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AN EXPLORATION OF SOCIAL DETERMINANTS OF HEALTH IN RELATION TO CONTRACEPTIVE USE AMONG YOUNG ADULTS.

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AN EXPLORATION OF SOCIAL DETERMINANTS OF HEALTH IN RELATION TO CONTRACEPTIVE USE AMONG YOUNG ADULTS.

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Abstract

Background: Low and inconsistent contraceptive use in young adults leads to increased unintended pregnancies. Prior research primarily focused on individual-level influences such as contraceptive attitudes and beliefs, with little consideration of social domains and contextual factors (e.g., economic and neighborhood characteristics). This dissertation project explored cross-sectional and longitudinal associations between social domains and young adult contraceptive use utilizing the Healthy People 2030 Social Determinants of Health (SDH) framework. Additionally, this dissertation also explored the mediating influence of contraceptive self-efficacy between SDH domains and contraceptive use. **Methods:** Proxy measures related to five SDH domains (economic stability, education, social and community context, health and health care, and neighborhood and built environment) were extracted from the National Longitudinal Study of Adolescent and Adult Health (Add Health) Wave I, II and III data to explore the association with past year ever-use and consistent use of contraception among young adults (18-26 years). Two multi-level binary logistic regressions were employed using Mplus v.8.7 to explore cross-sectional and longitudinal associations. Path analysis utilizing bias corrected bootstrapping was used for exploring mediating influence of contraceptive self-efficacy. **Results:** Of the 11,575 participants (Mean age: 22.02 years, (SD: 1.78); 53.77% female), 75.14% reported past year ever-use of contraception, while 45.33% were consistent contraceptive users. Cross-sectional results indicated that, out of 11 measures, six and ten measures had an empirical relationship with the past year ever-use of contraception and consistency of contraceptive use, respectively. Out of 14 key issues, in longitudinal study, six and eight key issues measured at adolescence had significant associations with past year ever-use of contraception and consistency of contraceptive use at young adulthood, respectively. Furthermore, contraceptive self-efficacy had a mediating influence between 4 key issues and past year ever-use of contraceptive use, while contraceptive self-efficacy mediated between 5 key issues and contraceptive use. The key

issues were associated with Education, Social and Community Context, and Health and Health care. **Conclusions:** A favorable environment during adolescence and young adulthood provide a foundation for positive health behaviors. Interventions aimed to increase contraceptive use among young adults should focus on creating supporting environments during adolescence. Contraceptive self-efficacy can be targeted in short behavioral interventions to improve contraceptive use.

Keywords: Contraceptive use, Social Determinants of Health, Healthy People 2030, consistency of contraception.

Chapter 1. Introduction

Unintended pregnancy is one of the most critical reproductive health issues that imposes irrevocable social and financial costs on individuals and society (Yazdkhasti, Pourreza, Pirak, & Abdi, 2015). Unintended pregnancies are those pregnancies that are either mistimed (the mother wanted the pregnancy to occur at a later time) or unwanted (the mother did not want the pregnancy to occur at that time or any time in the future) at the time of conception (Santelli et al., 2003). The rate of unintended pregnancy in the United States (51%, as per 2012 data) is comparatively higher than in other developed nations such as Western European countries (34%, as per 2012 data) (Sedgh, Singh, & Hussain, 2014). In the United States, out of 6.4 million pregnancies in 2001, 49% of pregnancies were unintended (Finer & Henshaw, 2006). The rates have remained stable over the years such that in 2008 and 2011, the rates of unintended pregnancies were as high as 51% and 45% respectively (Finer & Zolna, 2014, 2016).

Unintended pregnancies are associated with numerous negative social and economic outcomes for parents and their children. Mothers of all ages who experience unintended pregnancies are more likely to have negative attitude towards childbirth & parenting, overall poor psychological health, prenatal and perinatal risks such as inadequate prenatal care, and abuse of tobacco/alcohol/drugs (Logan, Holcombe, Manlove, & Ryan, 2007). For teen mothers especially, there is higher likelihood of dropping out from the high school, relying on public assistance and their children growing up in educationally and economically disadvantaged households (Furstenberg Jr, 2003). A review which compiled and examined 65 studies related to unintended pregnancies reported that the children born from unintended pregnancies have low birthweight, poor physical and mental health, poor behavioral and cognitive outcomes, and weaker bond with their mothers (Logan et al., 2007).

In 2011, of the 2,779,000 unintended pregnancies out of 6,138,000 pregnancies (45%) in the US, the rates of unintended pregnancy are the highest among women aged 18-24 years with a rate of 41% (430,000 per 574,000 pregnancies) for the 15-19 age group, and 81% (878,000 per 1,494,000 pregnancies) for the 20-24 age group (Finer & Zolna, 2016). To prevent unintended pregnancies, public health practitioners rely on awareness of contraceptive methods and contraceptive counselling along with other targeted structural and educational interventions (Center of Disease Control and Prevention (CDC), 2021b). Consistent use of effective contraceptive methods is a key protective behavior for the prevention of unintended pregnancies (Moore, 1995). But, reports suggest that the contraceptive use is low among this vulnerable population where only 37.2% of adolescent girls aged 15-19 and 61.9% of young women aged 20-29 years reported current use of contraceptive method during the year 2015-2017 (CDC, 2018). The low use of contraception amongst the sexually active adolescent and young adults can be one of the prominent reasons for higher percentage of unintended pregnancies among the 15-24 age groups.

