up with an in-home during *Wave I*. [191] In addition to the *Wave I In-School* sample the *Wave I In-Home* sample included supplemental groups of oversampled non-Hispanic Black adolescents with highly educated parents and adolescents from rural and urban settings, making up 20,745 adolescents aged 12-19 at *Wave I In-Home*. [191] Following 1994-1995, when the *Wave I In-Home* survey was conducted, additional in-home

waves were included in 1996, 2001-2002, 2008, and 2016-2018. [191] All *Wave I In-Home* participants in 7-11th grade were eligible to be interviewed for the *Wave II In-Home* one year later (*n*=14,738; 88.6% response rate). [191] By *Wave III In-Home*, participants were aged 18-26 (*n*=15,197; 77.4%) and were aged 24-32 by *Wave IV In-Home* (aged 24-32; *n*=15,701; 80.3% response rate), and most recently aged 32-42 by *Wave V In-Home* (*n*=12,300; 71.8% retention rate). [191] Additionally, the Add Health Study included a subset of parents (*n* = 17,670) of the *Wave I In-Home* participants. [191] The *Parent Interview* provided context to parent-adolescent perspectives relative to the Add Health Study's focus on health and health-related behaviors of adolescents. [191] For a complete list of question-and-answer options used in the Add Health Study, see Appendix A.

Table 6.
Study variables used and corresponding Add Health wave

Variables	*W1* 1995-96 (grade 7-12)	*Parent Interview* 1994-95	*W2* 1996 (grade 8-12)	*W3* 2001-02 (age 18-26)	*W4* 2008 (age 24-32)
Adolescent Demographic Covariates					
Biological Sex	x				
Race/Ethnicity	x				
Urbanicity	x				
Parent Demographic Covariates					
Parent Educational Attainment		x			
Parent-Adolescent Relationship		x			
Additional Descriptive Variables					
HIV dx			x	x	x
Parent Race/Ethnicity		x			
Inclusion Criteria					
School-Based Sex Education	x				
Syphilis dx	x		x	x	x
Chlamydia dx	x		x	x	x
Gonorrhea dx	x		x	x	x
Behavior-Based		x			
Social-Based		x			
Moral-Based		x			
Control Variables					
Marital Status			x	x	x
Age			x	x	x

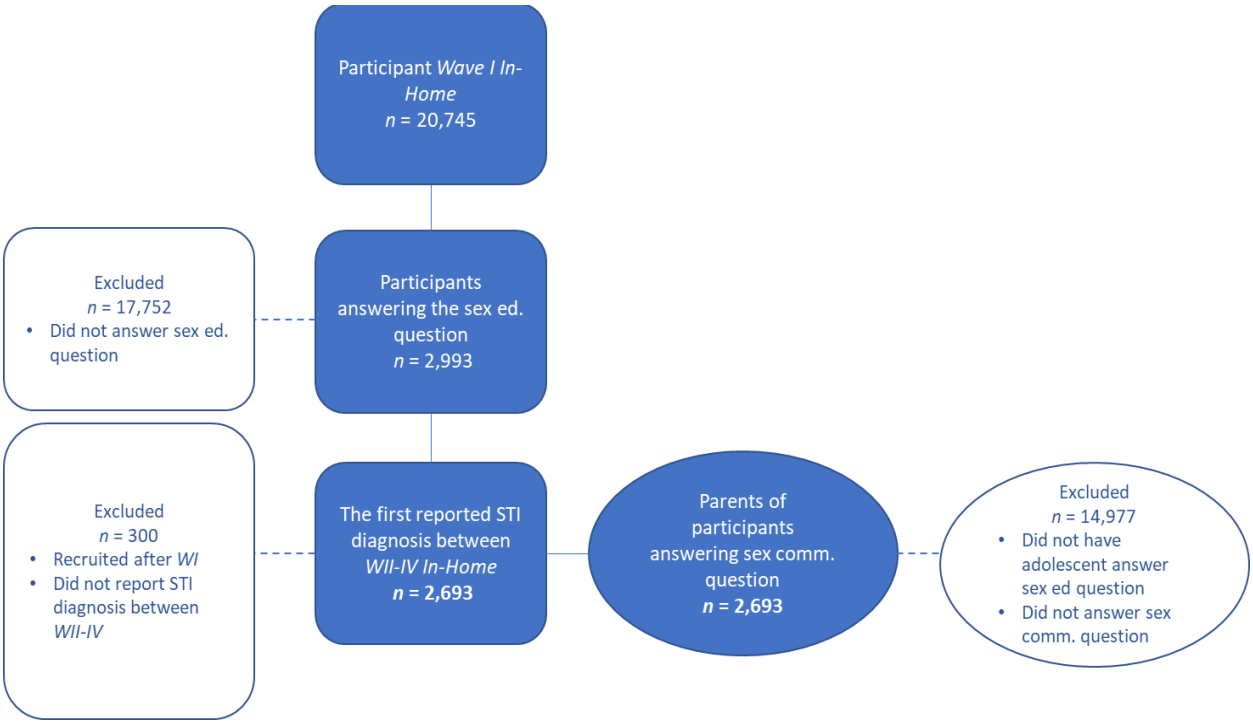
Sample.

Participants. This study used Add Health data from *Waves I-IV In-Home* and *Parent Interviews* (See Table 6). The Add Health Study asked participants to report their school-based HIV sex education history during *Wave I In-Home*. Within the same wave, participants were asked about diagnosis of syphilis, gonorrhea, and chlamydia. The Add Health Study did not provide a clear timeline of when school-based HIV sex education occurred in reference to diagnosis of syphilis, gonorrhea, and chlamydia. Therefore, the first report of syphilis, gonorrhea, or chlamydia within *Waves II-IV In-Home* were used in this study. For this study, to be eligible participants must have:

- Reported on school-based HIV sex education at *Wave I In-Home.*
- Self-reported at least one diagnosis of syphilis, gonorrhea, or chlamydia by a doctor or nurse between *Waves II-IV In-Home*
- Had a parent take part in the *Parent Interview* in 1994-1995 that also reported on sex communication between them and their participating adolescent (See Figure 5). [191]

With the inclusion criteria, the analytical sample used for this study was 2,693 participants and 2,693 of their participating parents (See Figure 5).

Figure 5.
Flow chart of inclusion criteria by wave



Note: Sex ed. = school-based HIV sex education
Sex comm. = parent-adolescent sex communication
STI = syphilis, chlamydia, or gonorrhea

Demographics. From *Wave I In-Home*, participant sex (male, female), race/ethnicity (non-Hispanic White, non-Hispanic Black, Hispanic), and urbanicity (rural, suburban, urban) were used as covariates. This study used three categories of race/ethnicity, with non-Hispanic Whites as the reference group. Additional racial groups too small in sample size were excluded to provide an accurate comparison to the reference group. Excluded participant racial groups included Native American/Indigenous person (n = 64) and Asian or Pacific Islander (n = 134).

From the *Parent Interview*, parent educational attainment (no high school, high school graduate, some college, college graduate or higher), and parent-adolescent relationship (biological mother, other parent figure) were included as covariates. Parent race/ethnicity (non-Hispanic White, non-Hispanic Black, Hispanic) was used a descriptive variable for this analysis

due to interest of participant race/ethnicity as a predictor of STI diagnosis, excluding HIV. Excluded racial parent groups included Native American/Indigenous person (n = 86) and Asian or Pacific Islander (n = 140) populations.

The control variables for this study included participant age when diagnosed with an STI (ages 12-18, 19-24, 25-32), excluding HIV, as well as marital status (married, not married) at time of STI diagnosis, and *Wave I In-Home* survey self-reports of STI diagnosis (yes, no), excluding HIV (See Table 6).

Instrumentation and Measurement Protocol.

School-Based HIV Sex Education. The primary predictor variable for this study, school-based HIV sex education, was assessed at *Wave I In-Home* using:

"Have you learned about the following in a class at school? (check all that apply)" [191]

Wave I In-Home participants were prompted to use a dichotomized response (yes, no) to indicate if they had experienced school-based HIV sex education at their current middle or high school (See Table 8).

Parent-Adolescent Sex Communication. This study used three centered variables as moderators measuring amount of *behavior-*, *moral-*, and *social-based* parent-adolescent sex communication as reported by a parent in the *Parent Interview* To measure amount of parent-adolescent sex communication, the Add Health Study used a 4-point Likert scale (not at all, somewhat, a moderate amount, a great deal). This study categorized parent-adolescent sex communication into three categories, *behavior-*, *moral-* , and *social-based.*
Moral-based parent-adolescent sex communication was measured using responses from one variable (See Table 8).

"How much have you and [NAME] talked about (his/her) having sexual intercourse and the moral issues of not having sexual intercourse?" [191]

Social-based parent-adolescent communication was measured using responses from one variable (See Table 7).

"How much have you and [NAME] talked about (his/her) having sexual intercourse and the negative or bad impact on (his/her) social life because (he/she) would lose the respect of others?" [191]

Behavior-based parent-adolescent sex communication was measured using an average score of responses from four variables (See Table 7).

"How much have you and [NAME] talked about (his/her) having sexual intercourse and the dangers of getting a sexually transmitted disease?"

"How much have you and [NAME]talked about (his/her) having sexual intercourse and the negative or and things that would happen if [he got someone/she got] pregnant?"

"How much have you and [NAME] talked about birth control?"

"How much have you and [NAME] talked about sex?" [191]

Sexually Transmitted Infection. The outcome variable for this study measured the first diagnosis of either syphilis, chlamydia, or gonorrhea self-reported within *Waves II-IV In-Home* surveys using:

"In the past year (or ever), have you been told by a doctor or a nurse that you had syphilis?"

"In the past year (or ever), have you been told by a doctor or a nurse that you had chlamydia?"

"In the past year (or ever), have you been told by a doctor or a nurse that you had gonorrhea?" [191]

Participants were able to self-report within *Waves II-IV In-Home* surveys on syphilis, chlamydia, or gonorrhea diagnosis by a doctor or a nurse. Syphilis, chlamydia, and gonorrhea share similar modes of transmission, so all three of the above Add Health Study questions were combined to form one variable measuring overall STI diagnosis of syphilis, chlamydia, or gonorrhea due to shared modes of transmission and accounting for the majority of STI diagnoses. Additionally, due to Add Health Study questions asking about diagnosis of syphilis, chlamydia, and gonorrhea in the past year (or ever), this analysis chose to use the first self-reported STI diagnosis, excluding HIV, between the *Waves II-IV In-Home* surveys. The Add Health Study allowed for responses of "yes," "no", "refused", "don't know", and "not applicable". For this analysis, responses for STI diagnosis, excluding HIV, were dichotomized (yes, no) with remaining answers recoded as missing (See Table 7).

Human Immunodeficiency Virus. To further define the study population this analysis included an additional descriptive variable measuring self-reported HIV diagnosis between *Waves II-IV In-Home* using:

"In the past year (or ever), have you been told by a doctor or a nurse that you had HIV?"

Participants were able to self-report HIV diagnosis between *Waves II-IV In-Home* surveys using a dichotomized response option (yes, no). Due to the small sample of participants self-reporting HIV diagnosis, this analysis used basic frequencies and Pearson chi-square analysis to evaluate *Waves II-IV In-Home* self-reported HIV diagnoses and its relationship with this analyses' descriptive variables.

Data Analysis.

Sampling and analytic weights provided by the Add Health Study [191] were used to account for cluster sampling where clusters (i.e., schools) were sampled with unequal probability. All data were analyzed using Stata 17 software. [162] The first step in this analysis examined variable means, standard deviations, basic frequencies, and weighted percentages. Pearson chi-square analysis was performed to understand differences between school-based HIV sex education and demographic variables. To determine the association of demographic variables with categories of parent-adolescent sex communication, weighted multiple linear regressions were employed. A weighted logistic regression was used to examine associations between school-based HIV sex education and self-reported STI diagnosis, excluding HIV. Collinearity among independent variables were explored using VIF. The VIF was less than 10 for all independent variables, meaning multicollinearity among analysis variables is unlikely to exist. Next, three separate logistic regressions with centered *behavior-, moral-, and social-based* parent-adolescent sex communication variables used as moderators were employed to understand the moderating effects of parent-adolescent sex communication on the relationships between school-based HIV sex education and self-reported STI diagnosis, excluding HIV.

Results.

This section includes weighted results through basic frequencies, as well as the results of analyses conducted in three stages: 1) Pearson chi-square analyses, 2) linear regression analyses, and 3) logistic regression analysis.

Basic Frequencies. Of the 2,993 *Wave I In-Home* participants, 52.6% were female, 77.5% identified as non-Hispanic White, and all participants were between the school grade level

of 7th-12th grade. Most participants (41.7%) resided in suburban areas during the *Wave I In-Home* survey, while 21.7% were living in a rural area (See Table 7).

Of the participating parents in the *Parent Interview*, the majority were the biological mother (88.8%) of the study participant and non-Hispanic White (81.1%). Most parents graduated high school (30.7%) or attended some college but did not graduate (30.9%). The demographic characteristics of the sample are presented in Table 7.

Overall, 90.6% of participants of *Wave I In-Home* participants reported having school-based HIV sex education, with about 9% not receiving HIV-based sex education. Males (43%) and females (47.6%) reported similar rates of receiving school-based HIV sex education. The number of participants from an urban area (34.5%) that received school-based HIV sex education was comparable to those from suburban areas (36.9%). By race, most of the non-Hispanic White (69.4%), non-Hispanic Black (10.6%), and Hispanic participants (10.4%) received school-based HIV sex education (See Table 9).

Based on race/ethnicity of parents in the *Parent Interview*, many participants (72.8%) reporting school-based HIV sex education had a non-Hispanic White parent participating. Parents who graduated high school (26.8%) or had some college experience but did not graduate (28.8%) had the most participants report having school-based HIV sex education during the *Wave I In-Home* survey. Participants with a biological mother (79.3%) in the *Parent Interview* were among the largest group reporting having school-based HIV sex education (See Table 9).

Overall, 15.2% of participants self-reported a diagnosis of syphilis, chlamydia, or gonorrhea between *Waves II-IV In-Home* surveys (See Table 8). Based on biological sex, positive STI diagnoses, excluding HIV, were mainly observed in females (10%) compared to 5.3% of males. Non-Hispanic White participants self-reported 7.9% of STI diagnoses, excluding

HIV, followed by non-Hispanic Black (5%), and Hispanic (1.8%). Urban-based (8.2%) participants reported a higher percentage of STI diagnoses, excluding HIV, compared to those in rural (2.3%) and suburban areas (4.8%). See Table 9.

When considering HIV diagnosis, small observations of positive HIV cases were observed. More male participants (*n*=15, 7.3%) than females (*n*=8, 2.4%) self-reported an HIV diagnosis within *Waves II-IV In-Home* surveys. Additionally, 5.7% of self-reported positive HIV cases were among non-Hispanic White participants, followed by 3.5% among non-Hispanic Blacks, and 1.1% among Hispanic participants. Self-reported HIV diagnoses were reported the most among urban participants (7.4%), followed by suburban (2.2%) and rural participants (2.2%).

Table 7.
Participant demographics

Variables	*N(%)*
Wave I In-Home Study Variables	
Biological Sex	
Male	1263 (47.4%)
Female	1728 (52.6%)
Race/Ethnicity	
Non-Hispanic White	1856 (64.6%)
Non-Hispanic Black	376 (13.1%)
Hispanic	444 (15.4%)
Other	198 (6.9%)
Urbanicity	
Rural	631 (21.7%)
Suburban	1260 (41.7%)
Urban	1046 (36.6%)
Control Variables	
Marital Status for those diagnosed with an STI from Wave II-IV In-Home	
Married	2008 (67.6%)
Not Married	962 (32.5%)
Age at first diagnosed STI from Wave II-IV In-Home	
15-18	313 (17.7%)
19-24	1593 (65.0%)
25-32	748 (26.3%)
Parent Interview Variables	
Parent Relationship to Adolescent	
Biological Mother	2420 (88.8%)
All Other	309 (11.2%)
Parent Race/Ethnicity	
Non-Hispanic White	1824 (67.7%)
Non-Hispanic Black	300 (11.2%)
Hispanic	345 (12.8%)
Other	226 (8.4%)
Parent Educational Attainment	
No HS	340 (14.8%)
HS Graduate	763 (30.7%)
Some College	858 (30.9%)
College+	720 (23.6%)

Note: Numbers of cases (*N*s) are weighted to adjust for complex sampling design of Add Health and for nonresponse.

Chi-Square Analyses. Using Pearson chi-square analyses to understand bivariate relationships between study variables, no significant relationships were observed between participant biological sex, race/ethnicity, or urbanicity and school-based HIV sex education.

Pearson chi-squared analysis indicated no significance between parent race/ethnicity and school-based HIV sex education, indicating these two variables are likely independent from one another. Pearson chi-squared indicated no difference between these two variables, meaning parent educational attainment and participant school-based HIV sex education are likely independent from one another. Additionally, no significance was observed between parent-adolescent relationship and school-based HIV sex education.

Pearson chi-square indicated significance between STI diagnosis and adolescent biological sex χ^2 = (1, n = 2,991, = 17.44, p<.01. Nearly five percent of males and 10% of females reported being positively diagnosed with an STI between *Waves II-IV In Home.* indicating biological sex and STI diagnosis are not independent from each other.

Pearson chi-squared indicated statistical significance between STI diagnoses and participant race/ethnicity χ^2 = (1, n = 2,991) = 58.73, p<.01. This significance indicates race/ethnicity and STI diagnosis are not independent from one another. Nearly eight percent of non-Hispanic Whites, five percent of non-Hispanic Blacks, and 2.8% of Hispanics reported being positively diagnosed with an STI between *Waves II-IV In-Home.*

Pearson chi-squared indicated statistical significance between STI diagnoses and urbanicity χ^2 = (1, n = 2,991) = 4.76, p<.02. This indicates urbanicity and STI diagnosis are not independent from each other. Pearson chi-squared was statistically significant χ^2 = (1, n = 2,991) = 9.11, p<.01, indicating urbanicity and HIV diagnosis are not independent from one another.

Multivariate Linear Regressions for Parent-Adolescent Sex Communication. Linear regressions were carried out to determine the effect of participant biological sex, race/ethnicity, urbanicity, parent educational attainment, and parent-adolescent relationship with reports of parent-adolescent sex communication, *behavior-*, *moral-*, and *social-based*. Each regression used the average of the 4-point Likert scale responses to amount of sex communication engaged in with their adolescent (1: not at all, 2: somewhat, 3: a moderate amount, 4: a great deal) the average reported amount of parent-adolescent sex communication fell between somewhat to a moderator amount of *behavior-* (M = 2.81, SD = 0.05), *moral-* (M = 2.88, SD = 0.05), and *social-based* (M = 2.85, SD = 0.05). See Table 8 for further details.

Table 8.

Participant sex education, STI/HIV diagnosis, and sex communication

Variable	*N* (%)				
Wave I In-Home Variables					
School-Based Sex Education					
HIV Sex Ed (Y)	2761 (90.0)				
HIV Sex Ed (N)	232 (10.0)				
Control Variable					
STI Diagnosis Wave I In-Home					
STI (Yes)	37 (5.0%)				
STI (No)	872 (95.0%)				
Waves II-IV In-Home Variables					
STI Diagnosis					
Syphilis (Y)	20 (<1)				
Syphilis (N)	2971 (99.2)				
Chlamydia (Y)	360 (12.7)				
Chlamydia (N)	2631 (87.3)				
Gonorrhea (Y)	117 (5.6)				
Gonorrhea (N)	2874 (94.5)				
STI (Y)	410 (15.2)				
STI (N)	2581 (84.8)				
HIV (Y)	23 (<1)				
HIV (N)	2968 (99.0)				
Parent-Adolescent Sex Communication	**Not at all (1)**	**Somewhat (2)**	**A moderate amount (3)**	**A great deal (4)**	***M* (SD)**
Behavior-Based					
How much have you and [NAME] talked about (his/her) having sexual intercourse and the dangers of getting a STD?	229 (8.4)	542 (18.4)	857 (30.9)	1084 (42.3)	3.06 (0.05)
How much have you and [NAME] talked about (his/her) having sexual intercourse and the negative or bad things that would happen if [he got someone/she got] pregnant?	301 (10.5)	619 (21.4)	933 (33.8)	852 (34.2)	2.92 (0.06)
How much have you and [name] talked about birth control?	494 (18.3)	764 (26.4)	776 (28.4)	670 (26.9)	2.64 (0.06)
How much have you and [NAME] talked about sex?	215 (7.0)	673 (22.7)	997 (38.2)	818 (32.1)	2.95 (0.04)
Grand Frequency (%)	260 (8.8)	770 (27.5)	1020 (37.6)	645 (26.1)	**Grand *M*= 2.81 (0.05)**
Moral-Based					
How much have you and [NAME] talked about (his/her) having sexual intercourse and the moral issues of not having sexual intercourse?	365 (15.1)	550 (18.0)	841 (31.0)	946 (35.9)	**Grand *M*= 2.88 (0.05)**
Social-Based					
How much have you and [NAME] talked about (his/her) having sexual intercourse and the negative or bad impact on (his/her) social life because (he/she) would lose the respect of others?	581 (23.8)	674 (22.8)	754 (27.7)	691 (25.7)	**Grand *M*= 2.55 (0.05)**

Note: All means are weighted by sampling weights that account for Add Health's sampling design. Numbers of cases (*N*s) are unweighted.

The *behavior-based* sex communication model ($F(5,124) = 5.73$, $p<.05$) was statistically significant, indicating these results were unlikely to have arisen by chance. With predictor variables, participant biological sex, race/ethnicity, urbanicity, parent educational attainment and parent-adolescent relationship, the adjusted R-squared indicated that 9.7% of the variance in amount of *behavior-based* sex communication can be explained by these variables. The analysis suggests urbanicity ($\beta = .17$, $t = 3.46$, $p<.01$) and being female are ($\beta = .05$, $t = 2.99$, $p<.01$) are significant predictors of parent-adolescent *behavior-based* sex communication. Urbanicity was a stronger predictor compared to parent educational attainment.

The regression analysis for *moral-based* communication was statistically significant ($F(5,124)=5.13$, $p<.05$) with the adjusted R-squared indicating 5.5% of the variance in parent-adolescent *moral-based* communication is explained by the study's predictor variables. Significant relationships observed were based on participant biological sex (($\beta = .31$, $t = 3.90$, $p<.01$), participant race/ethnicity ($\beta = -.02$, $t=-1.98$, $p<.05$), parent educational attainment ($\beta = .05$, $t = -2.05$, $p<.05$), and parent-adolescent relationship ($\beta = .35$, $t = 2.28$, $p<.05$). Parent-adolescent relationship was the strongest predictor and participant race was the least on parent-adolescent *moral-based* sex communication.

The regression model for *social-based* communication was statistically significant ($F(5,124)=8.38$, $p<.01$) with adjusted R-squared indicating 6.7% of the variance on *social-based* sex communication reported by the parent can be explained by the study's predictor variables. Significant relationships observed were based on participant biological sex ($\beta = .43$, $t=4.75$, $p<.01$), urbanicity ($\beta = .19$, $t=3.94$, $p<.01$), parent educational attainment ($\beta = -.10$, $t=-.13$, $p<.01$), and parent-adolescent relationship ($\beta = .31$, $t=.41$, $p<.01$). Among the significant

predictors, parent-adolescent relationship was strongest influencer on *social-based* parent-adolescent sex communication, while parent educational attainment was the weakest.

Logistic Regression for STI Diagnosis. A logistic regression was carried out to understand the influence of school-based HIV education on long-term diagnoses of STIs (syphilis, gonorrhea, and chlamydia), excluding HIV. Marital status at the time of diagnosis, age at the time of diagnosis, and *Wave I In-Home* survey reports of syphilis, gonorrhea, or chlamydia diagnosis were used as control variables in this study. With the main predictor variable, school-based HIV sex education, and additional covariates, participant biological sex, race/ethnicity, urbanicity, parent educational attainment, and parent-adolescent relationship a significant model predicting STI diagnosis was observed ($F(13,116)=3.88$, $p<.01$). This significant model indicates the results of this analysis did not arise by chance. The main predictor variable, school-based HIV sex education, was not a significant predictor of STI diagnosis. However, compared to males, being female (AOR: 2.7, 95%CI: 1.2,6.4, $p<.05$) was associated with an increased odds of being diagnosed with an STI. Additionally, compared to their non-Hispanic White counterpart, non-Hispanic Black participants were significantly associated with STI diagnosis (AOR: 3.1, 95%CI: 1.0,9.3, $p<.05$). See Table 9.

Table 9.
School-based HIV sex education and STI diagnosis

Variable		Received HIV-Based Sex Ed N(%)	Did Not Receive HIV-Based Sex Ed N(%)	Diagnosed with STI N(%)	Not Diagnosed with STI N(%)	B (SE)	AOR (95%CI)
STI Diagnosis							
HIV Sex Ed.						-.06 (.65)	.94 (.26,3.6)
Sex							
	Male (Ref)	1173 (42.7%)	91 (4.9%)	120 (5.3%)	1143 (42.2%)		
	Female	1588 (47.3%)	141 (5.1%)	290 (10.0%)	1438 (42.6%)	1.0 (.43)	2.7 (1.2,6.4) *
Race							
	Non-Hispanic White (Ref)	1710 (69.4%)	146 (8.0%)	174 (7.9%)	1682 (69.6%)		
	Non-Hispanic Black	350 (10.6%)	26 (6.7%)	135 (5.0%)	241 (6.3%)	1.1 (.55)	3.1 (1.0,9.3) *
	Hispanic	401 (10.4%)	43 (9.6%)	68 (1.8%)	376 (85.3%)	.32 (.54)	1.4 (.48,4.0)
Urbanicity							
	Rural (Ref)	582 (19.5%)	49 (2.2%)	61 (2.3%)	570 (19.3%)		
	Suburban	1162 (36.9%)	98 (4.8%)	165 (4.8%)	1095 (40.0%)	.40 (.38)	1.5 (.70,3.2)
	Urban	971 (34.5%)	75 (2.1%)	179 (8.2%)	867 (28.5%)	.22 (.51)	1.3 (.46,3.4)
Parent Education							
	No HS (Ref)	312 (13.1%)	28 (1.6%)	65 (4.0%)	275 (10.7%)		
	HS Grad	697 (27.0%)	66 (3.7%)	114 (5.3%)	649 (25.4%)	.09 (.49)	1.1 (.41,2.92)
	Some College	803 (28.8%)	55 (2.0%)	118 (3.7%)	740 (27.3%)	-.66 (.40)	.52 (.23,1.14)
	College+	662 (21.6%)	58 (2.1%)	70 (2.2%)	650 (21.4%)	-.53 (.53)	.59 (.20,1.68)
Parent Relationship							
	Other Parent Figure (Ref)	287 (10.6%)	22 (<1%)	49 (1.5%)	260 (9.7%)		
	Biological Mother	2228 (79.9%)	192 (9.0%)	324 (12.5%)	2096 (75.3%)	.25 (.63)	1.29 (.37,4.51)

Note. CI = confidence interval; AOR = adjusted odds ratio.
AOR significant at *$p < .05$
AOR represents increase in odds of self-reported an STI diagnosis
Adjusted for age, marital status, and *Wave I In-Home* STI diagnoses

Logistic Regression with Moderation of Parent-Adolescent Sex Communication. To understand if the relationship between school-based HIV sex education and STI diagnosis, excluding HIV, depends on amount of parent-adolescent sex communication, a logistic regression with a centered moderating variable measuring parent-adolescent *behavior-*, *moral-*, and *social-based* sex communication were added to the model. Participant biological sex, race, urbanicity, parent educational attainment, and parent-adolescent relationship were included as covariates. This model also included control variables, marital status, and age at time of reported STI diagnosis, excluding HIV, and *Wave I In-Home* reported STI diagnosis, excluding HIV (See Table 9).

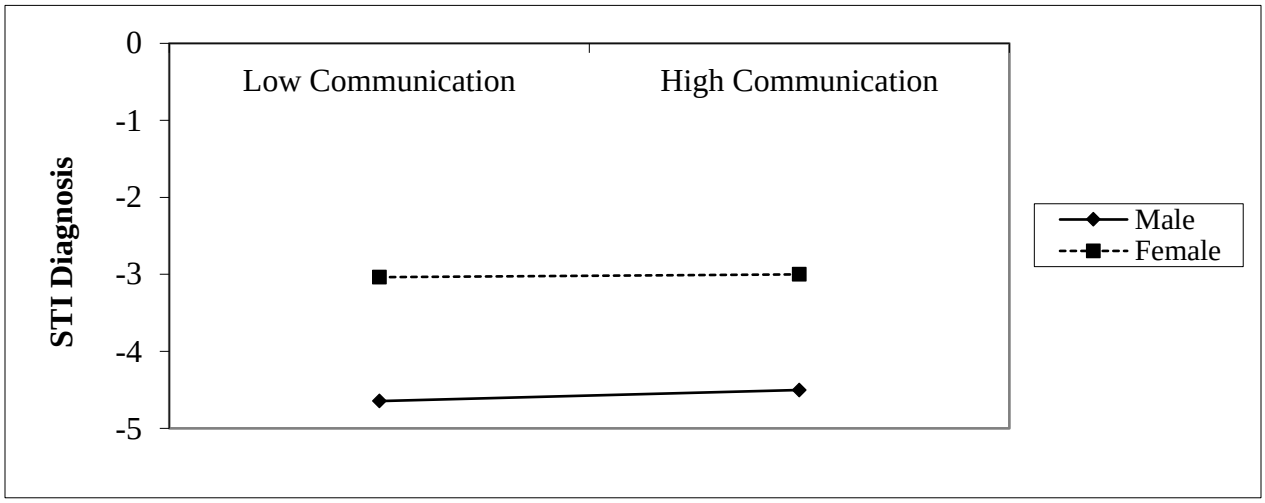
Table 10.
Parent-adolescent sex communication moderation

Variables	*Behavior-Based*		*Moral-Based*		*Social-Based*	
STI Diagnosis at Waves II-IV In-Home						
Wave I In-Home Variables						
	B (SE)	AOR (95%CI)	B (SE)	AOR (95%CI)	B (SE)	AOR (95%CI)
HIV Sex Ed	-1.7 (.98)	.17 (.02,1.2)	-.39 (.81)	1.7 (.37,7.8)	-.89 (1.1)	.41 (.05,3.8)
Biological Sex						
Male (Ref)						
Female	-1.1 (.46)	.34 (.14,.85) *	-.25 (.42)	.78 (.34,1.8)	-.33 (.46)	.72 (.29,1.8)
Race/Ethnicity						
Non-Hispanic White (Ref)						
Non-Hispanic Black	1.8 (.71)	6.2 (1.5,25.2) *	.41 (.72)	1.5 (.36,6.3)	.20 (.66)	1.2 (.33,4.5)
Hispanic	.51 (2.5)	.94 (.25,3.5)	.33 (.44)	1.4 (.59,3.3)	-.41 (.48)	.66 (.26,1.7)
Urbanicity						
Rural (Ref)						
Suburban	.69 (.95)	2.0 (.3,13.2)	.12 (.71)	1.1 (.28,4.6)	.23 (.47)	.70 (.04,3.2)
Urban	.22 (.82)	1.3 (.24,6.4)	-.05 (.44)	.95 (.40,2.3)	-.06 (.38)	1.5 (.10,22.4)
Parent Interview Variables						
Parent Education						
No HS (Ref)						
HS Grad	2.5 (.73)	12.1 (2.9,23.1) *	.45 (.37)	1.6 (.74,3.3)	.14 (.67)	1.1 (.31,4.3)
Some College	2.0 (.73)	7.2 (1.7,20.8) *	.39 (.53)	1.5 (.52,4.2)	-.14 (.63)	.87 (.25,3.0)
College+	-.38 (.73)	.68 (.16,2.9)	.05 (.54)	1.0 (.36,3.1)	-1.6 (.65)	.20 (.06,.73) **
Parent-Adolescent Relationship						
Other Parent Figure (Ref)						
Biological Mother	-.68 (.75)	8.5 (.11,2.2)	.02 (.49)	1.1 (.38,2.7)	-.30 (.42)	.74 (.33,1.7)

CI = confidence interval; AOR = adjusted odds ratio.
AOR significant at *$p < .01$, **$p < .05$
AOR represents increase in odds of self-reporting an STI diagnosis
Adjusted for age, marital status, and *Wave I In-Home* STI diagnoses

The *behavior-based* model was statistically significant ($F(24,105)=9.91$, $p<.01$) indicating these results were unlikely to have arisen by chance (See Table 11). With control variables added, moderating effects of parent-adolescent *behavior-based* sex communication were not observed with the main predictor variable, school-based HIV sex education. The analyses of interaction effects suggest participant biological sex significantly interacted with parent-adolescent *behavior-based* sex communication in influencing diagnosis of syphilis, chlamydia, or gonorrhea (AOR: .34, 95%CI: .14-.85, $p<.01$). As shown in Figure 6, a quicker acceleration of STI diagnosis from low amounts of parent-adolescent *behavior-based* sex communication to high amounts of parent-adolescent *behavior-based* sex communication was observed among male participants compared to female participants. In other words, parent-adolescent *behavior-based* sex communication played a stronger role in influencing risk of acquiring syphilis, chlamydia, or gonorrhea among male participants compared to female participants. However, the observed increase in risk is small (See Figure 6).

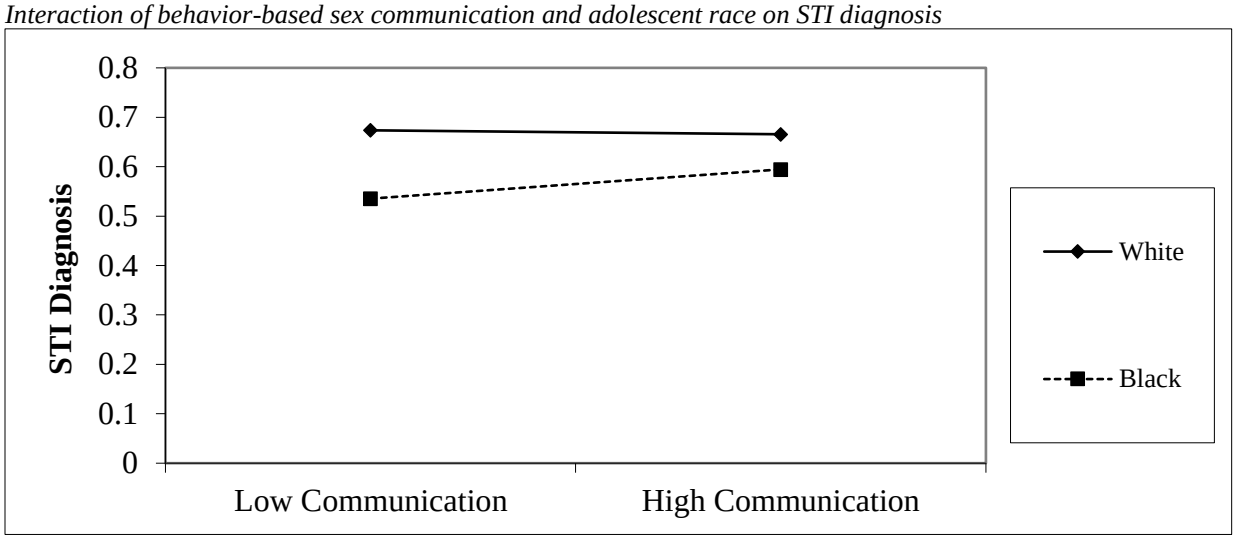
Figure 6.
Interaction of behavior-based sex communication and adolescent sex on STI diagnosis



Note: Low communication = low amount of parent-adolescent *behavior-based* sex communication.
High communication = high amount of parent-adolescent *behavior-based* sex communication
STI diagnosis = diagnosed with syphilis, chlamydia, or gonorrhea between *Waves II-IV*

Analyses of interaction effects suggest participant race significantly interacted with parent-adolescent *behavior-based* sex communication on risk of syphilis, chlamydia, or gonorrhea (AOR: 6.19, 95%CI: 1.5,25.2, $p<.01$). Illustrated in Figure 7, a quicker acceleration of STI diagnosis from low amount of parent-adolescent *behavior-based* sex communication to high amount of parent-adolescent *behavior-based* sex communication was observed among non-Hispanic Black participants compared to their non-Hispanic White counterparts. Among non-Hispanic Whites, a slight increase in risk of STI diagnosis was observed. In other words, parent-adolescent *behavior-based* sex communication played a stronger role in influencing risk of acquiring syphilis, chlamydia, or gonorrhea among non-Hispanic Black participants compared to non-Hispanic Whites (See Figure 7)

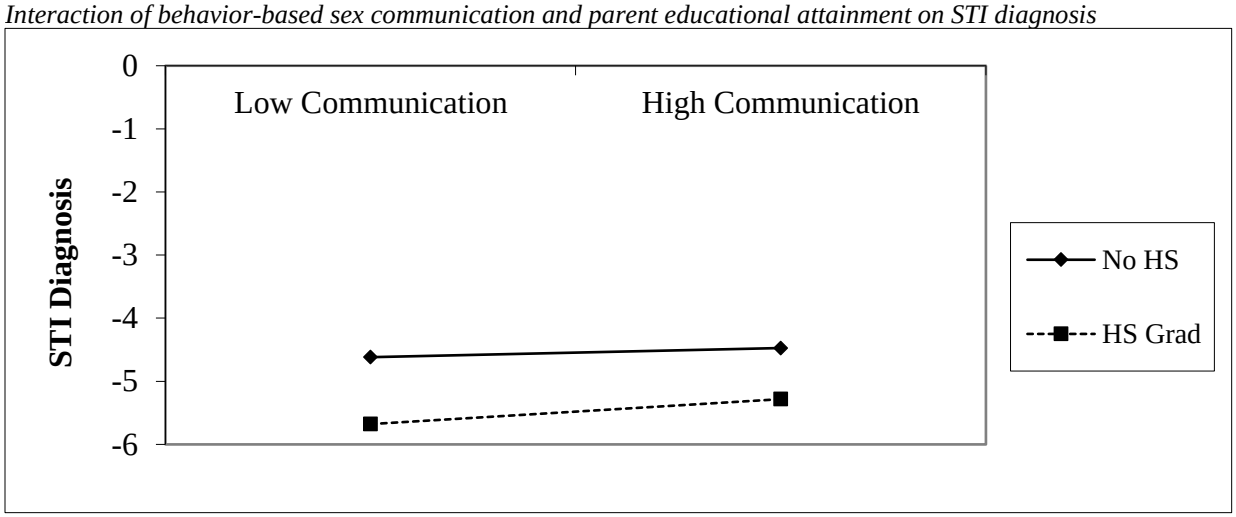
Figure 7.
Interaction of behavior-based sex communication and adolescent race on STI diagnosis



Note: Low communication = low amount of parent-adolescent *behavior-based* sex communication.
High communication = high amount of parent-adolescent *behavior-based* sex communication
STI diagnosis = diagnosed with syphilis, chlamydia, or gonorrhea between *Waves II-IV*

Analyses of interaction effects suggest parent educational attainment significantly interacted with parent-adolescent *behavior-based* sex communication on risk of acquiring syphilis, chlamydia, or gonorrhea (AOR: 12.15, 95%CI: 2.9,23.1, $p<.01$). Based on Figure 8, a quicker acceleration of participant STI diagnosis from low amount of parent-adolescent *behavior-based* sex communication to high amount of parent-adolescent *behavior-based* sex communication was observed when the parent in the *Parent Interview* was a high school graduate compared to parents with less than a high school education. In other words, parent-adolescent *behavior-based* sex communication played a stronger role in influencing participant risk of acquiring syphilis, chlamydia, or gonorrhea if the parent engaging in *behavior-based* sex communication had an educational attainment of high school compared to parents with less than a high school education (See Figure 8).

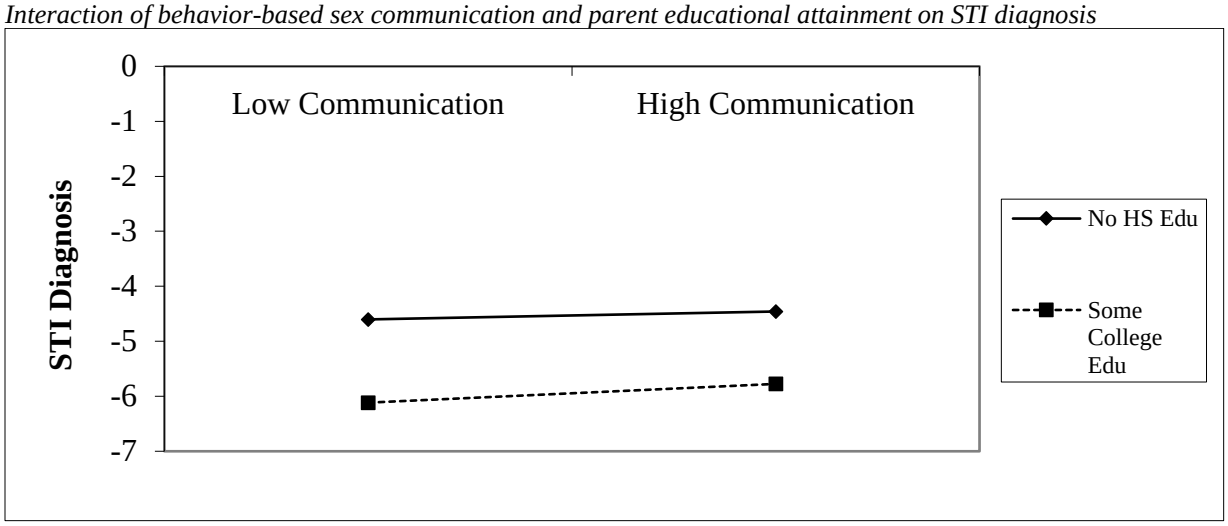
Figure 8.
Interaction of behavior-based sex communication and parent educational attainment on STI diagnosis



Note: Low communication = low amount of parent-adolescent *behavior-based* sex communication.
High communication = high amount of parent-adolescent *behavior-based* sex communication
STI diagnosis = diagnosed with syphilis, chlamydia, or gonorrhea between *Waves II-IV*
No HS = parent did not graduate high school
HS Grad = parent graduated high school

When using parent educational attainment as a predictor, significant moderating effects in the model were observed based on parent educational attainment (AOR: 7.2, 95%CI: 1.7,20.8, $p<.01$). As shown in Figure 9, a slightly quicker acceleration of participant STI diagnosis from low amount of *behavior-based* sex communication to high amount of *behavior-based* sex communication was observed when the parent in the *Parent Interview* reported an educational attainment of some college but did not graduate compared to parents reporting having less than a high school education. In other words, parent-adolescent *behavior-based* sex communication played a stronger role in participant risk of STI diagnosis when the parent participating in parent-adolescent *behavior-based* sex communication had an educational attainment of some college compared to parents with less than a high school education (See Figure 9).

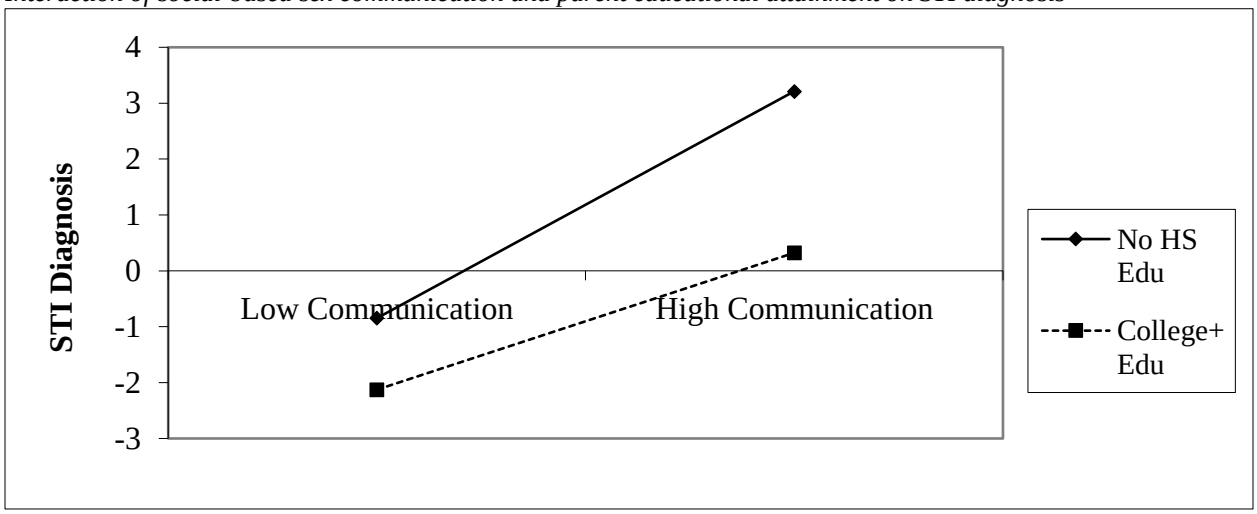
Figure 9.
Interaction of behavior-based sex communication and parent educational attainment on STI diagnosis



Note: Low communication = low amount of parent-adolescent *behavior-based* sex communication.
High communication = high amount of parent-adolescent *behavior-based* sex communication
STI diagnosis = diagnosed with syphilis, chlamydia, or gonorrhea between *Waves II-IV*
No HS = parent did not graduate high school
Some College Edu = parent went to college but did not graduate

The second model included parent-adolescent *social-based* sex communication as the moderator. With the control variables added, the model was statistically significant ($F(24,105)=10.08$, $p<.001$), indicating these results were unlikely to have arisen by chance (See Table 5). The main predictor variable, school-based HIV sex education, was not significant. However, significant moderating effects were observed based on parent educational attainment (AOR: 0.2, 95%CI: .10,.73, $p<.05$). As shown in Figure 10, a faster acceleration of participant STI diagnosis from low parent-adolescent *social-based* sex communication to high parent-adolescent *social-based* sex communication was observed when the parent had an educational attainment of less than high school compared to parents with at least a 4-year college degree or more. In other words, parent-adolescent *social-based* sex communication played a stronger role in influencing STI risk among participants if the parent participating in parent-adolescent *social-based* sex communication had less than a high school education compared to parents with a 4-year college degree or higher (See Figure 10).

Figure 10.
Interaction of social-based sex communication and parent educational attainment on STI diagnosis



Note: Low communication = low amount of parent-adolescent *social-based* sex communication.
High communication = high amount of parent-adolescent *social-based* sex communication
STI diagnosis = diagnosed with syphilis, chlamydia, or gonorrhea between *Waves II-IV In-Home*
No HS = parent did not graduate high school
College+ Edu = parent attained 4-year college degree or higher

Using the centered moderation variable measuring amount of parent-adolescent *moral-based* sex communication and control variables, a logistic regression was employed to understand the interaction with HIV-based sex education and STI diagnosis, excluding HIV. Additional covariates: participant biological sex, participants race/ethnicity, participant urbanicity, parent educational attainment, and parent-adolescent relationship were also included in this model. This model was statistically significant ($F(24,105)=3.00$, $p<.001$), indicating these results were unlikely to have arisen by chance (See Table 11). No interactions were observed in this model with the main predictor variable or covariates, meaning the relationship between school-based HIV sex education and STI diagnosis may not depend on amount of parent-adolescent *moral-based* sex communication.

Discussion.

This study expanded on the literature regarding school-based sex education and STI diagnosis by exploring the longitudinal link between school-based HIV sex education during adolescence and diagnosis of syphilis, gonorrhea, or chlamydia during young adulthood. Additionally, this study evaluated how parent-adolescent sex communication moderates the relationship between school-based HIV sex education during adolescence and STI diagnosis in young adulthood. Few studies have examined the longitudinal links between school-based sex education and STI diagnosis and the moderating effect of parent-adolescent sex communication. [45, 95] This study enhances our understanding of interventions employed during adolescence to reduce the risk of STIs by focusing on young adult STI diagnosis history following school-based HIV sex education during adolescence and how parent-adolescent sex communication influences the strength of this relationship.