When measuring contraceptive use, previous studies have explored ever use of contraception (Manlove & Terry-Humen, 2004), self-reported use of condoms (Pinchoff, Boyer, Mutombo, Chowdhuri, & Ngo, 2017), use of contraception in the sexual debut (Gomes, Speizer, Oliveira, Moura, & Gomes, 2008), contraceptive methods used in the recent intercourse (Kim, Gebremariam, Iwashyna, Dalton, & Lee, 2011) and frequency of contraceptive use in the past 12 months (Amialchuk & Gerhardinger, 2015; Kao & Manczak, 2013). Among these, contraceptive ever-use and consistency of use (i.e., always using contraception while engaging in the sexual activities, measured by frequency of use) have been suggested as the most important determinants of unintended pregnancies (Amialchuk & Gerhardinger, 2015; Brückner, Martin, & Bearman, 2004; J. Manlove, Ikramullah, & Terry-Humen, 2008). Ever use of the contraception indicates the tendency and intention of a person

to use contraception for a safe sex. With consistent or frequent use of contraception, there is significant reduction in pregnancy occurrence and transmission of STDs. Since ever use of contraception and consistency of contraceptive use are more accurate predictors of unintended pregnancies (Morrison et al., 2016), these measures were assessed in the current study. Assessing the ever-use and consistency of contraceptive use can help researchers get an idea about participants' behaviors related to safe sex.

Social Determinants of Health

While exploring precursors of behaviors and health outcomes in public health, often only individual or interpersonal level characteristics are explored, and overarching societal and community context are uninvestigated (Thompson, Rosen, & Maness, 2019). Similarly, in studying contraceptive use, past published studies reported associations of contraceptive ever use and consistency with relationship type, level of intimacy between partners, communication before sexual activities, higher self-efficacy, age and parental approval towards contraceptive use (Guzzo & Hayford, 2018; Longmore, Manning, Giordano, & Rudolph, 2003; J. Manlove, Ryan, & Franzetta, 2007). While these studies have greatly improved our understanding of factors associated with contraceptive use and consistency, there is a gap in literature regarding influence of factors beyond individual beliefs and interpersonal characteristics with the use of contraceptive methods.

Research studies exploring health behaviors and outcomes, such as cardiovascular and respiratory illness, have reported and supported observed associations of socioeconomic measures such as income, education attainment and poverty on varied health indicators (Braveman & Gottlieb, 2014; Sheldon Cohen, Doyle, Turner, Alper, & Skoner, 2004; Koch et al., 2010; Marmot et al., 1991). The immediate environment, community, and the social context determine a lot of the behaviors that people do, for example, having a community-based public health agency can increase the chances of identifying and intervening in a social

or environmental risk to a patient such as undernutrition. It is not surprising that, now in the patient care, additional focus on socio-cultural context is assured, in which social, political, economic, and cultural aspects are considered along with health behaviors (Chin, Monroe, & Fiscella, 2000).

Instead of haphazardly picking and choosing the social factors, frameworks are one way to explore the relationships and link between various social domains and health outcomes. For this study, I choose the Social Determinants of Health (U.S. Department of Health and Health Services (USDHHS), 2021) framework, which federal and national organizations have been using to achieve health objectives and goals since the late 1990s. SDH are the fundamental drivers of health conditions and behaviors and are defined as the conditions in which people are born, grow, live, work and age that affect wide range of health indicators and quality of life outcomes (USDHHS, 2021). SDH framework has been explicitly used to guide objectives for Health People 2030 – a national set of health-related goals for the decade. It includes 5 specific domains: Economic Stability, Education, Health and Health Care, Neighborhood and Built Environment, and Social and Community Context (USDHHS, 2021). The key determinants and issues included under these 5 domains are presented in the table below (Table 1)

SDH are distinct from medical and health care factors and are affected by social norms, culture, and policies, which in turn can shape health in powerful ways (Braveman & Gottlieb, 2014). Particularly during adolescence, social domains such as family, peers, and access to education trigger or enable specific health behaviors that are crucial to helping young people attain the optimum level of health in the transition to adulthood (Viner et al., 2012). Previous research has reported the association between SDH domains and various sexual health indicators such as sexual risk behaviors (Browne et al., 2014; Raiford et al., 2014), sexually transmitted infections (Kerr, Valois, Siddiqi, Vanable, & Carey, 2015),

Table 1

Healthy People 2030 Social Determinants of Health framework.

Social Determinants of Health					
Determinant areas	**Economic Stability**	**Education**	**Social and Community Context**	**Health and Healthcare**	**Neighborhood and Built Environment**
Critical components /key issues	• Poverty • Employment • Food Insecurity • Housing Instability	• High School graduation Rates • Enrollment in Higher Education • Language & Literacy • Early Childhood Education and Development	• Discrimination • Social Cohesion • Civic participation • Incarceration	• Access to health care • Access to primary care • Health literacy	• Quality of housing • Crime and violence • Environmental conditions • Access to foods that support healthy eating patterns

adolescent pregnancy (Maness, Buhi, Daley, Baldwin, & Kromrey, 2016) and HPV vaccination (Thompson et al., 2019) among adolescents and young adults. Although numerous past research studies have explored the association of contraceptive use with individual characteristics (Chola, Hlongwana, & Ginindza, 2020; Guzzo & Hayford, 2018; Hamidi, Deimling, Lehman, Weisman, & Chuang, 2018), many factors are beyond the individual level factors, often belonging to social domains, financial ability, access, literacy, and health systems. While some social domains have been explored in past published studies, SDH domains have not been explored extensively and comprehensively using a framework in relation to contraceptive use.

In addition to immediate social environment of the person, childhood environment and socio-economic status exposure have a large impact on choices people make in adulthood (Chin et al., 2000; Sheldon Cohen et al., 2004; S Cohen, Janicki-Deverts, Chen, Stewart, & Adler, 2010). Past research has also confirmed the impact of social domains and socio-economic disadvantage in early life on diseases, social stressors and substance use in later adolescence and adulthood (Braveman & Gottlieb, 2014; Galobardes, Lynch, & Davey Smith, 2004). The environment and care that children get in their early years have lingering effect on their health and behaviors. For example, poor dietary habits during childhood, which might be due to low socio-economic conditions or a greater exposure to unhealthy fast-food options, persist throughout adulthood (Sheldon Cohen, Janicki-Deverts, Chen, & Matthews, 2010). This does not only contribute to poor childhood health but ultimately results in elevated disease risk later in life. Indeed, the environment and social context appear to have a meaningful and long-term impact on the health of the population. Thus, it is beneficial to identify linkages between early-life social domains and contraceptive use in later life.