Adolescent and young adult populations are disproportionately diagnosed with STIs compared to all other age groups. [6] Due to adolescence being a critical period for behavior

development [223], it is not uncommon for researchers to observe developed behaviors in this period extending into young adulthood. [95, 223] Thus, public health practitioners must understand the longitudinal nature of school-based sex education during adolescence and its influence on the likeliness of being diagnosed with an STI in young adulthood. As well as identify how at-home sex communication between parent and adolescent strengthens or weakens this relationship.

Studies using randomized control trials and quasi-experimental designs have analyzed the association between types of school-based sex education and STI diagnosis. [25, 150] Researchers have identified differences in outcomes relative to the type of school-based sex education provided. [25, 45, 150, 224] For example, abstinence-based sex education in schools has shown little protective effects on STI diagnosis [183], while school-based comprehensive sex education may have a protective effect on STI diagnosis. [25, 45, 150] Among the existing studies focused on the long-term risk of STI, the follow-up period was less than six to twelve months post-school-based intervention. [25, 95, 224] This study did not observe a relationship between school-based sex education during adolescence and STI diagnosis into young adulthood. The Add Health Study asked participants to report if they had school-based HIV sex education but did not identify a timeline [191], making it difficult to identify an exact timepoint related to when school-based sex education occurred. Despite this limitation, this study controlled for STI diagnosis reported in *Wave I In-Home*, assuming self-reported STI diagnosis in *Waves II-* through *IV In-Home* occurred at least 12 months following the *Wave I In-Home study*. Therefore, this study suggests that school-based HIV sex education may not provide long-term protection against STIs.

STI disparities have disproportionately impacted women since the start of the CDC's surveillance in 2000. [202] Among participating females, the results of this study were in-line with existing literature indicating this population carries a higher risk of STI than their male counterparts. [6, 202] When parent-adolescent *behavior-based* sex communication was added as a moderator, the analysis observed a significant interaction with biological sex and STI diagnosis. Observed in this analysis was an accelerated increased risk of acquiring syphilis, chlamydia or gonorrhea among female participants compared to males as amount of parent-adolescent *behavior-based* sex communication increased. Previous studies have observed protective effects, particularly among female adolescence and STI risk, when parents engaged in sex communication. [189, 225, 226]

Of the existing studies, parent-adolescent sex communication has been evaluated based off the biological sex of child and parent, sex communication topic, style, tone, and language used. [189, 226, 227] Studies indicate consequence-focused parent-adolescent sex communication is associated with increased condom use, decreased unprotected sex, and decreased risk of STIs, including HIV. [226, 228] Additionally, conversations between mother and daughter about condom use has been associated with increased self-reported condom use and decreased number of sexual partners. [229] Despite existing studies indicating the positive influence parent-adolescent sex communication can have on risky sexual behaviors, the results of this current analysis suggest this protective effect could be influenced by the biological sex of the adolescent, the type of sex communication engaged in, and the amount of parent-adolescent sex communication.

Due to STIs disproportionately impacting Non-Hispanic Black and Hispanic populations [204, 205], this study used non-Hispanic Whites as a reference group to understand the

relationship between young adulthood STIs and race/ethnicity. Regression results were consistent with our current understanding of STI disparities among non-Hispanic Blacks, indicating an overall increased risk of being diagnosed with an STI among non-Hispanic Black populations in young adulthood. Another study using Add Health data also identified STI disparities among young adult non-Hispanic Black women and observed increased risk as this subpopulation aged from adolescence to young adulthood while controlling for age. [206] Pflieger et al. [206] also noted no difference in risky sexual behaviors compared to their non-Hispanic White and Hispanic counterparts. However, the increased risk of STI observed among non-Hispanic Black women in Pflieger et al.'s [206] study may be due to risky partner characteristics that differ based on participant race/ethnicity.

There was a significant interaction observed with parent-adolescent *behavior-based* sex communication as the moderator between participant race and diagnosis of syphilis, chlamydia, and gonorrhea. The model suggests the risk of STI accelerates among non-Hispanic Blacks as the amount of parent-adolescent *behavior-based* communication transitions from low to high. Existing literature indicates there are variations in parent-adolescent sex communication approaches based on race/ethnicity and these variations result in sexual risk differences. Two studies have observed significantly lower STI risk among non-Hispanic Blacks as amount of mother-daughter sex communication increased. [150, 229] Additionally, non-Hispanic Black adolescents report more paternal sex communication compared to their non-Hispanic White counterparts. [226, 229] However, overall non-Hispanic White adolescents report significantly more parent-adolescent sex communication than non-Hispanic Blacks. [226] With regard to existing literature, this current analysis suggests that higher amounts of *behavior-based* parent-adolescent sex communication may result in an increased risk of STI among non-Hispanic Black

adolescents. Additionally, this analysis used adolescent race/ethnicity as a predictor, but the previous studies included the race of both parent and adolescent in their analysis.

In addition to non-Hispanic Black populations, Hispanics have traditionally experienced disproportionate rates of STIs than their non-Hispanic White counterparts. Unlike other research in this area, this study did not find a relationship between Hispanic participants and the risk of STI. This apparent lack of relationship could be attributed to using self-reported STI as the outcome variable. It is plausible that participants provided socially desirable responses, causing study data inconsistencies. This limitation is further discussed later in this section.
Despite this study's findings, national surveillance indicates that Hispanic populations are disproportionately impacted by STIs. [1] Therefore, continued public health efforts to identify risk factors and effective interventions within this population are warranted.

This study failed to find a significant relationship based on urbanicity, despite a well-documented history of STI disparities in urban communities. Historically, urban populations have been disproportionately affected by STIs, but in recent decades [219], the distribution of STIs in rural areas has become comparable to their urban counterparts. [218, 219] In addition to urbanicity, race/ethnicity plays a significant role in STI status in rural populations. [205] This study did not focus on urbanicity and racial/ethnic minority status. However, future studies should consider how multiple health indicators, like race/ethnicity and urbanicity, contribute to long-term STI diagnosis.

Researchers have identified different risk factors for STIs between rural and urban populations, including accessibility disparities. [217, 219, 220] Rural populations lack accessibility to sexual health services, contributing to an increased risk for STIs. [218-220] In contrast, accessibility to sexual health services in urban areas is a protective factor due to higher

availability. [219] Additionally, research shows differences in approaches to school-based sex education exist between rural and urban areas. [12, 180] Most of the tested school-based sex education interventions are evaluated within urban schools. [25, 57, 95, 230] So, if a rural-based school chooses to utilize evidence-based sex education, the sexual health outcomes among rural adolescents will likely differ from their urban counterparts.

Researchers have used parents' educational attainment to understand adolescent and young adult health risks. [205, 231] This study included parent educational attainment as a predictor of STI diagnosis while moderating this relationship with parent-adolescent *behavior-based* sex communication. The statistically significant model indicated an accelerated risk of STI occurred among participants with a parent in the *Parent Interview* with an educational attainment of completion of high school compared to less than a high school education, and some college experience compared to less than a high school education. Additionally, the model using *social-based* sex communication as a moderator observed an accelerated increased STI risk among participants with a parent in the *Parent Interview* with an educational attainment of less than high school compared to parents with at least a 4-year college degree.

The significant results of the interaction models based on parent educational attainment may be explained by existing literature indicating sexual health disparities differ by additional factors within a person's socioeconomic status. [150, 205, 231] Harling et al. [205] used Add Health data to identify a significant relationship between STI risk and socioeconomic factors, including parent educational attainment. Their study observed a significant relationship between STI risk and their parent's educational attainment, but only among non-Hispanic Black participants. [205] A growing body of evidence suggests that despite equivalent education status between non-Hispanic White and non-Hispanic Black populations, non-Hispanic Blacks still

experience fewer economic and health benefits than their non-Hispanic White counterparts. [150, 205, 231] Understanding racial differences as it relates to socioeconomic status and STI risk is beyond the scope of this study. However, future studies should consider grouping socioeconomic status by subpopulation, then evaluating its relationship with STI risk.

Researchers evaluating parent-adolescent sex communication recognize that topic and amount of conversation influences adolescent sexual behavior. [187-189] Overall, this analysis observed variations in risk factors associated with topic of sex communication, amount of sex communication, and demographics of both the parent and adolescent. This analysis adds to existing literature highlighting the complex nature of parent-adolescent relationships and its influence on sexual risk behavior. Additional research is warranted to understand the interplay of this analysis' observed influential factors of STI risk.

This study is not without limitations, as it is unclear if these school-based HIV sex education programs utilized an evidence-based abstinence or comprehensive approach aimed to reduce the risk of HIV. Additionally, secondary data limited the ability to identify complex components of school-based sex education curricula. This study's predictor variable, school-based HIV sex education, was measured at *Wave I In-Home.* [191] Due to this measurement occurring only at *Wave I In-Home*, participants who reported not having school-based HIV sex education by the first wave could have had it by the time *Wave II In-Home* surveys were employed. [191]

Another limitation of this study is the wording of Add Health questions. [191] *Wave II-IV In-Home* participants reported ever-diagnosis of syphilis, chlamydia, and gonorrhea, making it unclear when diagnosis or non-diagnosis occurred. [191] This study controlled for the STI diagnosis experience reported in *Wave I In-Home* [191] and used the first reported diagnosis

experience between *Waves II-IV In-Home* to reduce the impact of limitations presented by Add Health Survey questions. It is possible that participants reported no diagnosis in *Waves II-* or *III In-Home*, and may have experienced a diagnosis by the time *Wave IV In-Home* occurred. [191] Therefore, future studies should ask participants about when school-based sex education occurred, as well as the time an STI diagnosis occurred to understand the sequence of events and the amount of time between these events.

The Add Health Study design also limited its *Parent Interview* sample to primarily biological mothers. [191] The justification for this was based on evidence suggesting that mothers are generally the primary sex educator compared to fathers. [190, 191] However, there is a lack of research on the dynamics of father-adolescent sex communication. In today's context, family structures have evolved, as rates of two-parent households are declining, and more mothers than ever have transitioned from the home to the workplace. [232] Changing homes and family environments require focusing on all parental figures concerning parent-adolescent relationships and STI risk.

Socially desirable responses can occur in studies focused on sexual health. As Add Health [191] survey questions were retrospective and based on sensitive topics, including STIs, sex education, and sex communication, it is appropriate to recognize the possibility of recall and social desirability bias. Add Health interviewers tried to reduce socially desirable responses by assuring participants' confidentiality and anonymity throughout the study. [191] Lastly, inconsistent measurements through *Waves I-IV In-Home* [191] resulted in an inability to include men-who-have-sex-with-men (MSM) as a subpopulation. MSM are among the most vulnerable to STIs and HIV. [2, 186] Despite this limitation, this study did include other populations with a

history of disproportionate STI rates, including women, non-Hispanic Black and Hispanic individuals, and groups based on urbanicity in the U.S. [6]

This study used logistic regressions to understand the interaction of parent-adolescent *behavior-*, *moral-*, and *social-based* sex communication on the relationship between school-based pregnancy sex education and the intention of the first reported pregnancy in this analysis. Additional covariates in the model represented participant biological sex, race/ethnicity, urbanicity, parent educational attainment, and parent-adolescent relationship.

The current study adds to our understanding of STI disparities experienced by females and non-Hispanic Blacks, regardless of age and marital status. While existing research recognizes the influential role parents have on adolescent STI risk, this analysis suggests reducing this risk could be dependent on factors related to type of sex communication, who is communicating and being communicated to, and amount of sex communication engaged in. These results emphasize the need for further exploration of parent-adolescent relationships, STI risk, and the longevity of protective effects due to school-based sex education.

Conclusion.

STIs are disproportionately distributed among subpopulations in the U.S. and are considered a leading cause of morbidity and mortality. Widening STI disparities are expected as overall rates of syphilis, chlamydia, and gonorrhea continue to grow. This study focuses on the risk of STIs from adolescence to young adulthood and its relationship with school-based HIV sex education during adolescence. Additionally, due to parents' known influence on adolescent sexual behaviors, this study used reports of parent-adolescent sex communication as a moderator to evaluate the interaction between school-based sex education and STI risk. While school-based HIV sex education was not associated with young adulthood risk of STI, significant interactions

were observed among participants based on adolescent biological sex and race. The interaction between parent-adolescent sex communication with parent educational attainment could also influence young adulthood STI risk. Overall, school-based HIV sex education is perhaps not tied to the young adulthood risk of syphilis, chlamydia, or gonorrhea. Public health interventions to reduce STI risk should include tailored approaches for parent-adolescent sex communication and targeted prevention efforts for all sexually active populations, regardless of age.

Chapter VI (Study III)

Introduction

Sexually transmitted infections (STIs), including Human Immunodeficiency Virus (HIV), are at epidemic levels in the United States. [6] Condoms are the only contraceptive method that protects against most vaginal, oral, and anal STIs and HIV. [199] Due to the direct relationship between condom use and STI/HIV risk, condom use behaviors are a common measurement standard of sexual risk. Existing studies have observed variations in condom use within subpopulations based on age, biological sex, race/ethnicity, sexuality, and relationship status. [9, 213] These variations in reported condom use are reflected in STI and HIV disparities within the same subpopulations. [213] Due to recent surveillance data depicting a record-high rate of STIs in 2020, increasing overall condom use is a national goal set by Healthy People 2030. [42]

Condomless sex contributes to the current sexual and reproductive health disparities experienced by adolescent and young adult populations, females, non-Hispanic Blacks, Hispanics, and men who have sex with men (MSM). [199, 202, 203] The implications of condomless sex include infertility, extreme pregnancy, infant complications [1, 222], and approximately $16 billion in direct lifetime medical costs. [1] Despite evidence of substantial health and economic consequences, self-reported condom use is at an all-time low among all sexually active populations. [9, 199] Studies indicate that attitudes towards condom use [215, 222], perceived risk of STIs/HIV [215], self-efficacy [212], and condom negotiation skills influence the use of condoms. [215]

Multilevel public health interventions can result in substantial behavior changes compared to single-level interventions. [24] To promote condom use, public health practitioners traditionally rely on formal sex education within schools and communities. [12, 45] Generally, school-based sex education is offered to young populations between grades six and 12, which is

during a critical developmental period related to sexual risk behaviors. [223] Historically, the U.S. government has provided funding for school-based sex education. [180, 183] Two common approaches to school-based sex education used in U.S. public schools are abstinence-based sex education and comprehensive sex education (CSE). These approaches typically aim to intervene and prevent negative sexual behavior that leads to adverse health outcomes but differs in methods and instruction. [12] Abstinence-based sex education traditionally promotes abstaining from sex, basing the content on morals and values. [183] CSE also promotes abstinence but includes additional instruction on contraceptives and condom use. [45]

School-based sex education is associated with condom use behaviors among adolescent populations. [45, 183, 224] However, the strength and direction of this relationship can be dependent on type of school-based sex education. [12, 224] For example, in a study using a nationally representative sample of males and females aged 15-24, participants that received abstinence-based sex education observed an increased odds of condom use at the last sex, but only among male participants. [95] When controlling for the age of first sex, the relationship became insignificant for all groups. This same study observed increased odds of females and males using a condom at the last sex if they experienced CSE, regardless of the age of first sex. [95] Kirby et al. [108] evaluated abstinence-based and CSE programs, finding increased condom use as an outcome of 15 CSE programs and no significant change in condom use behaviors in 17 other CSE programs. [108] Zero of the five abstinence-based programs in this review significantly influenced condom use behavior. [108]

Parent-adolescent sex communication is viewed as informal sex education, and many studies highlight its significant influence on adolescent sexual health behavior. [188, 189, 226, 227] Adolescent-aged populations commonly cite their parent as influential in their sexual

decision-making. [233] Research has proven this influence, indicating increased contraceptive use, including condom use. [226, 227, 234] Additionally, studies indicate multiple factors related to the parent, communication, and adolescent contribute to effective parent-adolescent sex communication. For example, high amount of parent-adolescent sex communication, particularly among non-Hispanic Black mothers and daughters, has been associated with increased contraceptive and condom use at recent sex. [226] Despite known protective effects of parent-adolescent sex communication, just one-third of adolescents state they have discussed sex-related topics with a parent. [9]

Condom use is effective in preventing adverse sexual health outcomes and school-based sex education aims to increase safer sex behaviors. Parents also play a critical role in their adolescent's sexual health through sex communication. Thus, understanding how the inclusion of parent-adolescent sex communication influences the relationship between school-based sex education and condom use behaviors will likely improve public health intervention programs for adolescents and young adults. This study will use reports of condom use at recent sex into young adulthood and evaluate its relationship with school-based HIV sex education during adolescence, as well as how the parent-adolescent sex communication interacts with this relationship.

Methods.

Add Health Study. The National Longitudinal Study of Adolescent to Adult Health (Add Health) is a nationally representative ongoing longitudinal study that is school- and home-based. Since 1994, the Add Health Study has collected five waves of data primarily focused on health and health-related behaviors of populations. This study started with in-school recruitment of 7^{th}-12^{th} grade adolescents to make up the 1994-1995 *Wave I In-School* study sample. Of the eligible *Wave I In-School* participants, a randomly selected core sample of 12,105 adolescents were recruited for Add Health's in-home survey. Supplemental groups comprised of

oversampled non-Hispanic Black adolescents with highly educated parents and adolescents from urban and rural settings were added to the in-home sample, resulting in 20,745 adolescents aged 12-19 for the *Wave I In-Home* study. All *Wave I In-Home* participants in 7-11th grade were eligible to continue with the *Wave II In-Home* study conducted one year later (1996, *n* = 14,738; 88.6% response rate. *Wave III In-Home* was collected between 2001-2002 when participants were aged 18-26 (*n* = 15,197, 77.4% response rate). Between 2008 and 2009, the *Wave IV In-Home* survey was conducted with participants now aged 24-32 (*n* = 15,701; 80.3% response rate). The final and most recent wave, *Wave V In-Home* took place between 2016 and 2018 when participants were aged 32-442 (*n* = 12,300, 71.8% response rate). Additionally, the Add Health Study recruited a subset of parents (*n* = 17,670) of the *Wave I In-Home* participants to take part in the *Parent Interview*. The purpose of the *Parent Interview* was to provide additional information of parent-adolescent perspectives relative to the primary focus of the Add Health Study. For a complete list of Add Health question and answer options, see Appendix A.

Table 11.
Study variables used and corresponding Add Health wave

Variables	*W1* 1994-95 (grade 7-12)	*Parent Interview* 1994-95	*W2* 1996 (grade 8-12)	*W3* 2001-02 (age 18-26)
Adolescent Descriptive				
Biological Sex	x			
Race/Ethnicity	x			
Urbanicity	x			
First-Sex Condom Use			x	
Parent Descriptive				
Parent Race/Ethnicity		x		
Parent Educational Attainment		x		
Parent-Adolescent Relationship		x		
Inclusion Criteria				
School-Based Sex Education	x			
Recent Birth Control Use	x		x	x
Recent Condom Use	x		x	x
Behavior-based				
Social-Based		x		
Moral-Based		x		
Control Variables				
Marital Status	x	x	x	x
Age	x	x	x	x

Note: School-based sex education = school-based HIV sex education
Behavior-, social-, moral-based = parent-adolescent sex communication topics

Sample.

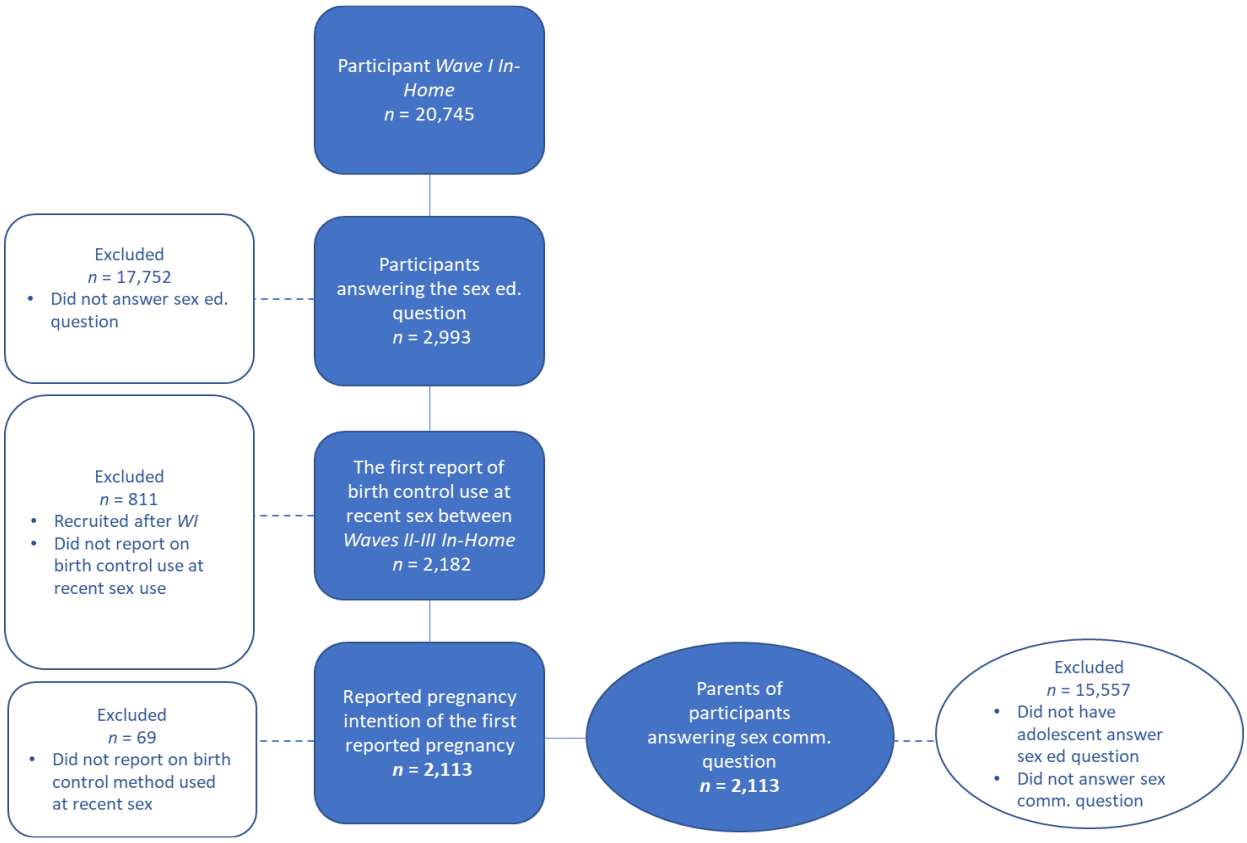
Participants. This study used Add Health data from *Waves I-III In-Home* and *Parent Interviews* (See Table 11). The Add Health Study asked participants to report about school-based HIV sex education at *Wave I In-Home*. Additionally, condom use behaviors were measured during the *Wave I In-Home* survey. Due to the *Wave I In-Home* survey measuring school-based HIV sex education and condom use behaviors without inclusion of a timeline, it is unclear about the sequence of these events. Therefore, this study used condom use behaviors collected between *Waves II-* and *III In-Home* surveys. To meet the inclusion criteria, participants must have:

- Reported on school-based HIV sex education at *Wave I In-Home*
- Reported use of birth control methods used at most recent-sex during *Wave II-* or *Wave III In-Home* surveys

- Had a parent take part in the *Parent Interview* in 1994-1995 that also reported on sex communication between them and their participating adolescent (See Figure 11).

With the inclusion criteria, the final sample used for this study was 2,113 participants and 2,113 of their participating parents (See Figure 11).

Figure 11.
Flow chart of inclusion criteria by wave



Note: Sex ed. = school-based HIV sex education
Sex comm. = parent-adolescent sex communication

Demographics. During the *Wave I-Home* survey, participant biological sex (male, female), race/ethnicity (non-Hispanic White, non-Hispanic Black, Hispanic), and urbanicity (rural, suburban, urban) were used as covariates (See Table 12). This study represented three categories of race/ethnicity, using non-Hispanic Whites as the reference population. Additional racial groups too small in sample size were excluded from this study to provide an accurate comparison to the reference group. Excluded participant racial groups included Native American/American Indian (*n* = 12) and Asian or Pacific Islander (*n* = 51).

Within the *Parent Interview*, educational attainment (no high school, high school graduate, some college, college graduate or higher), and parent-adolescent relationship (biological mother, other relationship) were also included as covariates. Parent race/ethnicity (non-Hispanic White, non-Hispanic Black, Hispanic) were used as descriptive variables. Excluded racial parent groups included Native American/American Indian (n = 62) and Asian or Pacific Islander (n = 140).

Participant age and marital status at the time of reported condom use behavior (between *Waves II* and *III In-Home*) were used as control variables for this study.

Instrumentation and Measurement Protocol.

School-Based Sex Education. The primary predictor variable, school-based HIV sex education, was assessed using *Wave I In-Home* survey responses using the question:

"Have you learned about the following in a class at school (check all that apply)"

Wave I In-Home participants were prompted to use a dichotomized response option (yes, no) to state if they had experienced school-based HIV sex education at the current middle or high school (See Table 13).

Parent-Adolescent Sex Communication. This study used three centered variables to measure amount of parent-adolescent sex communication. Broken down to three types, *behavior-*¸ *moral,* and *social-based,* amount of parent-adolescent sex communication was measured within the *Parent Interview* using a 4-point Likert scale (not at all, somewhat, a moderate amount, a great deal).

Moral-based parent-adolescent sex communication was measured using responses from one variable (See Table 13).

"How much have you and [NAME] talked about (his/her) having sexual intercourse and the moral issues of not having sexual intercourse?"

Social-based parent-adolescent sex communication was measured using responses from one variable (See Table 13).

"How much have you and [NAME] talked about (his/her) having sexual intercourse and the negative or bad impact on (his/her) social life because (he/she) would lose the respect of others?"

Behavior-based parent-adolescent sex communication was measured using an average score of responses from four variables (See Table 13).

"How much have you and [NAME] talked about (his/her) having sexual intercourse and the dangers of getting a sexually transmitted disease?"

"How much have you and [NAME]talked about (his/her) having sexual intercourse and the negative or and things that would happen if [he got someone/she got] pregnant?"

"How much have you and [NAME] talked about birth control?"

"How much have you and [NAME] talked about sex"?

Recent Sex Condom Use. The outcome variable for this study measured condom use at most recent-sexual intercourse between *Waves II*- and *III- In-Home* surveys using (See Table 13):

"What method of birth control did you or your partner use [most recently]?"

Participants were given up to three birth control options to report using at most recent sex (condoms, withdrawal, rhythm, birth control pills, vaginal sponge, suppositories, diaphragm, intrauterine device, Norplant, ring, Depo Provera, contraceptive film, some other method, no other method). In general, studies measuring condom use behaviors follow up with the target

population up to a year post-intervention. This analysis used condom use at recent sex reported between *Waves II-* and *III- In-Home.* Due to existing literature indicating 12-months or less as the typical follow-up time post-intervention, this study used the first report of condom use at recent sex between *Waves II-* and *III- In-Home.*

Recent sex condom use response options were dichotomized (yes, no) and participants reporting use of condoms within one of the three method options were placed into the group designated as used a condom at most recent sex (yes). If condoms were not reported within one of the three method options, participants were designated as a non-condom user at most recent sex (no).

First Sex Condom Use. To further define the study population, this analysis included an additional descriptive variable measuring condom use at first sex. Due to the wording of this Add Health survey question, it is unclear when condom use at first sex occurred (reported between *Waves I-II In-Home*) in reference to school-based HIV sex education (reported during the *Wave I In-Home* survey). For this reason, the study used reported use of condom at first sex from the *Wave II In-Home* survey as a descriptive variable.

To measure condom use at first sex, the Add Health Study asked participants in the *Wave II In-Home* survey*:*

> "What method of birth control did you or your partner use the first time you had sexual intercourse?"

Participants were able to report on up to three birth control methods used at the first time they had sexual intercourse (condoms, withdrawal, rhythm, birth control pills, vaginal sponge, suppositories, diaphragm, intrauterine device, Norplant, ring, Depo Provera, contraceptive film, some other method, no other method). For this study, answer options for first sex condom use

were dichotomized (yes, no). If a participant reported use of condom within one of the three birth control method options, participants were included in the condom use at first sexual intercourse group (yes). If condoms were not used within one of the three birth control method options, participants were placed in the no condom use at first sex group (no).

Table 12.
Participant demographics

Variable	*N(%)*
Wave I In-Home Variables	
Biological Sex	
Male	948 (45.9%)
Female	1388 (54.1%)
Race/Ethnicity	
Non-Hispanic White	1464 (67.0%)
Non-Hispanic Black	304 (13.9%)
Hispanic	354 (16.2%)
Other	63 (2.9%)
Adolescent Urbanicity	
Rural	505 (22.0%)
Suburban	958 (39.1%)
Urban	836 (38.9%)
Control Variables	
Marital Status at Reported Recent Condom Use between Waves II-III In-Home	
Married	741 (30.3%)
Not Married	1579 (69.7%)
Age at Reported Recent Condom Use Between Waves II-III In-Home	
15-18	815 (34.9%)
19-26	1521 (65.1%)
Parent Interview Variables	
Parent Relationship to Adolescent	
Biological Mother	1892 (87.6%)
Other Parent Figure	245 (12.4%)
Parent Race/Ethnicity	
Non-Hispanic White	1448 (52.7%)
Non-Hispanic Black	241 (11.1%)
Hispanic	278 (12.8%)
Other	212 (9.7%)
Parent Educational Attainment	
No HS	273 (14.7%)
HS Graduate	617 (32.2%)
Some College	702 (31.5%)
College+	516 (21.6%)

Note: Numbers of cases (*N*s) are weighted due to Add Health sampling design.
* Refers to marital status and age when participant reported recent condom use behavior

Analysis.

To account for cluster sampling where clusters (i.e., schools) were sampled with unequal probability, sampling and analytic weights were applied to this analysis. All data were analyzed using Stata 17 software. [162] The first step in this analysis examined variable means, standard deviations, basic frequencies, and weighted percentages. To understand if a relationship existed between school-based HIV sex education and participant demographic variables, as well as condom use behaviors, a Pearson chi-square analysis was performed. Multiple linear regressions were employed to understand the effect demographic variables have on categories of parent-adolescent sex communication (*behavior-, moral-, and social-based*). To examine associations between school-based sex education and recent condom use, a logistic regression was run.

The final step of this analysis utilized three separate multiple logistic regressions with centered *behavior-*, *moral-*, and *social-based* parent-adolescent sex communication categories as the moderator to understand if the relationship between school-based HIV sex education and reports of condom use at recent-sex depends on the amount of parent-adolescent sex communication. Additionally, this analysis aimed to understand if the relationship of recent-sex condom use and study covariates, including biological sex, participant race/ethnicity, participant urbanicity, parent educational attainment, and parent-adolescent relationship, depends on the amount of parent-adolescent sex communication.

Results.

This section includes study results through basic frequencies and analyses conducted in three stages: 1) Pearson chi-square analyses, 2) linear regression analyses, and 3)logistic regression analyses.

Basic Frequencies. Over half of the 2,336 *Wave I In-Home* survey participants were female (54.1%). Of the racial/ethnic subgroups, non-Hispanic Whites made up 75.8% (n = 1,464)

of the study sample, followed by 12.2% Hispanics (*n* = 354), and 12.1% non-Hispanic Blacks *(n* = 304). Most participants resided in suburban (39.1%) or urban (38.9%) areas when measured during the *Wave I In-Home* survey. Of the participating parents, 87.6% were biological mothers to a *Wave I In-Home* participant. Additionally, 80% of parents from the *Parent Interview* were non-Hispanic White (*n* = 1,448) and graduated from high school (32.2%) or had some college experience (31.5%). The demographic characteristics of the sample are presented further in Table 12.

Among the *Wave I In-Home* participants, most (89.9%) reported having experience with school-based HIV sex education. Based on biological sex, 47.3% of female *Wave I In-Home* survey participants reported having school-based HIV sex education compared to 42.7% of male participants. Among non-Hispanic White participants, nearly 70% reported having school-based HIV sex education, followed by 10.5% of non-Hispanic Blacks and 10.3% of Hispanics. Most participants that reported having school-based HIV sex education were from a suburban area (36.7%), compared to 19.3% of participants from rural areas (See Table 14).

Of the participants that had school-based HIV sex education, most had a parent in the *Parent Interview* with an educational attainment of some college experience but did not graduate (28.6%). About 13% of participants had school-based HIV sex education also had a participating parent with less than a high school educational attainment. Parent-adolescent relationship consisted of biological mothers and other relationships, with nearly 90% of participants who had school-based HIV sex education also having a biological mother participating in the *Parent Interview* (See Table 14).

The number of participating *Wave II In-Home* males (34.5%) reporting use of condoms at first sex was slightly more than females (32.2%). Broken down by race/ethnicity, 43.7% of non-

Hispanic White participants reported use of a condom at first sex, compared to 14.5% of non-Hispanic Blacks, and 9.1% of Hispanics. Of the participants residing in an urban location, 31.6% reported use of condoms at first sex, compared to 22.3% of suburban and 12.6% of rural participants (See Table 14).

Between the *Waves II-III In-Home* survey, less than half (45%) of participants reported use of condom at most recent sex. Based on biological sex, 21.5% of female participants used a condom at most recent sex, compared to 24% of male participants. About 33% of non-Hispanic Whites reported use of condom at most recent sex, compared to 6.6% of non-Hispanic Blacks and 6.4% of Hispanic participants. Among the three urbanicities measured in this study, 18.1% of urban participants and 17.8% of suburban participants used a condom at most recent sex (See Table 13).

Chi-Square Analyses. This study used Pearson chi-square analysis to understand the differences between study variables. This analysis indicated there was no significant differences based on biological sex and school-based HIV sex education. Additionally, no significant differences were observed based on school-based HIV sex education and participant race/ethnicity or urbanicity.

Based on parent educational attainment, no differences were observed with participant experience of school-based HIV sex education. Statistical significance $\chi^2\,(1, n = 2{,}113) = 5.1$, $p<.05$ was observed based on parent-adolescent relationship and school-based HIV sex education, meaning these two variables may not be independent from one another.

Pearson chi-square of participant biological sex and most recent condom use was significant $\chi^2\,(1, n = 2{,}113) = 22.2$, $p<.01$, indicating these two variables may not be independent from one another. Also significant, non-Hispanic Black participants and reports of

recent condom use χ^2 (1, $n = 2{,}113$) = 6.3, p<.05. No additional significant differences were observed.

Based on participant biological sex and condom use at first sex, a significant relationship was observed χ^2 (1, $n = 2{,}113$) = 11.5, p<.01. These results indicate biological sex and condom use at first sex are significantly different from one another. No significant differences were observed based on race/ethnicity, parent educational attainment, or parent-adolescent relationship and condom use at first sex.

Multivariate Linear Regressions for Parent-Adolescent Sex Communication. Three categories described amount of parent-adolescent sex communication reported in the *Parent Interview*: *behavior-*, *moral-*, and *social-based* communication. Using the average of the 4-point Likert scale responses to amount of parent-adolescent sex communication engaged in with participants (1: not at all, 2: somewhat, 3: a moderate amount, 4: a great deal) the average reported amount of parent-adolescent sex communication was between somewhat to a moderate amount for *behavior-* (M = 2.88, SD = .05), *moral-* (M = 2.91, SD = .05), and *social-based* (M = 2.62, SD = .06) categories. See Table 13 for further details.

Multiple linear regressions were carried out to determine the participant biological sex, race/ethnicity, urbanicity, parent educational attainment, and parent-adolescent relationship with reports of parent-adolescent sex communication.

The *behavior-based* sex communication model was statistically significant (F(5,124) = 9.12, p<.05), indicating these results did not arise by chance. Adjusted R-squared indicated 2.5% of the variance in the amount of *behavior-based* sex communication can be explained by variances in the descriptive variables. Urbanicity (β =.14, t=3.77, p<.01) was the only

statistically significant variable in this model. The results indicate *behavior-based* parent-adolescent sex communication may be influenced by urbanicity.

The model representing *moral-based* sex communication was statistically significant ($F(5,124) = 5.13$, $p<.05$). Adjusted R-squared indicated 4.0% of the variance in amount of *moral-based* parent-adolescent sex communication can be explained by this study's descriptive variables. Biological sex (β =.27, t=3.90, $p<.01$), participant race (β=-.14, t=-1.98, $p<.05$), parent educational attainment (β=-.08, t=-2.05, $p<.05$), and parent-adolescent relationship (β=.35, t=2.28, $p<.05$) were significant predictors in the model. Parent-adolescent relationship was the most influential on amount of parent-adolescent *moral-based* sex communication and participant race was the least.

The *social-based* sex communication model was statistically significant ($F(5,124)=8.38$, $p<.05$). Adjusted R-squared indicated 7.0% of the variance of amount of *social-based* sex communication can be explained by the study's descriptive variables. Biological sex (β=.37, t=4.75, $p<.01$), urbanicity (β=.18, t=-1.03, $p<.01$), parent educational attainment (β=-.13, t=-2.71, $p<.01$), and parent-adolescent relationship (β=.41, t=3.01, $p<.01$) were significant variables in the model. Parent-adolescent relationship was observed as the most influential on amount of parent-adolescent *behavior-based* sex communication and parent educational attainment was the least.

Logistic Regression with Parent-Adolescent Sex Communication Moderation. To understand the relationship between recent-sex condom use and school-based HIV sex education, a logistic regression was run. Additionally, biological sex, participant race, urbanicity, parent educational attainment, and parent-adolescent relationship were added to the model as covariates. Marital status and age at time of reported recent-sex condom use were used as control

variables. This model was statistically significant ($F(12,117)=4.95$, $p<.01$), indicating these results did not arise by chance. The main predictor variable, school-based HIV sex education, was not associated with recent-sex condom use. Compared to males, being female was associated was a decreased odds of reporting use of a condom at recent sex (AOR: 0.5, 95%CI: .41,.68, $p<.01$). No other statistically significant relationships were observed (See Table 14).

Table 13.

Participant sex education, condom use behavior, and sex communication

Variables	*N* (%)				
Wave I In-Home Variable					
School-Based Sex Education					
HIV Sex Ed (Y)	1899 (89.9)				
HIV Sex Ed (N)	234 (10.1)				
Waves II-III In-Home Variable					
Recent Sex Condom Use (Y)	1067 (45.5)				
Recent Sex Use (N)	1269 (54.5)				
Wave II In-Home Variable					
First Sex Condom Use (Y)	758 (68.7)				
First Sex Condom Use (N)	388 (31.3)				
Parent Interview Variables	**Not at all (1)**	**Somewhat (2)**	**A moderate amount (3)**	**A great deal (4)**	***M* (SD)**
Behavior-Based Sex Communication					
How much have you and [NAME] talked about (his/her) having sexual intercourse and the dangers of getting a STD?	157 (6.8)	394 (17.2)	676 (31.1)	894 (44.9)	3.14 (0.05)
How much have you and [NAME] talked about (his/her) having sexual intercourse and the negative or bad things that would happen if [he got someone/she got] pregnant?	190 (7.9)	462 (21.2)	750 (34.9)	718 (36.1)	2.99 (0.06)
How much have you and [name] talked about birth control?	334 (15.5)	578 (25.8)	638 (30.3)	567 (28.5)	2.72 (0.06)
How much have you and [NAME] talked about sex?	146 (5.7)	495 (21.4)	787 (39.1)	689 (33.7)	3.00 (0.04)
Grand Frequency (%)	**171 (6.5)**	**566 (26.7)**	**826 (39.1)**	**550 (27.7)**	**Grand *M* = 2.88 (0.05)**
Moral-Based Sex Communication					
How much have you and [NAME] talked about (his/her) having sexual intercourse and the moral issues of not having sexual intercourse?	**267 (13.3)**	**431 (18.5)**	**665 (32.2)**	**751 (36.1)**	**Grand *M*= 2.91 (0.05)**
Social-Based Sex Communication					
How much have you and [NAME] talked about (his/her) having sexual intercourse and the negative or bad impact on (his/her) social life because (he/she) would lose the respect of others?	**417 (20.9)**	**525 (23.1)**	**601 (28.9)**	**568 (27.1)**	**Grand *M* = 2.62 (0.06)**

Note: All means and number of cases are weighted by sampling weights that account for Add Health's sampling design.

Table 14.
School-based sex education and condom use behavior

Variables	Received HIV-Based Sex Ed *N(%)*	Did Not Receive HIV-Based Sex Ed *N(%)*	Used a condom *N(%)*	Did not use a condom *N(%)*	B(SE)	AOR (95%CI)†
Wave I In-Home Variables						
HIV Sex Ed.					-.27 (.43)	.76 (.33,1.8)
Adolescent Biological Sex						
Male	909 (42.7%)	104 (4.9%)	120 (5.3%)	1143 (42.2%)		Ref
Female	1007 (47.3%)	109 (5.1%)	290 (10.0%)	1438 (42.6%)	-.64 (.13)	.53 (.41,.68)*
Adolescent Race/Ethnicity						
Non-Hispanic White	1478 (69.4%)	171 (8.0%)	630 (32.8%)	834 (43.0%)		Ref
Non-Hispanic Black	226 (10.6%)	143 (6.7%)	174 (6.6%)	130 (5.4%)	.17 (.37)	1.2 (.57,2.4)
Hispanic	221 (10.4%)	204 (9.6%)	171 (6.4%)	180 (5.8%)	.43 (.33)	1.5 (.80,2.9)
Adolescent Urbanicity						
Rural	415 (19.5%)	47 (2.2%)	225 (9.4%)	280 (12.5%)		Ref
Suburban	787 (36.9%)	102 (4.8%)	432 (17.8%)	526 (21.3%)	.06 (.27)	1.1 (.63,1.8)
Urban	735 (34.5%)	45 (2.1%)	388 (18.1%)	448 (20.8%)	.18 (.27)	1.2 (.70,2.1)
Parent Interview Variables						
Parent Educational Attainment						
No HS	279 (13.1%)	34 (1.6%)	122 (6.5%)	151 (8.2%)		Ref
HS Grad	575 (27.0%)	79 (3.7%)	295 (15.2%)	322 (16.9%)	.16 (.34)	1.1 (.41,2.92)
Some College	613 (28.8%)	42 (2.0%)	309 (14.0%)	393 (17.6%)	.03 (.39)	.52 (.23,1.14)
College+	460 (21.6%)	45 (2.1%)	236 (9.8%)	208 (11.8%)	.26 (.41)	.59 (.20,1.68)
Parent-Adolescent Relationship						
Other Parent Figure	225 (10.6%)	21 (<1%)	109 (5.9%)	136 (6.5%)		Ref
Biological Mother	1702 (79.9%)	191 (9.0%)	863 (39.4%)	1029 (48.3%)	-.01 (.29)	1.29 (.37,4.5)

Note: HIV sex ed. = school-based HIV sex education
College+ = attained a bachelor's degree or higher
OR significant at *$p < .01$
OR represents odds of using a condom at most recent sex
Adjusted for marriage and age at during the first report of condom use at recent sex between *Waves II-* and *III In-Home.*

Table 15.
Parent-adolescent sex communication moderation

Variable	***Behavior-Based***		***Moral-Based***		***Social-Based***	
	B(SE)	AOR(95%CI)	B(SE)	AOR(95%CI)	B(SE)	AOR(95%CI)
Recent-Sex Condom Use						
School-Based Sex Ed	.40 (.47)	1.5 (.60,3.8)	.21 (.27)	1.2 (.72,2.1)	.12 (.32)	1.1 (.60,2.1)
Biological Sex						
Male (Ref)						
Female	.16 (.21)	1.2 (.79,1.7)	.25 (.20)	1.3 (.86,1.9)	.38 (.17)	1.5 (1.1,2.0) **
Race/Ethnicity						
Non-Hispanic White (Ref)						
Non-Hispanic Black	.67 (.24)	2.0 (1.2,3.2) *	-.06 (.22)	.94 (.61,1.5)	-.61 (.23)	.54 (.34,.86) *
Hispanic	.64 (.39)	1.9 (.89,4.1)	.03 (.23)	1.0 (.66,1.6)	-.10 (.22)	.91 (.58,1.4)
Urbanicity						
Rural (Ref)						
Suburban	-.32 (.25)	.73 (.45,1.2)	.02 (.20)	1.0 (.68,1.5)	-.15 (.19)	.86 (.59,1.3)
Urban	-.25 (.27)	.78 (.46,1.3)	.29 (.20)	1.3 (.91,2.0)	.41 (.21)	1.5 (1.1,2.3) **
Parent Education						
No HS (Ref)						
HS Grad	-.02 (.26)	.98 (.58,1.7)	.17 (.36)	1.2 (.58,2.4)	-.11 (.40)	.89 (.41,2.0)
Some College	.04 (.29)	1.0 (.59,1.8)	.42 (.36)	1.5 (.74,3.1)	.05 (.36)	1.0 (.52,2.1)
College+	.01 (.34)	1.0 (.51,2.0)	.33 (.41)	1.4 (.07,4.3)	-.12 (.43)	.89 (.38,2.1)
Parent Relationship						
Other Parent Figure (Ref)						
Biological Mother	-.44 (.36)	.64 (.31,1.3)	.35 (.27)	1.4 (.84,2.4)	.14 (.26)	1.2 (.24,2.8)

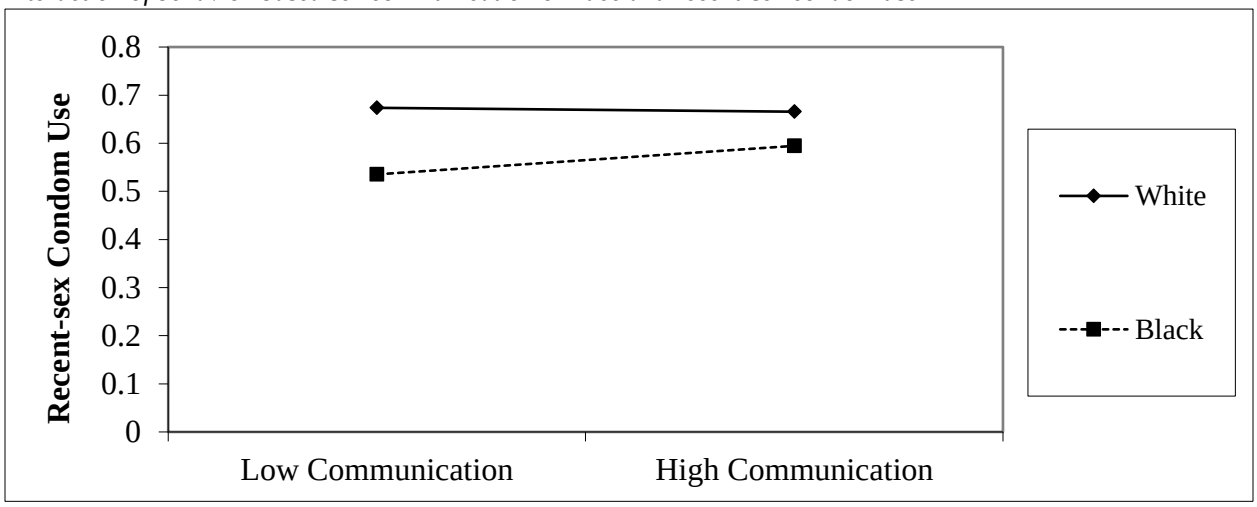
CI = confidence interval; AOR = adjusted odds ratio.
AOR significant at *$p<.01$, **$p < .05$
AOR represents increase in odds of condom use at most recent sex
Adjusted for marital status and age when recent sex condom use reported between *Waves II*- and *III In-Home*

Logistic Regressions with Moderation of Parent-Adolescent Sex Communication.