Contraceptive Self-efficacy

Previous studies have conflicting reports on the association of demographic and family influences on the contraceptive use. Some studies have reported significant association of contraceptive use with parental education and family income (Kao & Manczak, 2013). Another study shows that these variables (parental education and family income) do not influence use of contraceptives among adolescents (Longmore et al., 2003). These types of conflicting results could reflect the presence of modifiable factors that exist among adolescent and young adults that are related to contraceptive use.

Of all the factors associated with a behavior, perceived self-efficacy is considered a focal determinant of behavior change and is defined as "a person's particular set of beliefs that determine how well one can execute a plan of action in prospective situations"(Bandura, 2004). In relation to using contraception, contraceptive self-efficacy is defined as "a conviction that one can control sexual and contraceptive situations to achieve contraceptive protection" (Longmore et al., 2003, p. 47). Contraceptive self-efficacy has been associated with demographic and social characteristics such as higher parental education and higher family annual income (Crawford, Atchison, Ajayi, & Doyle, 2021; Longmore et al., 2003; Sieving, Bearinger, Resnick, Pettingell, & Skay, 2007). Similarly, contraceptive self-efficacy has also been linked with use & consistency of contraceptive use (Crawford et al., 2021; Longmore et al., 2003). It is possible that contraceptive self-efficacy can be a promising avenue for exploration as a mediating variable between social domains and contraceptive use. Establishing this link may ultimately inform future interventions, such as programs boosting adolescents' and young adults' self-efficacy (Jones et al., 2016), factors that are more modifiable than SDH domains.

Purpose of Studies

The purpose of the dissertation study is three-fold. The primary aim of the Study 1 is to explore associations between young adults' current SDH (5 domains: Economic Stability,

Education, Social & Community Context, Health & Healthcare, and Neighborhood & Built Environment) and two contraceptive outcomes: ever-use and consistency of use among 18-26 years old youths, using cross sectional data. Study 2 aims to identify associations between SDH reported at adolescence and their contraceptive ever-use and consistency of use in young adulthood, approximately 8 years later, using longitudinal data. Study 3 aims to explore if contraceptive self-efficacy acts as a potential mediator between the relationship of social domains at adolescence and contraceptive ever-use and consistency of use in young adulthood.

Research Questions: Study 1 (as shown in Figure 1)

RQ 1.1. Are the domains of Social Determinants of Health associated with young adults' ever-use of contraceptive methods cross-sectionally?

RQ 1.2. Are the domains of Social Determinants of Health associated with young adults' consistent use of contraceptive methods cross-sectionally?

Research Questions: Study 2 (as shown in Figure 2)

RQ 2.1. Are the domains of Social Determinants of Health at adolescence predictive of use of contraceptive methods during young adulthood?

RQ 2.2. Are the domains of Social Determinants of Health at adolescence predictive of consistency of contraceptive use during young adulthood?

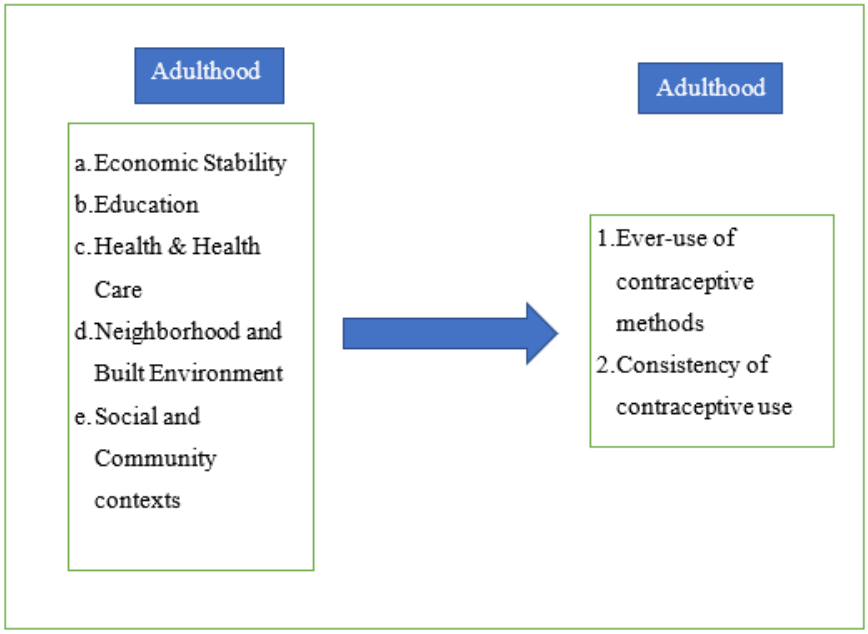
Research Questions: Study 3 (as shown in Figure 3)

RQ 3.1. Does contraceptive self-efficacy act as a mediating factor between each domain of SDH and contraceptive ever-use?

RQ 3.2. Does contraceptive self-efficacy act as a mediating factor between each domain of SDH and consistency of contraceptive use?