Three centered moderating variables measuring *behavior-*, *moral-*, and *social-based* parent-adolescent sex communication was added to three separate logistic regression models to understand the interaction of parent-adolescent sex communication on school-based HIV sex education and reports of recent-sex condom use. Additionally, covariates, participant biological sex, race/ethnicity, urbanicity, parent educational attainment, and parent-adolescent relationship were included in this model. Marital status and age at the time of reported recent-sex condom use were used as control variables (See Table 15).

The parent-adolescent *behavior-based* sex communication model was statistically significant ($F(23,106)=4.48$, $p<.01$), indicating these results did not arise by chance. There was no significant interaction observed with the main predictor variable, school-based HIV sex education. However, a significant interaction was observed among non-Hispanic Black participants (AOR: 1.96, 95%CI: 1.2,3.2, $p<.01$). Illustrated in Figure 12, a quicker acceleration of using a condom at most recent sex from low amount of parent-adolescent *behavior-based* sex communication to high amount of parent-adolescent *behavior-based* sex communication was observed among non-Hispanic Black participants compared to their non-Hispanic White counterparts. Among non-Hispanic White participants, a decrease in reported recent condom use was observed as the amount of *behavior-based* sex communication increased. In other words, parent-adolescent *behavior-based* sex communication played a stronger role in influencing use of condom at most recent sex among non-Hispanic Black compared to non-Hispanic White participants (See Figure 12).

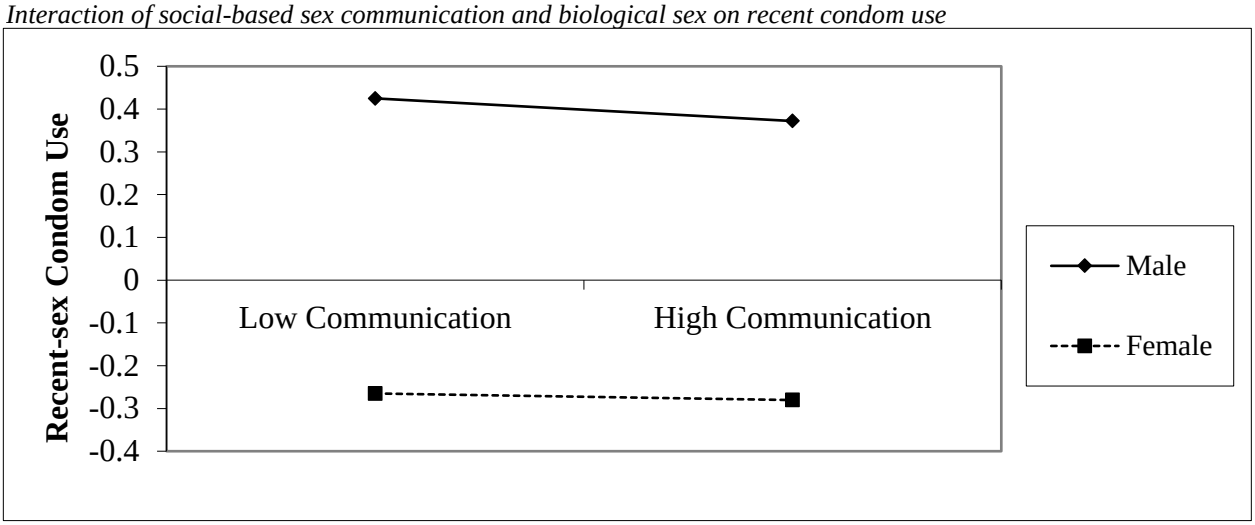
Figure 12.
Interaction of behavior-based sex communication on race and recent-sex condom use



Note. High communication = high amount of parent-adolescent *behavior-based* sex communication
Recent-sex condom use = reported use of condom at recent sex between *Waves II*- and *III In-Home*
White = non-Hispanic White participants
Black = non-Hispanic Black participants

The model for parent-adolescent <u>*social-based*</u> sex communication was statistically significant ($F(23,106)=3.31$, $p<.01$). A significant interaction was not observed among the main predictor variable, school-based HIV sex education and the outcome variable, recent-sex condom use. However, analysis of interaction effects suggests biological sex significantly interacted with parent-adolescent *social-based* sex communication (AOR: 1.46, 95%CI: 1.1,2.0, $p<.05$). Illustrated in Figure 13, a quicker deceleration of using a condom at most recent sex from low amount of parent-adolescent *social-based* sex communication to high amount of parent-adolescent *social-based* sex communication was observed among male participants compared to their female counterparts. In other words, parent-adolescent *social-based* sex communication played a stronger role in influencing use of condom at most recent sex among males compared to females (See Figure 13).

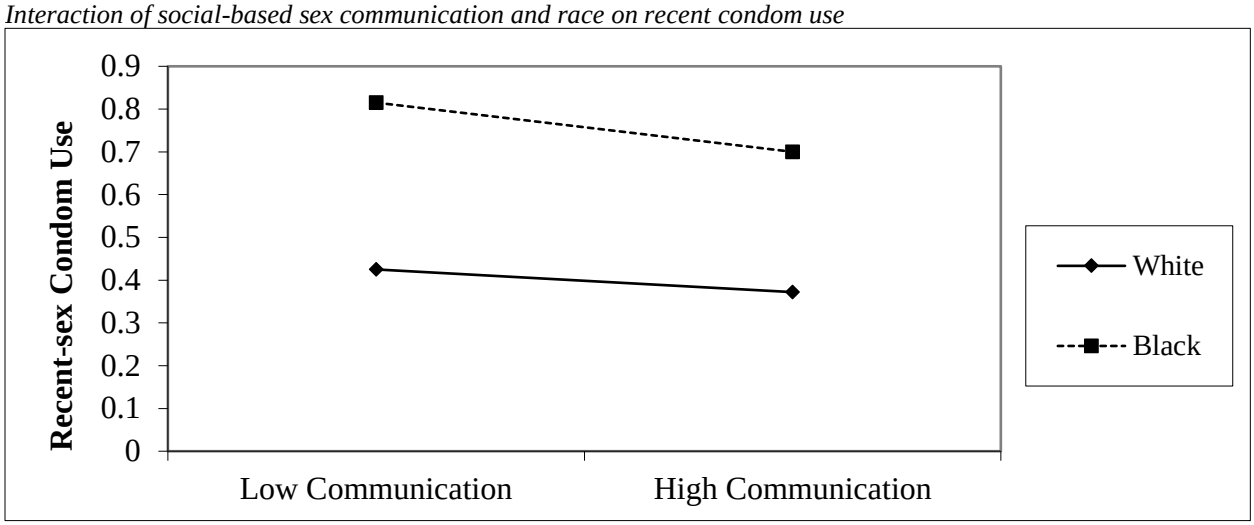
Figure 13.
Interaction of social-based sex communication and biological sex on recent condom use



Note: Low communication = low amount of parent-adolescent *social-based* sex communication
High communication = high amount of parent-adolescent *social-based* sex communication
Recent-sex condom use = reported use of condom at most recent-sex between *Waves II*- and *III In-Home*

Analyses of interaction effects suggest participant race significant interacted with parent-adolescent *social-based* sex communication on use of condom at most recent sex AOR: 0.5, 95%CI: .34,.86, $p<.01$). Depicted in Figure 14, a quicker deceleration of condom use at most recent sex from low amount of *social-based* sex communication to high amount of parent-adolescent *social-based* sex communication was observed among non-Hispanic Black participants compared to their non-Hispanic White counterparts. In other words, parent-adolescent *social-based* sex communication played a stronger role in influencing condom use at most recent sex among non-Hispanic Blacks compared to non-Hispanic Whites (See Figure 14).

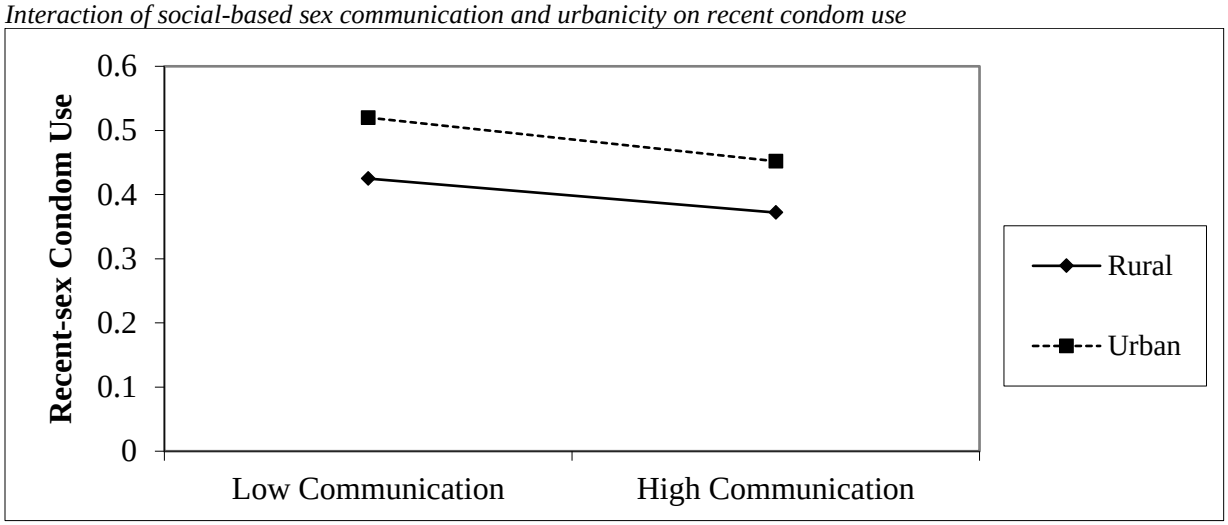
Figure 14.
Interaction of social-based sex communication and race on recent condom use



Note: Low communication = low amount of parent-adolescent *social-based* sex communication
High communication = high amount of parent-adolescent *social-based* sex communication
Recent sex condom use = reported use of condom at recent sex between *Waves II*- and *III In-Home*
White = non-Hispanic White participants
Black = non-Hispanic Black participants

Analyses of interaction effects suggest participant urbanicity interacted with parent-adolescent *social-based* sex communication on condom use at most recent sex (AOR: 1.5, 95%CI: 1.1,2.3, $p<.05$). Illustrated in Figure 15, a quicker deceleration of condom use at most recent sex from low amount of parent-adolescent *social-based* sex communication to high amount of parent-adolescent *social-based* sex communication was observed among urban participants compared to their rural counterparts. In other words, parent-adolescent *social-based* sex communication played a stronger role in influencing use of condom at most recent sex among participants residing in an urban area compared to those residing in a rural area (See Figure 15).

Figure 15.
Interaction of social-based sex communication and urbanicity on recent condom use



Note: Low communication = low amount of parent-adolescent *social-based* sex communication
High communication = high amount of parent-adolescent *social-based* sex communication
Rural = participants residing in a rural area at *Wave I In-Home*
Urban = participants residing in an urban area at *Wave II In-Home*
Recent-sex condom use = reported use of condom at most recent sex between *Waves II*- and *III In-Home*

The model for parent-adolescent ***moral-based*** sex communication was statistically significant ($F(23,106)=3.58$, $p<.01$). No significant interactions were observed, indicating amount of parent-adolescent *moral-based* sex communication may not influence the relationship between school-based HIV sex education and recent-sex condom use, or the relationships with of recent-sex condom use and the study's covariates (See Table 15).

Discussion.

Few studies have examined the interaction of school-based sex education and parent-adolescent sex communication on condom use behaviors. This study expanded on the literature on school-based sex education and condom use behaviors by exploring the longitudinal link between school-based HIV sex education during adolescence and condom use at recent sex into young adulthood. Additionally, this study evaluated how parent-adolescent sex communication interacts with school-based HIV sex education and condom use at recent sex. This section

discusses study results related to existing literature and includes recommendations for future research in this area.

Evidence of record-breaking STI cases among all sexually active populations is a critical concern for public health practitioners. [213] Besides abstinence, the only over-the-counter protection against most STIs, HIV, and pregnancy is the condom. [199] However, recent surveys highlight a gradual decrease in reported condom use among all sexually active populations. [9, 95] Prevention efforts in the form of school-based sex education can include topics on condom efficacy, use, and skills to reduce risky sexual behaviors. In this analysis, the relationship between school-based HIV sex education and recent sex condom use showed no significant association. The relationship remained insignificant when parent-adolescent sex communication entered the model as an interaction term. The lack of significant interaction with these variables may be explained by examining previous studies on sexual behavior and school-based sex education or parent-adolescent sex communication. The current understanding of parent-adolescent sex communication and school-based sex education on condom use behaviors is generally limited to adolescent-aged populations. [12, 45, 95, 227] The present analysis focused on condom use behaviors of adolescent and young adult populations. Thus, the lack of relationship observed in this study puts into question the long-term protective effects of these interventions following adolescence.

Despite the STI and HIV disparities experienced by non-Hispanic Black populations [6], existing research indicates no significant difference in condom use behaviors compared to their non-Hispanic White counterparts [206, 215]. No significant relationship between non-Hispanic Black participants and reported condom use at recent sex was observed in this present study. However, a significant interaction occurred when parent-adolescent *behavior-based* sex

communication was added to the model. In addition to *behavior-based*, the interaction of parent-adolescent *social-based* sex communication and non-Hispanic Black participants on condom use at recent sex was significant.

After plotting the interaction of parent-adolescent *behavior-bas*ed sex communication and participant race on condom use at recent sex, the analysis revealed parent-adolescent *behavior-based* sex communication had a more substantial positive influence on using a condom at recent sex among non-Hispanic Black participants compared to their non-Hispanic White counterparts. Thus, higher amounts of *behavior-based* sex communication among parents and their non-Hispanic Black adolescents may promote the use of condoms. In contrast, the interaction model using parent-adolescent *social-based* sex communication and participant race on reported condom use at recent sex observed a more substantial negative influence of condom use at recent sex among non-White participants compared to non-Hispanic Blacks.

Research shows that the effects of parent-adolescent sex communication on adolescent condom use behaviors can be based on varying characteristics, including adolescent race/ethnicity. [226, 227] Within the dynamics of parent-adolescent relationships, studies show greater feelings of closeness between non-Hispanic Black adolescents and their parents compared to non-Hispanic White adolescents. [189, 226] Perceived closeness is shown to moderate the relationship between sex communication and sexual risk behaviors. [228, 235] Additionally, non-Hispanic Black mothers are more likely to use negative personal experiences with sex as a teaching opportunity, and is associated with increased use of condoms. [226] Further, non-Hispanic Black adolescents are more likely to engage in paternal sex communication compared to their non-Hispanic White counterparts. [226] The results of this

current study add to the existing literature among non-Hispanic Black youth and the positive influence parent-adolescent sex communication has on condom use behaviors. Among non-Hispanic Whites, the observed negative association with condom use could be due to varying dynamics within the parent-adolescent relationship, like perceived closeness. Given the results of these interaction models, future research should explore the moderating relationship of parent-adolescent closeness between types of parent-adolescent sex communication and condom use behaviors among racial/ethnic subgroups.

Researchers have also reported higher sexual risk behaviors displayed among adolescents in urban areas compared to rural ones. [147, 219] Parent-adolescent *social-based* sex communication significantly interacted with participant urbanicity, and condom use at recent sex. This model indicated a quicker decline in condom use among urban participants as *social-based* sex communication moved from low to high amounts compared to their rural counterparts. Based on existing literature, parent-adolescent sex communication strength of protective influence is similar among rural and urban populations. [219, 228] Studies show greater amounts of parent-adolescent sex communication contribute to increased condom use behaviors. [189, 227] Urbanicity may play a role in the relationship between parent-adolescent sex communication and condom use behavior, but it may be due to sharing multiple risk factors. For example, non-Hispanic Black urban adolescents display a higher sexual risk than other racial/ethnic groups in the same area and non-Hispanic Blacks in rural areas. [228] The current study did not investigate how shared risk factors, like being non-Hispanic Black and living in an urban area, interact with parent-adolescent sex communication on condom use behavior. However, this study does show significant effects of parent-adolescent sex communication based on race and urbanicity.

The limitations of this study include the lack of information about specific characteristics of the school-based sex education reported at *Wave I In-Home*. [191] The ability to determine if the school-based HIV sex education was abstinence-based or comprehensive could have strengthened the study's generalization ability. This study treated all reports of school-based HIV sex education as similar in nature, despite the lack of specificity within the *Wave I In-Home* school-based sex education question. Additionally, participant school-based HIV sex education history was collected in the first wave of the Add Health Study. [191] The possibility exists that participants reported no experience with school-based HIV sex education by the *Wave I In-Home* survey and could have experienced school-based HIV sex education by the *Wave II In-Home* survey.

The Add Health Study primarily recruiting mothers for the *Parent Interview*, so most of the reports of parent-adolescent sex communication were among participating mothers. [191] Existing evidence suggests mothers are the primary sex educators and engage in more frequent parent-adolescent sex communication than fathers [226], which was the justification for the Add Health *Parent Interview* sample. [191] However, as family structure and family environments grow increasingly diverse, this limits the generalizability of the findings today. [232]

Add Health survey questions were retrospective [191], which introduces the limitation of recall bias to this study. Additionally, questions over sex-related topics, like condom use behaviors and parent-adolescent sex communication, can elicit socially desirable responses due to the sensitive nature of these topics. To negate socially desirable responses, Add Health Study interviewers assured participants confidentiality and anonymity throughout the study. [191]

This current study used logistic regressions to evaluate the interaction of parent-adolescent *behavior-*, *moral-,* and *social-based* sex communication on the relationship between

school-based pregnancy sex education and intentions of first pregnancy. Additional covariates in the model represented participant biological sex, race/ethnicity, urbanicity, parent educational attainment, and parent-adolescent relationship.

The results of this analysis adds to existing evidence of condom use behavior differences based on biological sex and the significant influence of parent-adolescent sex communication on condom use behavior based on biological sex, race, and urbanicity. These results emphasize the need for further exploration of the complex nature of parent-adolescent relationships and the influence on condom use behavior. Lastly, school-based HIV sex education does not appear to influence condom use behavior beyond adolescence, highlighting a need for continued public health prevention efforts tailored to at-risk populations as they age out of adolescence and into young adulthood.

Conclusion.

Condomless sex contributes to the continued increase of STIs among all sexually active populations, as well as transmission of HIV and risk of pregnancy. Adverse sexual health disparities are common among women, non-Hispanic Blacks, and younger people, and as widespread reports of condom use decline, the sexual health disparities widen. This project focuses on the interaction of two common sexual risk prevention approaches employed during adolescence and their influence on condom use at recent sex. Overall, school-based HIV sex education may not influence condom use, but parent-adolescent sex communication protects adolescent and young adult populations against risky sexual behaviors. Public health efforts should continue to promote the inclusion of parents in sexual risk prevention efforts.

Chapter VII. Global Implications.

This dissertation analysis concludes that there is no longitudinal relationship between receiving school-based sex education during adolescence and sexual health risk into young adulthood. However, parent-adolescent sex communication significantly interacts with individual and community factors, influencing young adult sexual health risks. This study identified how adolescent-targeted formal and informal sex education approaches influence the risk of unintended pregnancy, acquiring syphilis, chlamydia, or gonorrhea, and condomless sex into young adulthood. By identifying priority areas and populations of formal and informal sex education, this study contributes to future public health interventions that aim to increase sexual health equity.

Within the dynamics of parent-adolescent relationships, the results of this dissertation indicate the critical role of parent-adolescent sex communication on the long-term risk of STI, excluding HIV, and condom use behaviors. Based on this analysis, parent-adolescent sex communication can have protective effects ranging from about one to twelve years. Due to declines in school-based sex education availability, interventions can focus on at-home prevention of adverse sexual outcomes while perhaps offering community-based approaches for young adult populations that no longer reside with a parent. While the bulk of formal and informal sex education approaches target adolescent populations, all sexually active groups are experiencing epidemic rates of STIs paired with less utilization of condoms. Additionally, unintended pregnancy rates among reproductive-aged people continue to be higher than in other industrialized countries. Conveying the importance of parent-adolescent sex communication while providing education and skill development to adolescents and their parents should be a public health priority, especially among disparity-ridden populations.

Implications.

The implications of this dissertation can provide additional insight into the complex nature of parent-adolescent relationships and the protective short- and long-term effects on sexual risk. The results of this analysis can also inform public health practitioners about intervention development. Furthermore, this study observed no association between school-based sex education and long-term sexual risk. Therefore, the implications of these results can also inform current policy and federal funding as it relates to school-based sex education.

Research.

Much research on school-based sex education and parent-adolescent sex communication primarily evaluates sexual risk in adolescent populations. The present study provides valuable insight into the connection between common approaches to sexual risk prevention employed during adolescence and young adulthood outcomes. However, additional studies are warranted to understand the influence of contextual factors within school-based sex education, including content, tone, and time spent on topics. While the results of this analysis align with studies highlighting parents' influential roles in adolescent and young adult sexual risk [226, 227], additional research is needed to understand the interplay of the adolescent individual-, family- and community-level factors on young adult sexual risk.

Differences in school-based sex education approaches and parent-adolescent sex communication should be expected, as school-based approaches are generally formal, while parental approaches can be informal. Multilevel interventions can be effective if strategies align across levels. However, if a disconnect in messaging exists between schools and parents, preventive strategies could be ineffective in reducing sexual risk. In addition to schools and parents, sex-related discussion can be found in virtually any environment, like within friend

groups, the internet and social media, and other media sources. While some sources can influence sexual risk more than others, research should focus on the interactions between different educational platforms and its influence on sexual risk among all age groups. By understanding influence of sexual risk among all populations, public health practitioners can tailor future interventions for current sexually active populations using a multilevel approach.

This dissertation used reports of school-based sex education collected between 1994 and 1995 and sexual risk outcomes compiled between 1996 and 2018. [191] In December 2019, a disease caused by the SARS-CoV-2 virus (COVID-19) appeared in Wuhan, China, quickly spreading to pandemic levels by March 2020. [236] Social distancing measures to decrease the spread of COVID-19 were put in place by the Trump Administration, resulting in a shelter-in-place order. [236] Before orders to shelter-in-place, the weekly numbers of syphilis, chlamydia, and gonorrhea exceeded observations made in 2019. [216] COVID-19 and the guidelines of social distancing and sheltering-in-place significantly impacted STI trends during 2020, and annual surveillance numbers were likely underreported. [236] Despite the limitations of 2020 surveillance data, national public health organizations confirmed no improvement in STI rates occurred during that time [216], highlighting a critical need for interventions to reduce sexual risk more than ever before. Researchers should consider the impacts of COVID-19 on school-based sex education and parent-adolescent sex communication due to this pandemic. Furthermore, the sexual risk among all sexually active populations during the height of the pandemic should be evaluated, as the interventions to reduce sexual risk employed before COVID-19 were not designed for a society amid a pandemic. Evidence from this research could prepare future intervention strategies in the chance of a similar disease outbreak.

Practice.

The term 'evidence-based' is used to identify research with proven outcomes and to optimize decision-making within the design and implementation of interventions. However, there may be an overreliance on sexual health interventions labeled as evidence-based, especially if the setting attempting to replicate the evidence-based intervention deviates from the original intervention setting. For example, most evidence-based school sex education interventions are evaluated in urban areas, which may not translate over in rural and suburban settings. [12] Special consideration when implementing evidence-based interventions is critical for best practices and can be done through collaborative efforts with the community, schools, and parents. Multilevel approaches to sex education require collaboration from all key players as the field of public health cannot singlehandedly take on the challenge of STIs, HIV, unintended pregnancy, and condomless sex. Therefore, it is crucial for partnerships that aid in advocacy, shared understanding, relationship building, and collective focus on the goal of reducing sexual risk among all members of the community.

Promotion of parental involvement of sexual risk interventions should be a standard practice due to rigorous studies observing the strength these relationships have on sexual risk behaviors. [189, 226, 227] Public health practitioners have an opportunity to continue intervention efforts at-home between parent and child. Additionally, misconceptions about sex can put populations at increased sexual risk. Therefore, parents should be provided the opportunity for sex education and skill development to effectively communicate risk reducing concepts with their adolescent.

Policy.

In response to increased adolescent pregnancy rates in the 1960s [237] and the HIV/AIDS pandemic in the early 1980s, sex education became a critically important issue in public health and policy. [238] Federally mandated school-based sex education emerged in the late 1980s and early 1990s, with significant increases of adolescents receiving school-based sex education observed between 1988 and 1995. [45] Abstinence-only-until-marriage (AOUM) sex education was promoted by the U.S. government to implement into schools in the early 1990s. [239] Funding for AOUM was part of the "welfare reform," and aimed to reduce sexual risk through a focus on abstinence. [239] Since federal funding of AOUM, research has revealed the shortfalls of this educational approach in reducing sexual risk among all populations. [45, 115, 183] Since the emergence of AOUM, comprehensive approaches to sex education have been developed with proven effectiveness. [45, 240] However, the social and political influence of sex education practices in the U.S. is stronger than scientific evidence [12, 180], thus ineffective sex education can still be found in school settings.

Listening to the concerns of medical and public health officials, President Obama advocated for additional federal funding to be prioritized for evidence-based sex education, including teen pregnancy prevention programs. [12] Despite public health efforts to reduce sexual risk among all populations, especially groups burdened by disparities, barriers to implementation of evidence-based school sex education exist. [180] Furthermore, federal recommendations about school-based sex education are often overshadowed by state and local policies, which commonly disregard evidence-based practices and are influenced by the social and political environment. [43] Given the history of school-based sex education in the U.S., reliance on the federal, state, and local systems to provide interventions aimed to reduce sexual

risk may result in continued increases of adverse sexual health outcomes. Instead, focus on parent-adolescent relationships and community-based sex education may be a more effective plan for sexual risk interventions.

Limitations and Strategies Used.

Exploring the moderation effects of parent-adolescent sex communication through use of longitudinal study design expands on our current understanding of long-term sexual risk and behaviors. These studies also used large sample data to explore these associations and is a strength of the discussed moderation analyses. Nevertheless, a number of limitations need to be considered. First, the Add Health In-Home Interview survey question structure varies by wave, particularly with pregnancy intentions. [23] Inconsistent language used to measure pregnancy intentions in *Waves I-II In-Home* surveys compare to *Waves III-V In-Home* surveys, which could have threatened the internal validity of the study. [241] Thus, this study used the first report of pregnancy and the intention of that pregnancy in *Waves III-V In-Home* where the format of survey questions was consistent. [23]

Add Health survey questions also varied for measurements of sexual intercourse type. *Waves I* through *V In-Home* surveys measured ever-vaginal intercourse, while ever-anal intercourse was measured in *Waves II, IV,* and *V* surveys. [23] Due to this limitation, men-who-have-sex-with-men (MSM) could not be a subpopulation analyzed in this study. This is a concern as MSM are disproportionately impacted by STIs. [8]

Another limitation involves interviewer bias, as personal interviews were used to collect data. This can also introduce socially desirable responses. [242] The Add Health team used several strategies to reduce this type of bias, for example, survey responses were never open-ended. Participants were encouraged to respond to each question with the provided responses.

[23] Additionally, the Add Health study response options of "refused", "I don't know", or "legitimate skip" were part of every survey questions. [23] For the purpose of this study participants that answered 'refused', 'I don't know', and 'legitimate skip' were placed with missing variables.

Sensitive questions used in these analyses included experienced pregnancies and intentions, STI diagnoses, condom use behaviors, and communication on sex-related topics. These questions were self-administered, allowing respondents to self-report. [23] The bias of social desirability responses are a common concern in self-report studies [242], however, a team of researchers analyzed associations between self-reported health and four health indications (i.e., BMI, chronic conditions, functional limitations, and depressive symptoms) using Add Health data. [243] The findings were consistently associated with self-reported health from adolescence to young adulthood. Additionally, self-reported health was valid among all racial and ethnic groups included in the study. [243] Participants were also reminded during the consent and administration of the Add Health Survey that all information would be kept confidential, and their name would not be associated with their responses. [23]

An additional limitation of the analyses included the years in which the initial waves of the Add Health study occurred. The first waves of the Add Health Study were collected in the mid-1990s, since then, societal norms may have changed. This means that the results of these analyses may not be directly generalizable to the school-based sex education and parent-adolescent sex communication experiences of present-day adolescents. However, these analyses aimed to understand long-term trends beyond adolescence, indicating relevancy to today's adults that were of adolescent-age in the mid-1990s.

Finally, the proposed statistical procedures in these analyses involved several steps, which can create an opportunity for potential errors. The primary investigator worked closely with an experienced researcher that has conducted similar analyses. Additionally, the primary investigator kept in close contact with research personnel at the University of Oklahoma while preparing, analyzing, and interpreting data and results. Lastly, the primary investigator worked with the Add Health data in preparing for these analyses and became very familiar with the variables, codebooks, and Add Health analysis guidelines.

Conclusion.

The focus of this dissertation was to explore the longitudinal links of school-based sex education and unintended pregnancy, risk of STI, and condom use behaviors, while also evaluating how parent-adolescent sex communication strengthens or weakens this relationship. The results of this analysis suggest school-based sex education may not be related to long-term sexual risk, but parent-adolescent relationships might be that key factor. Research should focus on the interplay of parent-adolescent sex communication and other levels of sexual risk influences. In practice, parents should be provided an opportunity to develop sex communication skills to engage in meaningful and effective sex communication with their adolescent. While federal, state, and local policies on school-based sex education remain inconsistent, public health practitioners have an opportunity to collaborate with community members, parents, and adolescents to provide an environment that promotes safer sex behaviors.

References

1. Silverberg, B., et al., *2021 CDC Update: Treatment and Complications of Sexually Transmitted Infections (STIs).* Venereology, 2022. **1**(1): p. 23-46.
2. Hojilla, J., et al., *Sexually Transmitted Infection Screening in Key Populations of Persons Living with HIV.* AIDS and Behavior, 2022: p. 1-10.
3. Dailey, A., et al., *Diagnoses of HIV infection in the United States and dependent areas, 2020.* 2022.
4. McCracken, K.A. and M. Loveless, *Teen pregnancy: an update.* Current Opinion in Obstetrics and Gynecology, 2014. **26**(5): p. 355-359.
5. Iseyemi, A., et al., *Socioeconomic status as a risk factor for unintended pregnancy in the contraceptive CHOICE project.* Obstetrics and gynecology, 2017. **130**(3): p. 609.
6. Caplin, M. and L.R. Crane, *Sexually Transmitted Infections (STIs) and Diseases (STDs): A Growing Epidemic.* 2022.
7. Ritchwood, T.D., et al., *Condom use self-efficacy among younger rural adolescents: The influence of parent-teen communication, and knowledge of and attitudes toward condoms.* The Journal of early adolescence, 2017. **37**(2): p. 267-283.
8. Copen, C.E., *Condom Use During Sexual Intercourse Among Women and Men Aged 15-44 in the United States: 2011-2015 National Survey of Family Growth.* National health statistics reports, 2017(105): p. 1-18.
9. Control, C.f.D. and Prevention, *Youth risk behavior survey data summary & trends report 2007–2017.* 2020.

10. Brownson, R.C., J.E. Fielding, and L.W. Green, *Building capacity for evidence-based public health: reconciling the pulls of practice and the push of research.* Annual review of public health, 2018. **39**: p. 27.

11. Hall, W.J., et al., *State policy on school-based sex education: A content analysis focused on sexual behaviors, relationships, and identities.* American journal of health behavior, 2019. **43**(3): p. 506-519.

12. Lindberg, L.D., I. Maddow-Zimet, and H. Boonstra, *Changes in adolescents' receipt of sex education, 2006–2013.* Journal of Adolescent Health, 2016. **58**(6): p. 621-627.

13. Woo, G., et al., *Factors affecting sex education in the school system.* Journal of pediatric and adolescent gynecology, 2011. **24**(3): p. 142-146.

14. Bronfenbrenner, U., et al., *Handbook of child psychology.* Theoretical models of human development, 1998. **1**: p. 993-1028.

15. Suleiman, A.B. and C.D. Brindis, *Adolescent school-based sex education: Using developmental neuroscience to guide new directions for policy and practice.* Sexuality Research and Social Policy, 2014. **11**(2): p. 137-152.

16. Balaji, A.B., et al., *Association between parent–adolescent communication about sex-related topics and HIV testing, United States. 2006–2013.* AIDS care, 2017. **29**(3): p. 344-349.

17. Pariera, K.L., *Barriers and prompts to parent-child sexual communication.* Journal of Family Communication, 2016. **16**(3): p. 277-283.

18. Akers, A.Y., C.L. Holland, and J. Bost, *Interventions to improve parental communication about sex: a systematic review.* Pediatrics, 2011. **127**(3): p. 494-510.

19. Baptiste-Roberts, K., et al., *Addressing health care disparities among sexual minorities.* Obstetrics and Gynecology Clinics, 2017. **44**(1): p. 71-80.

20. Craig, A.D., et al., *Exploring young adults' contraceptive knowledge and attitudes: disparities by race/ethnicity and age.* Women's Health Issues, 2014. **24**(3): p. e281-e289.

21. James, C.V., et al., *Racial/ethnic health disparities among rural adults—United States, 2012–2015.* MMWR Surveillance Summaries, 2017. **66**(23): p. 1.

22. Control, C.f.D. and Prevention, *Youth risk behavior survey (YRBS).* 2019.

23. Harris, K.M., *The national longitudinal study of adolescent health: Research design.* http://www. cpc. unc. edu/projects/addhealth/design, 2011.

24. Paskett, E., et al., *Multilevel interventions to address health disparities show promise in improving population health.* Health Affairs, 2016. **35**(8): p. 1429-1434.

25. Denford, S., et al., *A comprehensive review of reviews of school-based interventions to improve sexual-health.* Health psychology review, 2017. **11**(1): p. 33-52.

26. Tanne, J.H., *Covid-19: Sexually transmitted diseases surged in US during pandemic*. 2022, British Medical Journal Publishing Group.

27. Transmitted, C.S., *Disease Surveillance 2018.* Department of Health and Human Services: Atlanta, GA, USA, 2019.

28. Unemo, M., et al., *World Health Organization Global Gonococcal Antimicrobial Surveillance Program (WHO GASP): review of new data and evidence to inform international collaborative actions and research efforts.* Sexual health, 2019. **16**(5): p. 412-425.

29. Organization, W.H., *Sexually transmitted infections (STIs): the importance of a renewed commitment to STI prevention and control in achieving global sexual and reproductive health*. 2013, World Health Organization.

30. Osterman, M.J., et al., *Births: final data for 2020.* 2022.

31. Hall, J.A., et al., *Pregnancy intention and pregnancy outcome: systematic review and meta-analysis.* Maternal and child health journal, 2017. **21**(3): p. 670-704.

32. Finer, L.B. and M.R. Zolna, *Unintended pregnancy in the United States: incidence and disparities, 2006.* Contraception, 2011. **84**(5): p. 478-485.

33. Finer, L.B. and M.R. Zolna, *Declines in unintended pregnancy in the United States, 2008–2011*. New England journal of medicine, 2016. **374**(9): p. 843-852.

34. Kost, K., I. Maddow-Zimet, and A. Arpaia, *Pregnancies, births and abortions among adolescents and young women in the United States, 2013: National and state trends by age, race and ethnicity*. 2017.

35. McCrory, C. and S. McNally, *The effect of pregnancy intention on maternal prenatal behaviours and parent and child health: results of an irish cohort study.* Paediatric and perinatal epidemiology, 2013. **27**(2): p. 208-215.

36. Nelson, J.A. and M. O'Brien, *Does an unplanned pregnancy have long-term implications for mother–child relationships?* Journal of Family Issues, 2012. **33**(4): p. 506-526.

37. Trussell, J., et al., *Burden of unintended pregnancy in the United States: potential savings with increased use of long-acting reversible contraception.* Contraception, 2013. **87**(2): p. 154-161.

38. Kavanaugh, M.L. and J. Jerman, *Contraceptive method use in the United States: trends and characteristics between 2008, 2012 and 2014.* Contraception, 2018. **97**(1): p. 14-21.

39. Control, C.f.D. and Prevention, *New CDC report: STDs continue to rise in the US*. 2019.

40. Hamilton, B., L. Rossen, and A. Branum, *Teen birth rates for urban and rural areas in the United States, 2007–2015. NCHS Data Brief, no 264. Hyattsville, MD: National Center for Health Statistics. 2016*.

41. Copen, C.E., et al., *National health statistics reports.* immunodeficiency, 2012. **1**: p. 4.

42. Hasbrouck, L., *Healthy People 2030: An Improved Framework.* Health Educ Behav, 2021. **48**(2): p. 113-114.

43. Institute, G., *Sex and HIV education: State laws and policies.* 2021.

44. Santelli, J., et al., *Abstinence-only-until-marriage policies and programs: An updated position paper of the Society for Adolescent Health and Medicine.* The Journal of adolescent health: official publication of the Society for Adolescent Medicine, 2017. **61**(3): p. 400.

45. Goldfarb, E.S. and L.D. Lieberman, *Three Decades of Research: The Case for Comprehensive Sex Education.* J Adolesc Health, 2021. **68**(1): p. 13-27.

46. Bryant, Z. and T. Hasbini, *Targeting Unintended Teen Pregnancy in the US.* International Journal of Childbirth Education, 2016. **31**(1): p. 28.

47. Abuse, S., *Mental Health Services Administration (SAMHSA): Risk and Protective Factors*.

48. Ratcliffe, M., et al., *Defining rural at the US Census Bureau.* American community survey and geography brief, 2016. **1**(8): p. 1-8.

49. Alderman, E.M. and C.C. Breuner, *Unique needs of the adolescent.* Pediatrics, 2019. **144**(6).

50. Hochberg, Z.e. and M. Konner, *Emerging Adulthood, a Pre-adult Life-History Stage.* Frontiers in Endocrinology, 2020. **10**(918).

51. Hughes, K., et al., *The effect of multiple adverse childhood experiences on health: a systematic review and meta-analysis.* The Lancet Public Health, 2017. **2**(8): p. e356-e366.

52. CDC, N.A., *The National Institute for Occupational Safety and Health (NIOSH).*

53. Collumbien, M., et al., *Social science methods for research on sexual and reproductive health.* 2012.

54. Arnett, J.J. and D. Mitra, *Are the features of emerging adulthood developmentally distinctive? A comparison of ages 18–60 in the United States.* Emerging Adulthood, 2020. **8**(5): p. 412-419.

55. Syed, M. and L.L. Mitchell, *Race, ethnicity, and emerging adulthood: Retrospect and prospects.* Emerging adulthood, 2013. **1**(2): p. 83-95.

56. Oesterle, S., *D, Background Paper: Pathways to Young Adulthood and Preventive Interventions Targeting Young Adults. Available from: Board on Children, Youth, and Families; Institute of Medicine; National Research Council. Improving the Health, Safety, and Well-Being of Young Adults: Workshop Summary*. 2013, Washington (DC): National Academies Press (US).

57. Blinn-Pike, L., *Sex education in rural schools in the United States: Impact of rural educators' community identities.* Sex Education, 2008. **8**(1): p. 77-92.

58. Frost, J.J., L.D. Lindberg, and L.B. Finer, *Young adults' contraceptive knowledge, norms and attitudes: associations with risk of unintended pregnancy.* Perspectives on Sexual and Reproductive Health, 2012. **44**(2): p. 107-116.

59. Stangor, C. and J. Walinga, *7.4 Early and Middle Adulthood: Building Effective Lives.* Introduction to Psychology, 2014.

60. Wood, D., et al., *Emerging Adulthood as a Critical Stage in the Life Course*. 2018: Springer, Cham (CH).

61. Hoyt, L.T., et al., *Positive Youth, Healthy Adults: Does Positive Well-being in Adolescence Predict Better Perceived Health and Fewer Risky Health Behaviors in Young Adulthood?* Journal of Adolescent Health, 2012. **50**(1): p. 66-73.

62. Atkins, D.N. and W.D. Bradford, *The effect of state-level sex education policies on youth sexual behaviors.* Archives of Sexual Behavior, 2021: p. 1-13.

63. Stanger-Hall, K.F. and D.W. Hall, *Abstinence-only education and teen pregnancy rates: Why we need comprehensive sex education in the US.* PloS one, 2011. **6**(10): p. e24658.

64. Hamilton, B.E., J.A. Martin, and M.J. Osterman, *Births: Provisional data for 2020.* 2021.

65. Troutman, M., S. Rafique, and T.C. Plowden, *Are higher unintended pregnancy rates among minorities a result of disparate access to contraception?* Contraception and reproductive medicine, 2020. **5**(1): p. 1-6.

66. Hasbrouck, L., *Healthy People 2030: an improved framework.* Health Education & Behavior, 2021. **48**(2): p. 113-114.

67. Prevention, O.o.D. and H. Promotion, *US Department of Health and Human Services: Healthy People 2010.* http://www/health/gov/healthypeople/, 2000.

68. Health, D.o. and H.S. USA, *Promoting health, preventing disease: Objectives for the nation*. 1980: Department of Health and Human Services.

69. Hamilton, B.E., L.M. Rossen, and A.M. Branum, *Teen birth rates for urban and rural areas in the United States, 2007-2015*. 2016: US Department of Health and Human Services, Centers for Disease Control and ….

70. Kim, T.Y., R.K. Dagher, and J. Chen, *Racial/ethnic differences in unintended pregnancy: evidence from a national sample of US women.* American journal of preventive medicine, 2016. **50**(4): p. 427-435.

71. Kost, K., I. Maddow-Zimet, and A. Arpaia, *Pregnancies, births and abortions among adolescents and young women in the United States, 2013: National and state trends by age, race and ethnicity*. 2017.

72. Lindberg, L.D. and K. Kost, *Exploring US men's birth intentions.* Maternal and child health journal, 2014. **18**(3): p. 625-633.

73. Wight, D. and D. Fullerton, *A review of interventions with parents to promote the sexual health of their children.* Journal of Adolescent Health, 2013. **52**(1): p. 4-27.

74. Paquette, D., D.D. Coyl-Shepherd, and L.A. Newland, *Fathers and development: New areas for exploration*. 2013, Taylor & Francis.

75. Mosher, W.D., J. Jones, and J.C. Abma, *Intended and unintended births in the United States: 1982–2010. National health statistics reports; no 55.* Hyattsville, MD: National Center for Health Statistics, 2012.

76. de La Rochebrochard, E. and H. Joshi, *Children born after unplanned pregnancies and cognitive development at 3 years: social differentials in the United Kingdom Millennium Cohort.* American journal of epidemiology, 2013. **178**(6): p. 910-920.

77. Control, C.f.D. and Prevention, *National center for HIV/AIDS, viral hepatitis, STD, and TB prevention.* Division of Tuberculosis Elimination. Interferon Gamma Relsease Assays (IGRAs)–Blood Tests for TB Infection, 2017.

78. Workowski, K.A., *Centers for Disease Control and Prevention sexually transmitted diseases treatment guidelines.* Clinical Infectious Diseases, 2015. **61**(suppl_8): p. S759-S762.

79. Du, M., et al., *Increasing incidence rates of sexually transmitted infections from 2010 to 2019: an analysis of temporal trends by geographical regions and age groups from the 2019 Global Burden of Disease Study.* BMC infectious diseases, 2022. **22**(1): p. 1-16.

80. Weinstock, H.S., et al., *STI Prevalence, Incidence, and Costs in the United States: New Estimates, New Approach.* Sexually Transmitted Diseases, 2021. **48**(4): p. 207.

81. Satterwhite, C.L., et al., *Sexually transmitted infections among US women and men: prevalence and incidence estimates, 2008.* Sexually transmitted diseases, 2013. **40**(3): p. 187-193.

82. Shaskolskiy, B., et al., *Antibiotic Resistance in Neisseria gonorrhoeae: Challenges in Research and Treatment*. 2022, MDPI. p. 1699.

83. Control, C.f.D. and Prevention, *Sexually transmitted disease surveillance 2018. 2019.* US Department of Health and Human Services: Atlanta, 2020.

84. Benjamins, M.R., et al., *HIV mortality across the 30 largest US cities: assessing overall trends and racial inequities.* AIDS care, 2021: p. 1-10.

85. Linley, L., et al., *Estimated HIV incidence and prevalence in the United States 2010–2016.* 2019.

86. Lyons, S.J., et al., *Monitoring selected national HIV prevention and care objectives by using HIV surveillance data: United States and 6 dependent areas, 2018.* 2021.

87. Legarth, R.A., et al., *Long-term mortality in HIV-infected individuals 50 years or older: a nationwide, population-based cohort study.* JAIDS Journal of Acquired Immune Deficiency Syndromes, 2016. **71**(2): p. 213-218.

88. Beer, L., et al., *Behavioral and Clinical Characteristics of Persons with Diagnosed HIV Infection Medical Monitoring Project, United States 2015 Cycle (June 2015–May 2016) pdf icon.* 2019.

89. Skarbinski, J., et al., *Human immunodeficiency virus transmission at each step of the care continuum in the United States.* JAMA internal medicine, 2015. **175**(4): p. 588-596.

90. Control, C.f.D. and Prevention, *Diagnoses of HIV infection in the United States and dependent areas, 2018.* HIV surveillance report, 2019. **31**.

91. Mitsch, A., et al., *Age-associated trends in diagnosis and prevalence of infection with HIV among men who have sex with men—United States, 2008–2016.* Morbidity and Mortality Weekly Report, 2018. **67**(37): p. 1025.

92. Crosby, R. and S. Bounse, *Condom effectiveness: where are we now?* Sexual health, 2012. **9**(1): p. 10-17.

93. Sales, J.M., et al., *The mediating role of partner communication frequency on condom use among African American adolescent females participating in an HIV prevention intervention.* Health Psychology, 2012. **31**(1): p. 63.

94. Van Tieu, H., et al., *Concurrent partnerships and HIV risk among men who have sex with men in New York City.* Sexually transmitted diseases, 2014. **41**(3): p. 200.

95. Lindberg, L.D. and I. Maddow-Zimet, *Consequences of sex education on teen and young adult sexual behaviors and outcomes.* Journal of Adolescent Health, 2012. **51**(4): p. 332-338.

96. Cohen, M.S., et al., *Antiretroviral therapy for the prevention of HIV-1 transmission.* New England Journal of Medicine, 2016. **375**(9): p. 830-839.

97. Peterman, T.A. and M.W. Carter, *Effective interventions to reduce STDs; Introduction to the special issue.* Sexually Transmitted Diseases, 2016. **43**(2 Suppl 1): p. S1.

98. Control, C.f.D. and Prevention, *Youth risk behavior survey: Data summary & trends report 2009-2019*. 2020, Division of Adolescent and School Health, National Center for HIV/AIDS ….

99. Trussell, J., et al., *Efficacy, safety, and personal considerations.* Contracept Technol. 21st ed. New York City: Ayer Company Publishers, Inc, 2018.

100. Szucs, L.E., et al., *Condom and contraceptive use among sexually active high school students—Youth Risk Behavior Survey, United States, 2019.* MMWR supplements, 2020. **69**(1): p. 11.

101. Abara, W.E., et al., *Prevalence and correlates of condom use among sexually active men who have sex with men in the United States: findings from the National Survey of Family Growth, 2002, 2006–10 and 2011–13.* Sexual health, 2017. **14**(4): p. 363-371.

102. Reece, M., et al., *Condom use rates in a national probability sample of males and females ages 14 to 94 in the United States.* The journal of sexual medicine, 2010. **7**: p. 266-276.