Figure 1

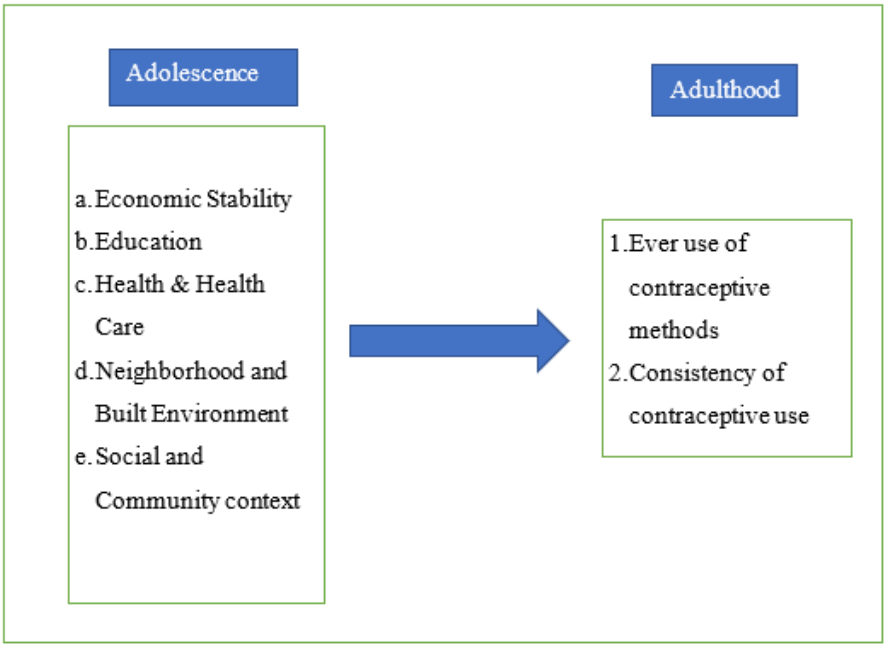
Cross-sectional association between SDH domains and contraceptive behavior



Note: The arrow indicates relationship direction being tested and does not suggest causality.

Figure 2

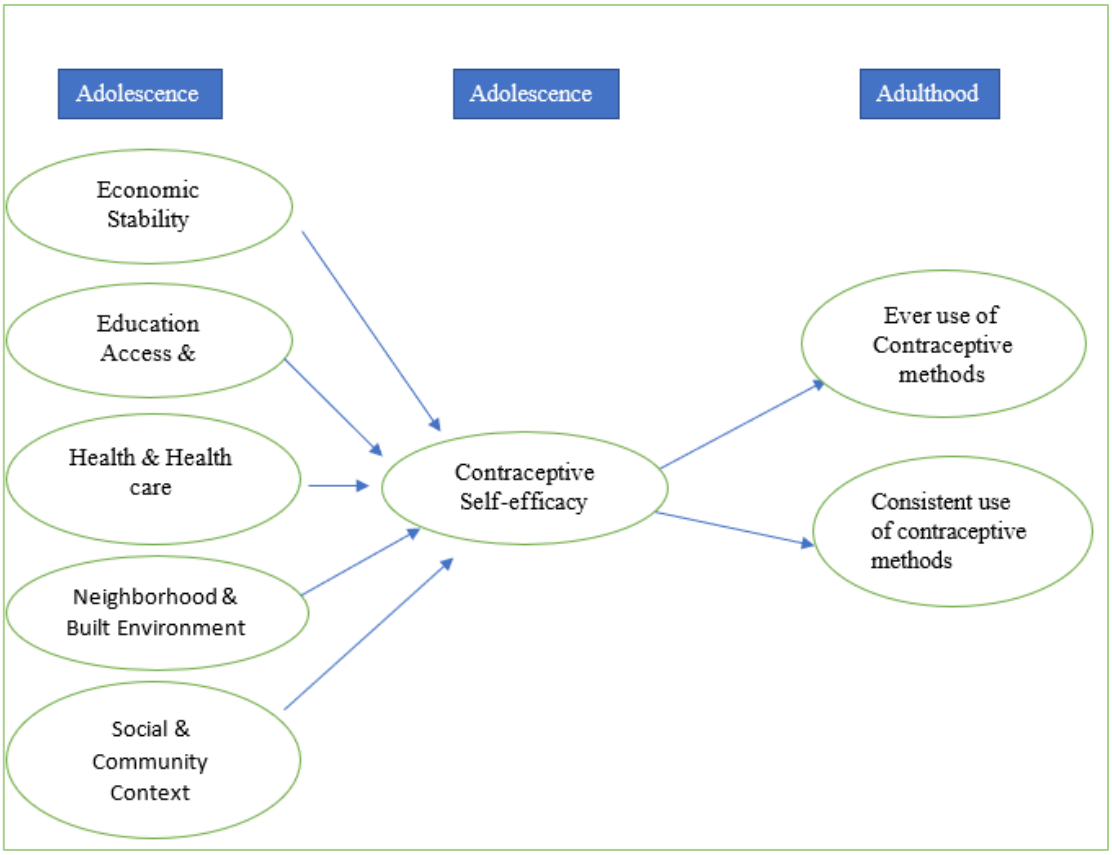
Longitudinal association between SDH domains and contraceptive behavior



Note: The arrow indicates relationship direction being tested and does not suggest causality.

Figure 3

Hypothesized Mediation model involving social determinants of health, contraceptive self-efficacy, and contraceptive behavior.



Significance of the Research

Despite a slight decline in unintended pregnancies from 2008 to 2011 (i.e., from 51% to 45%) , the unintended pregnancies reported in 2011 remain as high as 41% (430,000 per 574,000 pregnancies) for 15-19 age group, and 81% (878,000 per 1,494,000 pregnancies) for 20-24 age group (Finer & Zolna, 2016). This situation is particularly concerning when there are ways to prevent pregnancy such as contraceptive devices widely available and prescribed by health care practitioners (Stanback, Steiner, Dorflinger, Solo, & Cates, 2015). Additionally, adolescents and young adults within 15-24 years age group are highly vulnerable to Sexually Transmitted Diseases (STDs) and account for almost half of the 20 million new sexually transmitted infections that occur in the United States each year (CDC,

2017). In 2018 alone, the STDs related infections cost approximately $16 billion in direct lifetime medical costs for the US health care system (CDC, 2021a). These preventable infections also incorporate other indirect costs associated with loss of productivity and other non-medical expenses. To minimize these consequences, CDC specifically recommends the use of latex condoms, which are highly effective when used correctly and consistently, to reduce the risk of STD transmission (CDC, 2021). Since both unintended pregnancies and transmission of STDs among adolescents and young adults includes a host of consequences for individual, society, and the entire health care system as a whole, it is important to learn the factors associated with the preventive behavior, i.e., contraceptive use among these population groups. A dissertation study that explores the association between SDH and contraceptive use can provide valuable information in several key areas such as research, practice, and policy development.