103. Anderson, J.E., L. Warner, and M. Macaluso, *Condom use among US adults at last sexual intercourse, 1996–2008: an update from national survey data.* Sexually transmitted diseases, 2011. **38**(10): p. 919-921.

104. Botvin, G.J. and K.W. Griffin, *Toward the development of preventive interventions to reduce HRSB, HIV/AIDS, and multiple problem behaviors.* Prevention Science, 2014. **15**(1): p. 81-83.

105. Gruenberg, B.C., *High schools and sex education*. 1940: US Government Printing Office.

106. Lindberg, L.D., S. Boggess, and S. Williams, *Multiple Threats: The Co-Occurrence of Teen Health Risk Behaviors.* 2000.

107. Hasstedt, K., A. Sonfield, and R.B. Gold, *Public funding for family planning and abortion services, FY 1980–2015.* Guttmacher Institute. Available: www. guttmacher. org/report/public-funding-family-planning-abortion-services-fy-1980-2015. Accessed November, 2017. **3**: p. 2020.

108. Kirby, D.B., *The impact of abstinence and comprehensive sex and STD/HIV education programs on adolescent sexual behavior.* Sexuality Research & Social Policy, 2008. **5**(3): p. 18-27.

109. Breuner, C.C., et al., *Sexuality education for children and adolescents.* Pediatrics, 2016. **138**(2).

110. Farkas, A.H., et al., *Racial and ethnic differences in young men's sex and contraceptive education.* Journal of Adolescent Health, 2015. **56**(4): p. 464-467.

111. Denny, G. and M. Young, *An evaluation of an abstinence-only sex education curriculum: An 18-month follow-up.* Journal of School health, 2006. **76**(8): p. 414-422.

112. Kendall, N., *Sexuality education in an abstinence-only era: A comparative case study of two US states.* Sexuality Research & Social Policy, 2008. **5**(2): p. 23-44.

113. Underhill, K., D. Operario, and P. Montgomery, *Systematic review of abstinence-plus HIV prevention programs in high-income countries.* PLoS medicine, 2007. **4**(9): p. e275.

114. Bennett, S.E. and N.P. Assefi, *School-based teenage pregnancy prevention programs: A systematic review of randomized controlled trials.* Journal of Adolescent Health, 2005. **36**(1): p. 72-81.

115. Kohler, P.K., L.E. Manhart, and W.E. Lafferty, *Abstinence-only and comprehensive sex education and the initiation of sexual activity and teen pregnancy.* Journal of adolescent Health, 2008. **42**(4): p. 344-351.

116. Mueller, T.E., L.E. Gavin, and A. Kulkarni, *The association between sex education and youth's engagement in sexual intercourse, age at first intercourse, and birth control use at first sex.* Journal of adolescent health, 2008. **42**(1): p. 89-96.

117. Siegel, D.M., M.J. Aten, and M. Enaharo, *Long-term effects of a middle school–and high school–based human immunodeficiency virus sexual risk prevention intervention.* Archives of Pediatrics & Adolescent Medicine, 2001. **155**(10): p. 1117-1126.

118. *Guttmacher policy review.* 2021.

119. Flores, D. and J. Barroso, *21st Century Parent-Child Sex Communication in the United States: A Process Review.* Journal of sex research, 2017. **54**(4-5): p. 532-548.

120. Albert, B., *America's Adults and Teens Sound off about Teen Pregnancy: An Annual Survey.* Washington, DC: National Campaign to Prevent Teen Pregnancy, 2007.

121. Huebner, A.J. and L.W. Howell, *Examining the relationship between adolescent sexual risk-taking and perceptions of monitoring, communication, and parenting styles.* Journal of adolescent health, 2003. **33**(2): p. 71-78.

122. Meschke, L.L., S. Bartholomae, and S.R. Zentall, *Adolescent sexuality and parent-adolescent processes: Promoting healthy teen choices.* Journal of adolescent health, 2002. **31**(6): p. 264-279.

123. DeVore, E.R. and K.R. Ginsburg, *The protective effects of good parenting on adolescents.* Current opinion in pediatrics, 2005. **17**(4): p. 460-465.

124. Widman, L., et al., *Sexual communication between early adolescents and their dating partners, parents, and best friends.* The Journal of Sex Research, 2014. **51**(7): p. 731-741.

125. Foster, C.E., et al., *Connectedness to family, school, peers, and community in socially vulnerable adolescents.* Children and youth services review, 2017. **81**: p. 321-331.

126. Ghobadzadeh, M., R.E. Sieving, and K. Gloppen, *Positive youth development and contraceptive use consistency.* Journal of Pediatric Health Care, 2016. **30**(4): p. 308-316.

127. Malcolm, S., et al., *Predicting condom use attitudes, norms, and control beliefs in Hispanic problem behavior youth: The effects of family functioning and parent–adolescent communication about sex on condom use.* Health Education & Behavior, 2013. **40**(4): p. 384-391.

128. Aronowitz, T. and E. Agbeshie, *Nature of communication: Voices of 11–14 year old African-American girls and their mothers in regard to talking about sex.* Issues in Comprehensive Pediatric Nursing, 2012. **35**(2): p. 75-89.

129. Coffelt, T.A., *Is sexual communication challenging between mothers and daughters?* Journal of Family Communication, 2010. **10**(2): p. 116-130.

130. Cornelius, J.B., M.A.D. CORNELIUS, and A.C. White, *Sexual communication needs of African American families in relation to faith-based HIV prevention.* Journal of cultural diversity, 2013. **20**(3).

131. Collins, C.L., J.L. Angera, and C.R. Latty, *COLLEGE AGED FEMALES'PERCEPTIONS OF THEIR FATHERS AS SEXUALITY EDUCATORS.* Journal of Ethnographic & Qualitative Research, 2008. **2**(2).

132. Morgan, E.M., A. Thorne, and E.L. Zurbriggen, *A longitudinal study of conversations with parents about sex and dating during college.* Developmental Psychology, 2010. **46**(1): p. 139.

133. Solebello, N. and S. Elliott, *"We want them to be as heterosexual as possible" fathers talk about their teen children's sexuality.* Gender & Society, 2011. **25**(3): p. 293-315.

134. Lantos, H., et al., *Parent-teen communication about sexual and reproductive health: cohort differences by race/ethnicity and nativity.* International journal of environmental research and public health, 2019. **16**(5): p. 833.

135. Pearson, J., C. Muller, and M.L. Frisco, *Parental involvement, family structure, and adolescent sexual decision making.* Sociological Perspectives, 2006. **49**(1): p. 67-90.

136. Robert, A.C. and F.L. Sonenstein, *Adolescents' reports of communication with their parents about sexually transmitted diseases and birth control: 1988, 1995, and 2002.* Journal of adolescent Health, 2010. **46**(6): p. 532-537.

137. Commendador, K.A., *Parental influences on adolescent decision making and contraceptive use.* Pediatric nursing, 2010. **36**(3): p. 147.

138. Holman, A. and J.K. Kellas, *High school adolescents' perceptions of the parent–child sex talk: How communication, relational, and family factors relate to sexual health.* Southern Communication Journal, 2015. **80**(5): p. 388-403.

139. Akers, A.Y., et al., *Family discussions about contraception and family planning: a qualitative exploration of black parent and adolescent perspectives.* Perspectives on sexual and reproductive health, 2010. **42**(3): p. 160-167.

140. Dennis, A.C. and J.T. Wood, *"We're not going to have this conversation, but you get it": Black mother–daughter communication about sexual relations.* Women's Studies in Communication, 2012. **35**(2): p. 204-223.

141. Brown, D.L., et al., *Does daddy know best? Exploring the relationship between paternal sexual communication and safe sex practices among African-American women.* Sex Education, 2014. **14**(3): p. 241-256.

142. Kao, T.-S.A. and M. Manczak, *Family influences on adolescents' birth control and condom use, likelihood of sexually transmitted infections.* The Journal of School Nursing, 2013. **29**(1): p. 61-70.

143. Marré, A., *Rural education at a glance*. 2017.

144. Ng, A. and K. Kaye, *Sex in the (non) city: Teen childbearing in rural America.* Washington, DC: The National Campaign to Prevent Teen and Unplanned Pregnancy, 2015.

145. Geske, S., et al., *Comparisons of contraceptive use between rural and urban teens.* Journal of pediatric and adolescent gynecology, 2016. **29**(1): p. 33-41.

146. Bureau, U.C., *Measuring America: Our Changing Landscape*. 2016, US Census Bureau Washington, DC.

147. Sutton, A., D.T. Lichter, and S. Sassler, *Rural–urban disparities in pregnancy intentions, births, and abortions among US adolescent and young women, 1995–2017.* American Journal of Public Health, 2019. **109**(12): p. 1762-1769.

148. Sabia, J.J., *Does sex education affect adolescent sexual behaviors and health?* Journal of Policy Analysis and Management: The Journal of the Association for Public Policy Analysis and Management, 2006. **25**(4): p. 783-802.

149. Coley, R.L., E. Votruba-Drzal, and H.S. Schindler, *Fathers' and mothers' parenting predicting and responding to adolescent sexual risk behaviors.* Child development, 2009. **80**(3): p. 808-827.

150. Annang, L., et al., *Does education matter? Examining racial differences in the association between education and STI diagnosis among black and white young adult females in the US.* Public Health Reports, 2010. **125**(4_suppl): p. 110-121.

151. Shafii, T., K. Stovel, and K. Holmes, *Association between condom use at sexual debut and subsequent sexual trajectories: a longitudinal study using biomarkers.* American journal of public health, 2007. **97**(6): p. 1090-1095.

152. Banspach, S., et al., *CDC grand rounds: adolescence—preparing for lifelong health and wellness.* Morbidity and Mortality Weekly Report, 2016. **65**(30): p. 759-762.

153. Metzler, M., et al., *Adverse childhood experiences and life opportunities: Shifting the narrative.* Children and youth services review, 2017. **72**: p. 141-149.

154. Bernat, D.H., et al., *Risk and direct protective factors for youth violence: results from the National Longitudinal Study of Adolescent Health.* American journal of preventive medicine, 2012. **43**(2): p. S57-S66.

155. Steiner, R.J., et al., *Adolescent connectedness and adult health outcomes.* Pediatrics, 2019. **144**(1).

156. Morales-Alemán, M.M. and I.C. Scarinci, *Correlates and predictors of sexual health among adolescent Latinas in the United States: A systematic review of the literature, 2004–2015.* Preventive medicine, 2016. **87**: p. 183-193.

157. Hayford, S.R. and K.B. Guzzo, *Racial and ethnic variation in unmarried young adults' motivation to avoid pregnancy.* Perspectives on sexual and reproductive health, 2013. **45**(1): p. 41-51.

158. Penman-Aguilar, A., et al., *Socioeconomic disadvantage as a social determinant of teen childbearing in the US.* Public Health Reports, 2013. **128**(2_suppl1): p. 5-22.

159. Bloom, H.S., L. Richburg-Hayes, and A.R. Black, *Using covariates to improve precision for studies that randomize schools to evaluate educational interventions.* Educational Evaluation and Policy Analysis, 2007. **29**(1): p. 30-59.

160. Huber, V.J. and M.W. Firmin, *A history of sex education in the United States since 1900.* International journal of educational reform, 2014. **23**(1): p. 25-51.

161. Jones, R.K., et al., *Teens reflect on their sources of contraceptive information.* Journal of Adolescent Research, 2011. **26**(4): p. 423-446.

162. StataCorp, L., *Stata/MP 16.1 MP for windows.* College Station, TX2021, 2020.

163. Dayton, C.M., *Logistic regression analysis.* Stat, 1992: p. 474-574.

164. Fairchild, A.J. and D.P. MacKinnon, *A general model for testing mediation and moderation effects.* Prevention science, 2009. **10**(2): p. 87-99.

165. Baron, R.M. and D.A. Kenny, *The moderator–mediator variable distinction in social psychological research: Conceptual, strategic, and statistical considerations.* Journal of personality and social psychology, 1986. **51**(6): p. 1173.

166. Sutan, R. and A.N. Mahat, *Parenting Skills Determinant in Preventing Adolescents' Sexual Health Risk Behavior.* Open Journal of Preventive Medicine, 2017. **7**(1): p. 1-13.

167. ELLEN, J.M., S.O. ARAL, and L.S. MADGER, *Do Differences in Sexual Behaviors Account for the Racial/Ethnic Differences in Adolescents' Self-Reported History of a Sexually Transmitted Disease?* Sexually Transmitted Diseases, 1998. **25**(3): p. 125-129.

168. Scully, E.P., *Sex Differences in HIV Infection.* Current HIV/AIDS reports, 2018. **15**(2): p. 136-146.

169. Marcell, A.V., et al., *The Socioecology of Sexual and Reproductive Health Care Use Among Young Urban Minority Males.* The Journal of adolescent health : official publication of the Society for Adolescent Medicine, 2017. **60**(4): p. 402-410.

170. Eaton, D.K., et al., *Youth risk behavior surveillance-United States, 2009.* MMWR Surveill Summ, 2010. **59**(5): p. 1-142.

171. Kann, L., et al., *Youth risk behavior surveillance—United States, 2017.* MMWR Surveillance Summaries, 2018. **67**(8): p. 1.

172. Copen, C.E., M.E. Thoma, and S. Kirmeyer, *Interpregnancy intervals in the United States: data from the birth certificate and the national survey of family growth.* National Vital Statistics Reports: From the Centers for Disease Control and Prevention, National Center for Health Statistics, National Vital Statistics System, 2015. **64**(3): p. 1-10.

173. Sedgh, G., et al., *Adolescent pregnancy, birth, and abortion rates across countries: levels and recent trends.* Journal of adolescent health, 2015. **56**(2): p. 223-230.

174. Lindberg, L.D., J. Santelli, and S. Desai, *Understanding the decline in adolescent fertility in the United States, 2007–2012.* Journal of Adolescent Health, 2016. **59**(5): p. 577-583.

175. Zolna, M. and L.D. Lindberg, *Unintended pregnancy: Incidence and outcomes among young adult unmarried women in the United States, 2001 and 2008*. 2012: Alan Guttmacher Institute New York.

176. Finer, L.B. and M.R. Zolna, *Shifts in intended and unintended pregnancies in the United States, 2001–2008.* American journal of public health, 2014. **104**(S1): p. S43-S48.

177. Moaddab, A., et al., *Health care disparity and pregnancy-related mortality in the United States, 2005–2014.* Obstetrics & Gynecology, 2018. **131**(4): p. 707-712.

178. Kost, K. and L. Lindberg, *Pregnancy intentions, maternal behaviors, and infant health: investigating relationships with new measures and propensity score analysis.* Demography, 2015. **52**(1): p. 83-111.

179. Abma, J.C., et al., *Estimated pregnancy rates and rates of pregnancy outcomes for the United States, 1990-2008.* 2012.

180. Hall, K.S., et al., *The state of sex education in the United States.* Journal of Adolescent Health, 2016. **58**(6): p. 595-597.

181. Gwon, S.H. and S. Jeong, *Concept analysis of impressionability among adolescents and young adults.* Nursing open, 2018. **5**(4): p. 601-610.

182. Health, U.D.o. and H. Services, *Preventing tobacco use among youth and young adults: a report of the Surgeon General*. 2012, Atlanta, GA: US Department of Health and Human Services, Centers for Disease ….

183. Carr, J.B. and A. Packham, *The effects of state-mandated abstinence-based sex education on teen health outcomes.* Health economics, 2017. **26**(4): p. 403-420.

184. Guse, K., et al., *Interventions using new digital media to improve adolescent sexual health: a systematic review.* Journal of adolescent health, 2012. **51**(6): p. 535-543.

185. Cheedalla, A., C. Moreau, and A.E. Burke, *Sex education and contraceptive use of adolescent and young adult females in the United States: an analysis of the National Survey of Family Growth 2011–2017.* Contraception: X, 2020. **2**: p. 100048.

186. Mustanski, B. and J. Hunter, *Parents as agents of HIV prevention for gay, lesbian, and bisexual youth.* Family and HIV/AIDS, 2012: p. 249-260.

187. Krauss, B.J. and K.S. Miller, *Parents as HIV/AIDS educators*, in *Family and HIV/AIDS*. 2012, Springer. p. 97-120.

188. Patel, H., et al., *The association of parental monitoring and parental communication with sexual and substance use risk behaviors among Native American Youth.* Children and Youth Services Review, 2021. **129**: p. 106171.

189. Gavin, L.E., et al., *Programs to strengthen parent–adolescent communication about reproductive health: a systematic review.* American journal of preventive medicine, 2015. **49**(2): p. S65-S72.

190. Alzate, M.M., S. Villegas, and H.M. Salihu, *The power of culture and context on Hispanic/Latina teen pregnancy and birth in Oklahoma: provider and parental perspectives.* Social Work in Health Care, 2018. **57**(10): p. 890-905.

191. Harris, K.M., *The add health study: Design and accomplishments.* Chapel Hill: Carolina Population Center, University of North Carolina at Chapel Hill, 2013. **1**: p. 1-22.

192. Aztlan-James, E.A., M. McLemore, and D. Taylor, *Multiple unintended pregnancies in US women: a systematic review.* Women's Health Issues, 2017. **27**(4): p. 407-413.

193. Miller, E., et al., *Pregnancy coercion, intimate partner violence and unintended pregnancy.* Contraception, 2010. **81**(4): p. 316-322.

194. Kemet, S., L.S. Lundsberg, and A.M. Gariepy, *Race and ethnicity may not be associated with risk of unintended pregnancy.* Contraception, 2018. **97**(4): p. 313-318.

195. Manze, M.G. and D.R. Romero, *Revisiting the association between race, ethnicity, and beliefs about pregnancy.* Ethnicity & Disease, 2020. **30**(4): p. 525.

196. Hernandez, N.D., et al., *Young adult US-born Latina women's thoughts, feelings and beliefs about unintended pregnancy.* Culture, health & sexuality, 2020. **22**(8): p. 920-936.

197. Parker, K. and W. Wang, *Modern parenthood.* Pew Research Center's Social & Demographic Trends Project, 2013. **14**.

198. Maxson, P. and M.L. Miranda, *Pregnancy intention, demographic differences, and psychosocial health.* Journal of Women's Health, 2011. **20**(8): p. 1215-1223.

199. Workowski, K.A. and L.H. Bachmann, *Centers for Disease Control and Prevention's Sexually Transmitted Diseases Infection Guidelines.* Clinical Infectious Diseases, 2022. **74**(Supplement_2): p. S89-S94.

200. Control, C.f.D. and Prevention, *Gonorrhea–CDC fact sheet.* Atlanta: Centers for Disease Control and Prevention, 2014.

201. Krupp, K. and P. Madhivanan, *Antibiotic resistance in prevalent bacterial and protozoan sexually transmitted infections.* Indian journal of sexually transmitted diseases and AIDS, 2015. **36**(1): p. 3.

202. Kreisel, K.M., et al., *Sexually transmitted infections among US women and men: prevalence and incidence estimates, 2018.* Sexually transmitted diseases, 2021. **48**(4): p. 208-214.

203. Leichliter, J.S., L.T. Haderxhanaj, and O.A. Obafemi, *Increasing sexually transmitted infections among adolescents in the USA.* The Lancet Child & Adolescent Health, 2021. **5**(9): p. 609-611.

204. Corcoran, J.L., et al., *Adolescent chlamydia rates by region, race, and sex: trends from 2013 to 2017.* Journal of Pediatric Health Care, 2021. **35**(2): p. 172-179.

205. Harling, G., et al., *Socioeconomic disparities in sexually transmitted infections among young adults in the United States: examining the interaction between income and race/ethnicity.* Sexually transmitted diseases, 2013. **40**(7): p. 575.

206. Pflieger, J.C., et al., *Racial/ethnic differences in patterns of sexual risk behavior and rates of sexually transmitted infections among female young adults.* American journal of public health, 2013. **103**(5): p. 903-909.

207. Geisler, W.M., *Diagnosis and management of uncomplicated Chlamydia trachomatis infections in adolescents and adults: summary of evidence reviewed for the 2015 Centers for Disease Control and Prevention Sexually Transmitted Diseases Treatment Guidelines.* Clinical Infectious Diseases, 2015. **61**(suppl_8): p. S774-S784.

208. Cantor, A., et al., *Screening for Syphilis in Nonpregnant Adolescents and Adults.* 2016.

209. LeFevre, M.L. and U.P.S.T. Force*, *Screening for chlamydia and gonorrhea: US Preventive Services Task Force recommendation statement.* Annals of internal medicine, 2014. **161**(12): p. 902-910.

210. Hensel, D.J. and J.D. Fortenberry, *A multidimensional model of sexual health and sexual and prevention behavior among adolescent women.* Journal of Adolescent Health, 2013. **52**(2): p. 219-227.

211. Poynten, I.M., A.E. Grulich, and D.J. Templeton, *Sexually transmitted infections in older populations.* Current opinion in infectious diseases, 2013. **26**(1): p. 80-85.

212. Hook, E.W., *Gender differences in risk for sexually transmitted diseases.* The American journal of the medical sciences, 2012. **343**(1): p. 10-11.

213. Control, C.f.D. and Prevention, *CDC estimates 1 in 5 people in the US have a sexually transmitted infection.* Retrieved on June, 2021. **17**: p. 2021.

214. Cyr, S.S., et al., *Update to CDC's treatment guidelines for gonococcal infection, 2020.* Morbidity and Mortality Weekly Report, 2020. **69**(50): p. 1911.

215. Leichliter, J.S., et al., *Trends in factors indicating increased risk for STI among key subpopulations in the United States, 2002–2015.* Sexually transmitted infections, 2020. **96**(2): p. 121-123.

216. Pagaoa, M., et al., *Trends in nationally notifiable sexually transmitted disease case reports during the US COVID-19 pandemic, January to December 2020.* Sexually transmitted diseases, 2021. **48**(10): p. 798.

217. Gesink, D.C., et al., *Does core area theory apply to sexually transmitted diseases in rural environments?* Sexually Transmitted Diseases, 2013. **40**(1): p. 32-40.

218. Pinto, C.N., et al., *Chlamydia and gonorrhea acquisition among adolescents and young adults in Pennsylvania: A Rural and urban Comparison.* Sexually transmitted diseases, 2018. **45**(2): p. 99-102.

219. Sarno, E.L., et al., *Sexual health of rural and urban young male couples in the United States: differences in HIV testing, pre-exposure prophylaxis use, and condom use.* AIDS and Behavior, 2021. **25**(1): p. 191-202.

220. Thompson, E.L., et al., *Rural and urban differences in sexual behaviors among adolescents in Florida.* Journal of Community Health, 2018. **43**(2): p. 268-272.

221. Banks, D.E., D.J. Hensel, and T.C. Zapolski, *Integrating individual and contextual factors to explain disparities in HIV/STI among heterosexual African American youth: a contemporary literature review and social ecological model.* Archives of sexual behavior, 2020. **49**(6): p. 1939-1964.

222. Gao, R., et al., *Association of maternal sexually transmitted infections with risk of preterm birth in the United States.* JAMA network open, 2021. **4**(11): p. e2133413-e2133413.

223. Jessor, R., *Problem behavior theory: A half-century of research on adolescent behavior and development.* 2014.

224. McKay, E.A., et al., *Associations Between Sex Education Types and Sexual Behaviors Among Female Adolescents: a Secondary Data Analysis of the National Survey of Family Growth 2011–2019.* Sexuality Research and Social Policy, 2021: p. 1-14.

225. Evans, R., et al., *Gender differences in parents' communication with their adolescent children about sexual risk and sex-positive topics.* The Journal of Sex Research, 2020. **57**(2): p. 177-188.

226. Flores, D. and J. Barroso, *21st century parent–child sex communication in the United States: A process review.* The Journal of Sex Research, 2017. **54**(4-5): p. 532-548.

227. Widman, L., et al., *Assessment of parent-based interventions for adolescent sexual health: A systematic review and meta-analysis.* JAMA pediatrics, 2019. **173**(9): p. 866-877.