Using comprehensive framework like SDH that has been used and put under practice for more than three decades can analyze multiple determinants within a single population, examine the associations and strengths with determinants, and pinpoint the strongest determinants related to the behavior (Healthy People 2030). Despite the relevance of SDH framework, there is only one study to date that has employed this framework to study contraceptive use among adolescents while other prior research provided scattered evidence of one or two social domains associated with contraceptive use without using a framework. More research and multiple analysis are necessary to delve deeper into the association of immediate social domains with contraceptive use among vulnerable population and confirm the links and associations. Additionally, early social environment and childhood experiences have been shown to be linked with behaviors and health outcomes in later adulthood (Chin et al., 2000; Sheldon Cohen et al., 2010). This type of association might also be a possibility for contraceptive use and its consistency. Exploring longitudinal links between social domains

and contraceptive use can help the program planner to intervene sooner and create immense impact in increasing the use of contraception in the adolescence and young adulthood. This dissertation fills an important gap in the literature by identifying the cross-sectional and longitudinal associations of social domains with ever use and consistency of contraceptive use.

This study also explores the possible mediation effect of self-efficacy between social domains and contraceptive behavior. If there exists a mediation effect of contraceptive self-efficacy, this construct can be another malleable concept that can be targeted in school-based initiatives. Based on the outcomes, future intervention programs can plan and implement school and community level programs targeting specific pathways related to SDH. The research findings from this study may ultimately inform interventions and policies and educational environment that revolves around contraceptive use among adolescents and young adults. Results of this study can advance the application of the concept of Social Determinants of Health and push for increase in federal grant funding for interventions that address key determinants and issues of SDH.

Operational Definitions

Social Determinants of Health: The environmental conditions where people are born, live, learn, work and age. This cumulative environmental aspects affect a wide range of health condition, function, wellbeing, and quality of life outcomes (USDHHS, 2021).

Contraceptive methods: Various devices, sexual practices, hormones, drugs or surgical procedure that are used to intentionally prevent conception (Jain & Muralidhar, 2011).

Contraceptive Self-efficacy: A conviction that one can control sexual and contraceptive situations to achieve contraceptive protection (Longmore et al., 2003).

Poverty: The poverty level is based on monetary income before taxes and does not include noncash benefits such as public housing or food stamps (US Census Bureau, 2021).

Employment Status: The status indicates whether an individual in the civilian non-institutional population worked for pay or profit within the last week or were temporarily absent from work in the last week (U.S. Census, 2021).

Housing Instability: Housing instability includes all the challenges related to housing conditions such as having trouble paying rent, overcrowding, moving frequently, staying with relatives, or spending a bulk of income on housing (Frederick, Chwalek, Hughes, Karabanow, & Kidd, 2014).

High School Graduation Rate: Percentage of public high school freshmen who graduate with a regular diploma within 4 year of starting 9^{th} grade (U.S. Department of Education, 2021).

Enrollment in Higher Education : Any type of education after high school including 2-year college, certificate programs, professional programs and 4-year college (USDHHS, 2021)

Language and Literacy: Language is defined as "the method of human communication, either spoken or written, consisting of the use of words in a structured and conventional way" while literacy is "the degree to which individuals have the capacity to obtain, process and understand basic information needed to make decisions" (Kindig, Panzer, & Nielsen-Bohlman, 2004).

Social Cohesion: Strength of relationships and the sense of solidarity among community members (Kawachi & Berkman, 2000).

Perceptions of Discrimination: Perceptions of discrimination is when people themselves perceive or experience discrimination due to characteristics such as their gender, ethnicity, age, sexual orientation or disability (Andriessen, Fernee, & Wittebrood, 2014).

Civic Participation: Involvement in wide range of formal and informal activities including voting, volunteering, group activities, and community gardening (Abbott, 2010).

Access to Health services: Timely use of personal health services to achieve the best possible health outcomes (Millman, 1993).

Health Literacy: “The degree to which individuals have the capacity to obtain, process, and understand basic health information needed to make appropriate health decisions” (Kindig et al., 2004).

Access to Primary Care: Provision of integrated and accessible health care services by clinicians who can attend to personal health care needs and develop sustained partnership with patients and practice in the benefit of family and community (Donaldson, Yordy, Lohr, & Vanselow, 1996).

Quality of Housing: Include the physical condition of a person’s home as well as the social and physical environment in which the home is located (Bonnefoy, 2007).

Crime: Includes violent crimes, property crimes and victimization due to violence (USDHHS, 2021).

Violence: An extreme form of aggression such as assault, rape or murder. (American Psychological Association, 2021)

Environmental Conditions: Safe environmental conditions include clean air, uncontaminated water and appropriate air temperature (USDHHS, 2021)

Access to Healthy Foods : The ability of an individual or household to acquire food, either through own production or purchasing from market (Rose, 2010).

Incarceration: Being under the jurisdiction of state or federal prisons or held in local jails (Glaze & Parks, 2011).

Chapter 2. Literature review

Correct and consistent use of contraceptive methods has been advised as an important preventative approach against STDs and unintended pregnancies (Moore, 1995; Parrish & Ryan, 1996). This literature review briefly describes the types and measures of contraceptives and discuss the two behavioral measures focused on this dissertation: contraceptive ever-use and use consistency, followed by a review of contextual factors associated with contraceptive use. This review describes the concept of social determinants of health, its varied versions used in studies and explain the linkage between social determinants of health and contraceptive use that have been explained in the literature so far. Additionally, the concept of contraceptive self-efficacy and its relationship with ever-use and consistent use of contraceptive methods are discussed.

Contraceptive Use

Types of Contraceptives

Since unintended pregnancy in the United States is one of the most critical reproductive health issues (Yazdkhasti et al., 2015), and the rate of unintended pregnancy has been consistently the highest among women aged 15 to 24 years old (Finer & Zolna, 2016), numerous studies have studied the contraceptive use among this age group (Kim et al., 2011; Manlove & Terry-Humen, 2004; Morrison et al., 2016). Of the numerous types of contraceptive methods, some are prescribed by the physician, such as Intra Uterine Devices (IUD) and Oral Contraceptive Pills (OCP), while some are easily available over the counter in the supermarkets or online store such as condoms. Among adolescents, birth control pills and condoms are the most commonly used contraceptives and studies have generally explored the use/non-use of them (

& Manczak, 2013; J. Manlove, Ikramullah, et al., 2008; Wado, Gurmu, Tilahun, & Bangha, 2019). In young adults, in addition to condom and birth control pills, studies explored the use of implants as a contraceptive method for young women aged 18 and above, which have greater efficacy in preventing pregnancies for significantly longer period of times – 3 or 5 years (Pritt, Norris, & Berlan, 2017; Wado et al., 2019). A few studies explored the dual use of contraception where additional use of condoms are warranted in addition to other hormonal contraceptive methods such as implants (Sieving et al., 2007; Tyler et al., 2014). Dual method use promotes effective prevention against both STDs and pregnancies. In the literature related to contraceptive use, the use of above-mentioned methods is explored.

In some studies, only the use of modern contraception is considered to be contraceptive devices (Crawford et al., 2021; Olika, Kitila, Terfa, & Olika, 2021; Sserwanja, Musaba, & Mukunya, 2021). Modern methods of contraception include barrier methods (e.g., condoms), hormonal methods (e.g., OCP), implants (e.g., IUD) and surgical methods (e.g., female sterilizations and male sterilizations). Modern methods of contraception have higher effectiveness and are more reliable in preventing unintended pregnancies when compared to traditional methods, such as rhythm method and calendar method. Due to its effectiveness and efficacy in preventing unintended pregnancies, studies usually focus on modern method while studying contraceptive use.

Measures

Alike the variation in the categorization of contraceptive methods across the published research, multiple types of measures were used to document the use or non-use of contraceptive methods. Studies explored the ever-use of contraceptive methods (J. Manlove, Ikramullah, et al., 2008; J. Manlove et al., 2007), self-reported use of condoms (Pinchoff et al., 2017), use or non-use of methods of contraception in their first sexual intercourse (Gomes et al., 2008), type of contraception used in their last sexual intercourse (Kim et al., 2011),

frequency of the contraceptive use in the past 12 months (Amialchuk & Gerhardinger, 2015; Kao & Manczak, 2013; Morrison et al., 2016; Orihuela et al., 2020), and whether the participants have used two types of contraception – dual use in their last intercourse (Sieving et al., 2007; Tyler et al., 2014). Among the research that are based on Add Health study, most of the studies have used one or multiple measures related to ever-use of contraceptive methods, type of contraceptive used and frequency of contraceptive use during sexual intercourse. Single time measures, such as use of contraception in the recent intercourse or type of contraceptive used in last vaginal intercourse, does not give much information about overall safe sex behavior of the participants. In assessing the behaviors that prevent unintended pregnancies, ever-use and frequency of contraceptive use can help researchers to indicate participants' past behavior, pattern, and consistency of contraceptive use of a person.

History of Social Determinants of Health

While exploring the use of contraceptive methods, it is important to identify the larger social factors that impact individuals' decisions and use related to contraception. There are pathways other than biological factors such as structural and behavioral factors that influence the use of contraceptive methods across population sub-groups. Identification of these factors and links within social domains help program planners to build interventions that can reduce transmission of STIs and unintended pregnancy in the most vulnerable population. In this study, social domains are examined within a framework of Social Determinants of Health (U.S. Department of Health and Health Services (USDHHS)). In the section below, I further discuss SDH, its history, its definitions, and varied versions as described by prominent organizations.

The specific vocabulary of "social determinants of health" (U.S. Department of Health and Health Services (USDHHS)) came into use in the mid 1990s (Tarlov, 2002). This was after the enormous paradigm shift when health professionals recognized disease as more

of an outcome of social causes than individualistic biological factors (World Health Organization (WHO), 2010). After 1970s, when various "vertical" programs—narrowly focused and campaigns driven interventions such as malaria and tuberculosis elimination program were proven to be a costly failure (Litsios, 1997), leading scholars and public health experts began to advocate for addressing social, economic, and political causes of poor health (WHO, 1978). Officially, in 1978, at the International Conference on Primary Healthcare held at Alma-Ata, Kazakhstan emphasized the need for a comprehensive health strategy that also addresses social conditions along with providing health care services. The popularity of SDH quickly diminished in 1980s because of the economic conditions focused on privatization and free markets (Werner, Saunders, & Schweiger, 1997). Nevertheless, the concept of SDH received more recognition in public health during 2000s when developed countries like United Kingdom and developing countries such as Mexico were successful in narrowing health gaps by investing in SDH (Bakker & Mackenbach, 2003). Upon the establishment of the Commission on Social Determinants of Health (CSDH) in 2005 under the supervision of the World Health Organization, government agencies and health organizations around the world began to take notice and develop initiatives incorporating domains of social determinants of health (WHO, 2010).

Definitions of Social Determinants of Health

Although there are no single accepted definition of social determinants of health, the concept has gained popularity in the recent years and thus, used widely by public health experts and program planners (Ansari, Carson, Ackland, Vaughan, & Serraglio, 2003; USDHHS, 2021; WHO, 2021) In the section below, I have compiled varied definitions and frameworks of SDH as endorsed by the prominent organizations in public health. All the definitions and concept are based on the premise that social factors are closely linked with health behaviors and outcomes.

Concepts Endorsed by Organizations

World Health Organization (World Health Organization (WHO)). The World Health Organization (World Health Organization (WHO)) is a major proponent of endorsing, examining, and implementing the concept of SDH on a global scale. The main agenda of WHO to use SDH was to reduce longstanding global inequities. WHO includes all the non-medical factors that influence health outcomes under SDH (WHO, 2021). The non-medical factors endorsed by WHO include forces and systems such as economic policies, social norms, developmental agendas, social policies, health policies and political dynamics. WHO defines SDH as "the conditions in which people are born, grow, work, live, and age, and the wider set of forces and systems shaping the conditions of daily life" (WHO, 2021). Some key variables incorporated by WHO that influence health equity are income and social protection, education, unemployment, and job insecurity, working life conditions, food insecurity, housing and the environment, early childhood development, social inclusion & non-discrimination, structural conflict, and access to affordable health services. Research have shown that these SDH variables account for between 30-55% of health outcomes (WHO, 2021).