228. Harris, A.L., M.A. Sutherland, and M.K. Hutchinson, *Parental influences of sexual risk among urban African American adolescent males.* Journal of Nursing Scholarship, 2013. **45**(2): p. 141-150.

229. Hutchinson, M.K. and A.J. Montgomery, *Parent Communication and Sexual Risk Among African Americans.* Western Journal of Nursing Research, 2007. **29**(6): p. 691-707.

230. Jones, C.L., R.E. Jensen, and A. Selzer King, *Future sex educator perceptions of rural versus urban instruction: A case for community-centered sexual health education.* American Journal of Sexuality Education, 2014. **9**(4): p. 464-484.

231. Sheringham, J., et al., *It matters what you measure: a systematic literature review examining whether young people in poorer socioeconomic circumstances are more at risk of chlamydia.* Sexually transmitted infections, 2013. **89**(2): p. 175-180.

232. Seltzer, J.A., *Family change and changing family demography.* Demography, 2019. **56**(2): p. 405-426.

233. Sneed, C.D., H.P. Tan, and J.C. Meyer, *The influence of parental communication and perception of peers on adolescent sexual behavior.* Journal of Health communication, 2015. **20**(8): p. 888-892.

234. Padilla-Walker, L.M., *Longitudinal change in parent-adolescent communication about sexuality.* Journal of Adolescent Health, 2018. **63**(6): p. 753-758.

235. Rew, L., T. Carver, and C.-C. Li, *Early and risky sexual behavior in a sample of rural adolescents.* Issues in comprehensive pediatric nursing, 2011. **34**(4): p. 189-204.

236. Moreland, A., et al., *Timing of state and territorial COVID-19 stay-at-home orders and changes in population movement—United States, March 1–May 31, 2020.* Morbidity and Mortality Weekly Report, 2020. **69**(35): p. 1198.

237. Ventura, S.J. and M.A. Freedman, *Teenage childbearing in the United States, 1960–1997.* American Journal of Preventive Medicine, 2000. **19**(1): p. 18-25.

238. Sharp, P.M. and B.H. Hahn, *Origins of HIV and the AIDS pandemic.* Cold Spring Harbor perspectives in medicine, 2011. **1**(1): p. a006841.

239. Raymond, M., et al., *State refusal of federal funding for abstinence-only programs.* Sexuality Research & Social Policy, 2008. **5**(3): p. 44-55.

240. Bordogna, A.L., et al., *Comprehensive sexuality education to reduce pregnancy and STIs in adolescents in the United States: A systematic review and meta-analysis.* American Journal of Sexuality Education, 2022: p. 1-45.

241. White, R.T. and H.J. Arzi, *Longitudinal studies: Designs, validity, practicality, and value.* Research in science education, 2005. **35**(1): p. 137-149.

242. Braun, H.I., D.N. Jackson, and D.E. Wiley, *Socially desirable responding: The evolution of a construct*, in *The role of constructs in psychological and educational measurement*. 2001, Routledge. p. 61-84.

243. Allen, C.D., C.A. McNeely, and J.G. Orme, *Self-rated health across race, ethnicity, and immigration status for US adolescents and young adults.* Journal of Adolescent Health, 2016. **58**(1): p. 47-56.

Appendix A.

Section I.

Adolescent Demographics

- **Wave I in-home Adolescent. H1GI4:** Are you of Hispanic or Latino origin?*
    a) No
    b) Yes
    c) Refused
    d) Don't know

- **Wave I in-home Adolescent. H1GI8:** Which ONE category best describes your racial background?
    a) White
    b) Black or African American
    c) American Indian or Native American
    d) Asian or Pacific Islander
    e) Other
    f) Refused
    g) Legitimate skip
    h) Don't know
    i) Not applicable

- **Wave I in-home Adolescent. BIO_SEX:** Interviewer, please confirm that R's sex is (male) female. (Ask if necessary)*
    a) Male
    b) Female
    c) Refused
    d) Don't know

- **Wave I in-home Adolescent. H1CO1:** Have you ever had sexual intercourse? When we say sexual intercourse, we mean when a male inserts his penis into a female's vagina. ŧ
    a) No
    b) Yes
    c) Refused
    d) Don't know
    e) Not applicable

Note: * indicates variable is a demographic and covariate;
ŧ indicates variable is explanatory

- **Wave II in-home Adolescent. H2CO2:** Have you ever had sexual intercourse? When we say sexual intercourse, we mean when a male inserts his penis into a female's vagina. ŧ
    a) No
    b) Yes
    c) Refused
    d) Don't know

- **Wave III in-home Young Adult. H3SE1:** Have you ever had vaginal intercourse? (Vaginal intercourse is when a man inserts his penis into a woman's vagina.) ŧ
    a) No
    b) Yes
    c) Refused
    d) Don't know
    e) Not applicable

- **Wave IV in-home Young Adult – Adult. H4SE6:** Have you ever had vaginal intercourse? (Vaginal intercourse is when a man inserts his penis into a woman's vagina.) ŧ
    a) No
    b) Yes
    c) Refused
    d) Don't know

- **Wave V. in-home Adult. H5SE1:** Have you ever had vaginal intercourse? Vaginal intercourse is when a man inserts his penis into a woman's vagina. ŧ
    a) No
    b) Yes

Parent Demographics

- **Wave I in-home Parent. PA4:** Are you of Hispanic or Latino origin?*
    a) No
    b) Yes
    c) Refused

Note: * indicates variable is a demographic and covariate;
ŧ indicates variable is explanatory

- **Wave I. in-home Parent. PA8B:** What ONE category best describes your racial background?
    a) White
    b) Black/African American
    c) American Indian/Native American
    d) Asian or Pacific Islander
    e) Other
    f) Refused
    g) Legitimate skip

- **Wave I. in-home Parent. PA6_2:** What is your race (check all that apply): Black or African American*
    a) Not marked
    b) Marked
    c) Refused

- **Wave I in-home Parent. PA1:** Record the respondents sex.
    a) Male
    b) Female

- **Wave I in-home Parent. PA12:** How far did you go in school?*
    a) 8th grade or less
    b) More than 8th grade, but did not graduate from high school
    c) Went to business, trade, or vocational school instead of high school
    d) High school graduate
    e) Completed GED
    f) Went to business, trade, or vocational school after high school
    g) Went to college, but did not graduate
    h) Graduated from a college or university
    i) Professional training beyond a 4-year college or university
    j) Never went to school
    k) Refused

Note: ł indicates variable is explanatory; * indicates variable is a demographic and covariate.

- **Wave I in-home Parent. PC1:** What is your relationship to {NAME}? ł
    a) Biological mother
    b) Step-mother
    c) Adoptive mother
    d) Foster mother
    e) Grandmother
    f) Aunt
    g) Other female relative
    h) Other female non-relative
    i) Biological father
    j) Step-father
    k) Adoptive father
    l) Foster father
    m) Grandfather
    n) Uncle
    o) Other male relative
    p) Other male non-relative
    q) Refused

Section II.

Covariates

- **Wave I in-home Adolescent. H1IR12:** How would you describe the immediate area or street (one block, or both sides) where the respondent lives?
    a) Rural
    b) Suburban
    c) Urban, residential only
    d) 3 or more commercial properties, mostly retail
    e) 3 or more commercial properties, mostly wholesale or industrial
    f) Other
    g) Refused
    h) Don't know
    i) Not applicable

- **Wave I in-home Adolescent. H1GI15:** Have you ever been married?
    a) No
    b) Yes
    c) Refused
    d) Legitimate skip
    e) Don't know

Note: ł indicates variable is explanatory; * indicates variable is a demographic and covariate.

- **Wave II in-home Adolescent. H2GI3:** Since {MOLI}, did you get married?
    a) No
    b) Yes
    c) Legitimate skip

- **Wave III in-home Young Adult. H3PG22:** Were you and {initials} married to each other at the time of this birth?
    a) No
    b) Yes
    c) Legitimate Skip
    d) Don't know

- **Wave IV in-home Young Adult – Adult. H4PG9:** Were you and {initials} married to each other at the time of (pregnancy/birth)?
    a) No
    b) Yes
    c) Refused
    d) Legitimate skip
    e) Don't know

- **Wave V in-home Adult. H5HR1:** Are you currently?
    a) Married
    b) Widowed
    c) Divorced
    d) Separated
    e) Never married

Section III.

Formal School-Based Sex Education

- **Wave I in-home. H1TS8:** Have you learned about the following in a class at school (check all that apply): Pregnancy
    a) No
    b) Yes
    c) Refused
    d) Don't know

- **Wave I in-home. H1TS9:** Have you learned about the following in a class at school (check all that apply): AIDS
    a) No
    b) Yes
    c) Refused
    d) Don't know

Section IV.

Parent-Adolescent Sex Communication

- **Wave I in-Home Parent. PC42A:** How much do you agree or disagree with the following statement? You really don't know enough about sex and birth control to talk about them with {NAME}. ł
    a) Strongly agree
    b) Agree
    c) Neither agree nor disagree
    d) Disagree
    e) Strongly disagree
    f) Refused

- **Wave I in-home Parent. PC42B:** How much do you agree or disagree with the following statement? It would embarrass {NAME} to talk about sex and birth control. ł
    a) Strongly agree
    b) Agree
    c) Neither agree nor disagree
    d) Disagree
    e) Strongly disagree
    f) Refused

- **Wave I in-home Parent. PC42C:** How much do you agree or disagree with the following statement? It would be difficult for you to explain things if you talked with {NAME} about sex and birth control. ł
    a) Strongly agree
    b) Agree
    c) Neither agree nor disagree
    d) Disagree
    e) Strongly disagree
    f) Refused

Note: ł indicates variable is explanatory

- **Wave I in-home Parent. PC42D:** How much do you agree or disagree with the following statement? {NAME} will get the information somewhere, so you don't really need to talk to (him/her) about sex and birth control. ŧ
    a) Strongly agree
    b) Agree
    c) Neither agree nor disagree
    d) Disagree
    e) Strongly disagree
    f) Refused

- **Wave I in-home Parent. PC42E.** How much do you agree or disagree with the following statement? Talking about birth control with {NAME} would only encourage (him/her) to have sex. ŧ
    a) Strongly agree
    b) Agree
    c) Neither agree nor disagree
    d) Disagree
    e) Strongly disagree
    f) Refused

- **Wave I in-home Parent. PC43AA:** How much have you and {Name} talked about (his/her) having sexual intercourse and the negative or bad things that would happen if [he got someone/she got] pregnant?
    a) Not at all
    b) Somewhat
    c) A moderate amount
    d) A great deal
    e) Refused

- **Wave I in-home Parent. PC43AB:** How much have you and {Name} talked about (his/her) having sexual intercourse and the dangers of getting a sexually transmitted disease?
    a) Not at all
    b) Somewhat
    c) A moderate amount
    d) A great deal
    e) Refused

Note: ŧ indicates variable is explanatory; * indicates variable is a demographic and covariate.

- **Wave I in-home Parent. PC43AC:** How much have you and {NAME} talked about (his/her) having sexual intercourse and the negative or bad impact on (his/her) social life because (he/she) would lose the respect for others?
    a) Not at all
    b) Somewhat
    c) A moderate amount
    d) A great deal
    e) Refused

- **Wave I in-home Parent. PC43AD:** How much have you and {NAME} talked about (his/her) having sexual intercourse and the moral issues of not having sexual intercourse?
    a) Not at all
    b) Somewhat
    c) A moderate amount
    d) A great deal
    e) Refused

- **Wave I in-home Parent. PC43BA:** How much have you and {NAME} talked about birth control?
    a) Not at all
    b) Somewhat
    c) A moderate amount
    d) A great deal
    e) Refused

- **Wave I in-home Parent. PC43BB:** How much have you and {NAME} talked about sex?
    a) Not at all
    b) Somewhat
    c) A moderate amount
    d) A great deal
    e) Refused

Section V.

Pregnancy Intentions

- **Wave I in-home Adolescent. HIFP15_1-5:** Before you got pregnant, did you want to get pregnant by your partner at that time? (up to 5 pregnancies)
    a) Definitely no
    b) Probably no
    c) Not sure
    d) Probably yes

e) Definitely yes

- **Wave II in-home Adolescent. H2FP19_1-3:** Before you got pregnant, did you want to get pregnant by your partner at that time? (up to 3 pregnancies)
    a) Definitely no
    b) Probably no
    c) Not sure
    d) Probably yes
    e) Definitely yes

- **Wave III in-home Young Adult. H3PG8:** Please think back to the time just before {<PARTNER>/YOU} became pregnant. Did you want to have a child then?
    a) No
    b) Yes
    c) Refused
    d) Don't know
    e) Not applicable

- **Wave IV in-home Young Adult – Adult.** Thinking back to the time just before this pregnancy with {fill initials}, did you want to have a child then?
    a) No
    b) Yes
    c) Refused
    d) Legitimate skip
    e) Don't know

- **Wave V in-home Adult. H5PG191-6:** Thinking back to the time just before this pregnancy, did you want to have a baby then? (up to 6 pregnancies)
    a) No
    b) Yes

Sexually Transmitted Infections

- **Wave I in-home Adolescent. H1CO16A:** In the past year (or ever), have you been told by a doctor or a nurse that you had chlamydia?
    a) No
    b) Yes
    c) Refused
    d) Legitimate skip
    e) Don't know
    f) Not applicable

- **Wave I in-home Adolescent. H1CO16B:** In the past year (or ever), have you been told by a doctor or a nurse that you had syphilis?
    a) No
    b) Yes
    c) Refused
    d) Legitimate skip
    e) Don't know
    f) Not applicable

- **Wave I in-home Adolescent. H1CO16C:** In the past year (or ever), have you been told by a doctor or a nurse that you had gonorrhea?
    a) No
    b) Yes
    c) Refused
    d) Legitimate skip
    e) Don't know

- **Wave II in-home Adolescent. H2CO19A:** In the past year (or ever), have you been told by a doctor or a nurse that you had chlamydia?
    a) No
    b) Yes
    c) Refused
    d) Legitimate skip
    e) Don't know

- **Wave II in-home Adolescent. H2CO19B:** In the past year (or ever), have you been told by a doctor or a nurse that you had syphilis?
    a) No
    b) Yes
    c) Refused
    d) Legitimate skip
    e) Don't know

- **Wave II in-home Young Adult. H2CO19C:** In the past year (or ever), have you been told by a doctor or a nurse that you had gonorrhea?
    a) No
    b) Yes
    c) Refused
    d) Legitimate skip
    e) Don't know

- **Wave III in-home Young Adult. H3SE21A:** In the past year (or ever), have you been told by a doctor or a nurse that you had chlamydia?
    a) No
    b) Yes
    c) Refused
    d) Don't know
    e) Not applicable

- **Wave III in-home Young Adult**. **H3SE21D:** In the past year (or ever), have you been told by a doctor or a nurse that you had syphilis?
    a) No
    b) Yes
    c) Refused
    d) Don't know
    e) Not applicable

- **Wave III in-home Young Adult. H3SE21B:** In the past year (or ever), have you been told by a doctor or a nurse that you had gonorrhea?
    a) No
    b) Yes
    c) Refused
    d) Don't know
    e) Not applicable

- **Wave IV in-home Adult. H4SE36A/H4SE37A:** In the past year (or ever), have you been told by a doctor or a nurse that you had chlamydia?
    a) Not selected
    b) Selected
    c) Refused
    d) Legitimate skip
    e) Don't know

- **Wave IV in-home Adult. H4SE36D/H4SE37D:** In the past year (or ever) have you been told by a doctor or a nurse that you had syphilis?
    a) Not selected
    b) Selected
    c) Refused
    d) Legitimate skip
    e) Don't know

- **Wave IV in-home Adult. H4SE36B/H4SE37B:** In the past year (or ever), have you been told by a doctor or a nurse that you had gonorrhea?
    a) Not selected
    b) Selected
    c) Refused
    d) Legitimate skip
    e) Don't know

Condom Use Behaviors

- **Wave I In-Home Adolescent. H1CO3:** Did or your partner use any method of birth control the first time you had sexual intercourse?
    a) No
    b) Yes
    c) Refused
    d) Legitimate skip
    e) Don't know
    f) Not applicable

- **Wave I In-Home Adolescent. H1CO4A:** What method of birth control did you or your partner use the first time you had sexual intercourse? (first response)
    a) Condoms (rubbers)
    b) Withdrawal
    c) Rhythm (safe time)
    d) Birth control pills
    e) Vaginal sponge
    f) Foam, jelly, crème, suppositories
    g) Diaphragm, with or without jelly
    h) IUD (intrauterine device)
    i) Norplant
    j) Ring
    k) Depo Provera
    l) Contraceptive film
    m) Some other method
    n) Refused
    o) Legitimate skip
    p) Don't know
    q) Not applicable

- **Wave I In-Home Adolescent. H1CO4B-C:** What other method of birth control did you or your partner use the first time you had sexual intercourse? (second and third response)
    a) Condoms (rubbers)
    b) Withdrawal
    c) Rhythm (safe time)
    d) Birth control pills
    e) Vaginal sponge
    f) Foam, jelly, crème, suppositories
    g) Diaphragm, with or without jelly
    h) IUD (intrauterine device)
    i) Norplant
    j) Ring
    k) Depo Provera
    l) Contraceptive film
    m) Some other method
    n) No other method
    o) Refused
    p) Legitimate skip
    q) Don't know
    r) Not applicable

- **Wave I In-Home Adolescent. H1CO6:** Did you or your partner use any method of birth control when you had sexual intercourse most recently?
    a) No
    b) Yes
    c) Refused
    d) Legitimate skip
    e) Don't know
    f) Not applicable

- **Wave I In-Home Adolescent. H1CO7A:** What method of birth control did you or your partner use? (first response)
    a) Condoms (rubbers)
    b) Withdrawal
    c) Rhythm (safe time)
    d) Birth control pills
    e) Vaginal sponge
    f) Foam, jelly, crème, suppositories
    g) Diaphragm, with or without jelly
    h) IUD (intrauterine device)
    i) Norplant
    j) Ring
    k) Depo Provera
    l) Contraceptive film
    m) Some other method
    n) Refused
    o) Legitimate skip
    p) Don't know
    q) Not applicable

- **Wave I In-Home Adolescent. H1CO7B-C:** What other methods of birth control did you or your partner use? (second and third response)
    a) Condoms (rubbers)
    b) Withdrawal
    c) Rhythm (safe time)
    d) Birth control pills
    e) Vaginal sponge
    f) Foam, jelly, crème, suppositories
    g) Diaphragm, with or without jelly
    h) IUD (intrauterine device)
    i) Norplant
    j) Ring
    k) Depo Provera
    l) Contraceptive film
    m) Some other method
    n) No other method
    o) Refused
    p) Legitimate skip
    q) Don't know
    r) Not applicable

- **Wave I In-Home Adolescent. H1CO9:** Thinking about all the times you have had sexual intercourse, about what proportion of the time {HAVE YOU/HAS A PARTNER OF YOURS} used a condom?
    a) None of the time
    b) Some of the time
    c) Half of the time
    d) Most of the time
    e) All of the time
    f) Refused
    g) Legitimate skip
    h) Don't know

- **Wave II In-Home Adolescent. H2CO4:** Did you or your partner use any method of birth control the first time you had sexual intercourse?
    a) No
    b) Yes
    c) Refused
    d) Legitimate skip
    e) Don't know

- **Wave II In-Home Adolescent. H2CO5A-C:** What method of birth control did you or your partner use the first time you had sexual intercourse? If more than one method was used, indicate them all. (first response)
    a) Condoms (rubbers)
    b) Withdrawal
    c) Rhythm (safe time)
    d) Birth control pills
    e) Vaginal sponge
    f) Foam, jelly, crème, suppositories
    g) Diaphragm, with or without jelly
    h) IUD (intrauterine device)
    i) Norplant
    j) Ring
    k) Depo Provera
    l) Contraceptive film
    m) Some other method
    n) Legitimate skip
    o) Don't know

- **Wave II In-Home Adolescent. H2CO5B-C:** What other method of birth control did you or your partner use the first time you had sexual intercourse? If more than one method was used, indicate them all. (second and third response)
    a) Condoms (rubbers)
    b) Withdrawal
    c) Rhythm (safe time)
    d) Birth control pills
    e) Vaginal sponge
    f) Foam, jelly, crème, suppositories
    g) Diaphragm, with or without jelly
    h) IUD (intrauterine device)
    i) Norplant
    j) Ring
    k) Depo Provera
    l) Contraceptive film
    m) Some other method
    n) No other method (first presented after first response)
    o) Legitimate skip
    p) Don't know

- **Wave II In-Home Adolescent. H2CO7:** Did you or your partner use any method of birth control when you had sexual intercourse most recently?
    a) No
    b) Yes
    c) You only had intercourse once
    d) Refused
    e) Legitimate skip
    f) Don't know

- **Wave II In-Home Adolescent. H2CO8A:** What method of birth control did you or your partner use? (first response)
    a) Condoms (rubbers)
    b) Withdrawal
    c) Rhythm (safe time)
    d) Birth control pills
    e) Vaginal sponge
    f) Foam, jelly, crème, suppositories
    g) IUD (intrauterine device)
    h) Norplant
    i) Ring
    j) Depo Provera
    k) Contraceptive film
    l) Some other method
    m) Refused
    n) Legitimate skip
    o) Don't know

- **Wave II In-Home Adolescent. H2CO8B-C:** What other method of birth control did you or your partner use? (second and third response)
    a) Condoms (rubbers)
    b) Withdrawal
    c) Rhythm (safe time)
    d) Birth control pills
    e) Vaginal sponge
    f) Foam, jelly, crème, suppositories
    g) IUD (intrauterine device)
    h) Norplant
    i) Ring
    j) Depo Provera
    k) Contraceptive film
    l) Some other method
    m) Refused
    n) No other method (first presented after first response)
    o) Legitimate skip
    p) Don't know

- **Wave II In-Home Adolescent. H2CO10/H2CO11:** Thinking about all the times you have had sexual intercourse, about what proportion of the time {HAVE YOU/HAS A PARTNER OF YOURS} used a condom?
    a) None of the time
    b) Some of the time
    c) Half of the time
    d) Most of the time
    e) All of the time
    f) Refused
    g) Legitimate skip
    h) Don't know

- **Wave III In-Home Young Adult. H3SE8:** On how many of these occasions did {YOU/YOUR PARTNER} use a condom?
    a) None
    b) Some
    c) Half
    d) Most
    e) All
    f) Refused
    g) Legitimate skip
    h) Don't know
    i) Not applicable

- **Wave III In-Home Young Adult. H3SE9:** Did you or your partner use any method of birth control when you had sexual intercourse most recently?
    a) No
    b) Yes
    c) Refused
    d) Legitimate skip
    e) Don't know
    f) Not applicable

- **Wave III In-Home Young Adult. H3SE10:** The most recent time you had vaginal intercourse did {YOU/YOUR PARTNER} use a condom?
    a) No
    b) Yes
    c) Refused
    d) Legitimate skip
    e) Don't know
    f) Not applicable

- **Wave III In-Home Young Adult. H3SE30A:** In the past 12 months, which of the following methods of birth control {HAS A MALE PARTNER OF YOURS/HAVE YOU} used? Mark all that apply.
    a) Condom
        - Not marked
        - Marked
        - Refused
        - Don't know
        - Not applicable

- **Wave IV In-Home Adult. H4SE26A:** In the past 12 months, did you or your partner(s) use any of these methods of birth control or disease prevention (check all that apply):
    a) Condoms (rubbers)
        - Not marked
        - Marked
        - Refused
        - Don't know
        - Not applicable

- **Wave IV In-Home Adult. H4SE26B:** In the past 12 months, did you or your partner(s) use any of these methods of birth control or disease prevention (check all that apply):
    a) Female condom
        - Not marked
        - Marked
        - Refused
        - Don't know
        - Not applicable

- **Wave V In-Home Adult. H5TR17:** On average, how often do you or your partner use a contraceptive method for birth control for disease prevention?
    a) None of the time
    b) Some of the time
    c) About half of the time
    d) Most of the time
    e) All of the time
    f) Legitimate skip