To promote awareness and action utilizing SDH, the WHO Regional Office for Europe produced a book titled *The Solid Facts* which described social determinants of health in Europe (Wilkinson & Marmot, 1998). Later, a second edition of this work was published in 2003 with updated evidence (Wilkinson & Marmot, 2003). In this publication, the concept of SDH outlines 10 most powerful determinants of health standards in modern world which are social gradient, stress, early life, social exclusion, work, unemployment, social support, addiction, food, and transport. This version of SDH uniquely combines economics, sociology and psychology with human health and wellness, and provides a framework to tackle some of the material and social injustices beyond policies.

The establishment of the Commission on Social Determinants of Health (CSDH) in 2005 under the leadership of the former WHO Director General, Dr J.W.Lee, further promoted health equity pertinent to global scenario (WHO, 2010). With three years of intensive networking and information gathering, the CSDH reported that a huge emphasis is needed on policies and interventions that can decrease social stratification, decrease the specific exposure to health-damaging factors, lessening the vulnerability of disadvantages population, and intervening through health care to reduce disparities in health outcomes (WHO, 2010). The CSDH framework stresses that socioeconomic position is at the root case of health inequities at the population level. The CSDH framework is aligned to SDH concept of WHO where it encourages the public health experts to get involved in health politics, to develop a flexible system facilitating access, participation and intersectoral coordination to reach citizens in varied socioeconomic positions (Solar & Irwin, 2010). The intersectoral policy making and implementation, and participation of affected communities with the government agencies to empower the civil society and community are the most unique characteristics of this framework, which were not discussed in the previous version of SDH.

The CSDH framework was further adopted by the member states of World Conference on Social Determinants of Health in Rio de Janeiro, Brazil in 2011 and in 65th World Health Assembly in Geneva, Switzerland in 2012. Evidence of WHO's commitment in expanding and implementing the SDH in global arena can be found in various research, reports, and publications (WHO, 2021).

Centers for Disease Control and Prevention (CDC). The website of CDC uses the WHO definition of social determinants of health with a minor change. CDC defines social determinants of health as "the conditions in the places where people live, learn, work, and play that affect a wide range of health risks and outcomes"(CDC, 2021). CDC also acknowledges the five key areas of SDH as outlined by Healthy People 2030.

CDC encourages the use of state level and national level data set such as Chronic Kidney Disease (CKD) Surveillance System and National Center for HIV, Viral Hepatitis, STD and TB Prevention (NCHHSTP) AtlasPlus to explore domains related to SDH. Few notable areas of research conducted by CDC authors on a range of SDH topics are under mental health, substance use, HIV, chronic illness, obesity, abuse, and violence (CDC, 2020). Programs across CDC recognize the importance of SDH and thus, work in partnership with the communities and institutions across various sectors such as housing, education, and transportation services that can have an impact on health and health outcomes.

Specifically related to contraception, CDC, the federal Office of Adolescent Health (Ahinkorah, Seidu, et al.) and the Office of Population Affairs collaboratively designed and implemented evidence-based, innovative, and community-based reproductive health care services targeted at young adolescents (CDC, 2020) . These initiatives were implementing programs related to contraceptive access, confidential counseling, and preventative school health services.

U.S. Department of Health and Human Services (U.S. Department of Health and Health Services (USDHHS)). Healthy People initiative under the USDHHS includes ambitious and measurable 10-year health related objectives (USDHHS, 2021). Healthy People 1990 was the first set of initiative that focused on decreasing mortality and increasing independence among older adults. Since then, the United States has made significant progress in public health priorities at local, state, and national levels and improved the health and well-being of people with program's consecutive initiatives. The latest iterative of the Health People initiative is Health People 2030 which was launched in August 2020.

Healthy People 2030 uses SDH framework to achieve the leading health indicators that include various factors and behaviors related to morbidity and mortality in the United States (USDHHS, 2021). The definition of SDH enforced by USDHHS Healthy People

initiative is, “the conditions in the environments where people are born, live, learn, work, play, worship, and age that affect a wide range of health, functioning, and quality-of-life outcomes and risks.” Under SDH, five domains are included which are Economic Stability, Education, Health and Health Care, Neighborhood and Built Environment, and Social and Community Context.

Figure 4

Social Determinants of Health

Reprinted from “Social Determinants of Health,” 2021, U.S. Department of Health and Human Services, Office of Disease Prevention and Health Promotion.

Table 2

Components of Healthy People 2030 social determinants of health framework

The five key domains of social determinants of health endorsed by Healthy People 2030 are:

- Economic Stability
    1. Poverty
    2. Employment
    3. Food insecurity
    4. Housing instability
- Education
    1. High School Graduation
    2. Language and Literacy
    3. Enrollment in Higher Education
    4. Early Childhood and Development
- Health and Health Care
    1. Access to Health care
    2. Access to Primary Care
    3. Health Literacy
- Neighborhood and Built Environment
    1. Access to foods that support healthy eating patterns
    2. Quality of Housing
    3. Crime and violence
    4. Environmental conditions
- Social and Community Context
    1. Social Cohesion
    2. Civic Participation
    3. Discrimination
    4. Incarceration

Note: Reprinted from "Social Determinants of Health," 2021, U.S. Department of Health and Human Services, Office of Disease Prevention and Health Promotion.

Healthy People 2030 social determinants of health framework uses the same critical components/key issues as described in Healthy People 2020. Since the key issues that make up the underlying factors of SDH are unchanged, the key issues have not been redefined in the webpage of Healthy People 2030 under USDHHS. Each of the five determinant areas are presented in the *Table 1* with inclusion of critical components/key issues as proposed by Healthy People 2020/30.

York University Conference – Canadian Perspectives. A Canadian model of social determinants of health was developed and announced at the 2002 York University Conference in Toronto (Raphael, 2009). Recognizing that the living conditions such housing and food security are related to health indicators, rather than biomedical indicators, are the primary determinants of health, twelve key areas under SDH were identified by the organizers of the York University which are: aboriginal status, early life, education, employment, food security, fender, health care facilities, housing, income and its distribution, social safety net, social exclusion, and unemployment and employment security (Raphael, 2009).

Women's Health West. The Australian model of SDH was put together for sexual and reproductive health by Women's Health West organization in 2012. This report was influenced by the WHO Commission on Social Determinants of Health 2010 report and includes subsections of public policy, cultural norms, poverty and economic status, violence and discrimination, gender norms, and access to affordable health care services (Taylor, 2016).

Comparison of Definition of SDH

Although there were a few subtle differences in the definition and concepts incorporated under SDH (e.g., inclusion of the concept of quality of life in USDHHS's definition, other forces and systems related to health in WHO's definition), all the definitions

from different organizations are inspired from WHO's definition of SDH. Both similarities and differences can be found when comparing definitions and frameworks of the SDH.

Various concepts of SDH endorsed by organizations and countries acknowledged the impact of social domains on health outcomes and recognized the SDH as a new approach to reduce global health disparities. The domains included in all the frameworks discussed earlier present behaviors and health outcomes as a result of factors beyond individual characteristics. Although definitions vary in some extent, the factors commonly included in the concepts are environment, economic situation, and health services (CDC, 2021; USDHHS, 2021; WHO, 2021).

Comparing the list included under the SDH domains, it was unclear where all definitions and concepts provided by the aforementioned organizations are valid domains, or simply a list of examples. For example, on the website of CDC under National Center for Chronic Disease Prevention and Health Promotion (National Center for Chronic Disease Prevention and Health Promotion (NCCDPHP)), CDC uniquely positioned five key determinants which are: built environment, community clinical linkages, food and nutrition security, social connectedness, and tobacco free policy (National Center for Chronic Disease Prevention and Health Promotion (NCCDPHP), 2021). These domains are different than what is included under CDC's definition of SDH, Healthy People SDH framework or WHO concept. The key difference between definitions is what exactly is included as a social determinant under each framework, and even within a framework endorse by an organization, the domains change as per the programs. Some concepts are overlapping, while some miss areas from one definition to the next, making it difficult to determine which specific areas are important enough to act on.

Out of five frameworks described earlier, the Healthy People 2030 Framework is the only model that describes key issues/critical components and explicitly mentions what key

issues to focus on within each domains (Healthy People 2030). Furthermore, detailed operation definition of each key areas of SDH are presented on the website of *Healthypeople.gov* with elaborated examples and results from peer-reviewed studies. To document changes in the health indicators associated with each key issues, Healthy People 2030 also has numerous measurable objectives pertinent to different age-groups/population groups under each SDH domains (U.S. Department of Health and Health Services (USDHHS), 2021).

Choice of Theoretical Framework for the Present Study

Frameworks are one way to capture the link and describe the pathways between social determinants of health and health outcomes. For this dissertation study, the Healthy People 2030 SDH Framework is utilized because this is the only framework that has a firmer definition of all specific key issues included in the domains. Additionally, this framework does not have conflicting versions and includes measurable objective and goals related to each critical areas, making the changes detectable. The Healthy People 2030 SDH Framework have five unique domains: Economic Stability, Education, Social and Community Context, Health and Health Care, and Neighborhood and Built Environment. Each of these domains include three to five key issues that needs to be addressed to reduce health inequity (Table 1). In the next section, the link between SDH domains and contraceptive use are described based on published studies.

Links between Social Determinants of Health and Contraceptive Use

From a thorough literature search, I identified 41 unique studies that examined contraceptive use and its association with one or more key issues related to domains of SDH. All studies examined cross-sectional relationships. Exploring the empirical links between at least one social domain and contraceptive use, 40 of 41 studies reported at least one statistically significant association. These research has explored the association of

contraceptive use with social domains that fell into the categories of Education, Economic Stability, Health and Health Care, and Social and Community Context. Of the 41 studies included, only one study has utilized the Healthy People 2030 SDH framework to assess the links with adolescent contraceptive use and social domains(Maness, Thompson, & Lu, 2022). Apart from the stated study, none of the other published studies have used any framework to exclusively discuss SDH domains related to contraceptive use. Broad models such as those endorsed by WHO have not been published with application to contraceptive use.

Economic Stability

A total of 26 studies have explored the link of contraceptive use with some measures related to economic stability. The studies from Sub-Saharan Africa region have used household wealth quintile to indicate economic status of the participants (Ahinkorah, Hagan Jr, et al., 2020; Ahinkorah, Seidu, et al., 2020; Crawford et al., 2021; Kabagenyi, Habaasa, & Rutaremwa, 2016; Oppong et al., 2021). These studies have documented higher odds of contraceptive use among participants from the richest wealth quintile when compared to the poorest wealth quintile (Ahinkorah, Hagan Jr, et al., 2020; Ahinkorah, Seidu, et al., 2020; Kabagenyi et al., 2016; Sserwanja et al., 2021). Similar association is also documented in the use of Long Acting Reversible Contraceptives (LARC), such as implants, in Ethiopia (Wado et al., 2019). One study included item related to receipt of welfare as a measure of poverty level and found no significant association between receiving welfare and any use of contraception (Tyler et al., 2014). Additionally, current employment status was also examined as an indicator of economic stability in few of the studies. There are mixed results related to impact of employment status on the use/non-use of contraception. Few of the studies have documented no significant link between employment status and contraceptive use (Chola et al., 2020; Olika et al., 2021), however, Pinchoff et al., 2017 reported a 9% decrease in non-use of male condoms when the participants are employed. Additionally, a

study from Ethiopia also documented increased odds of LARC use among those women who are employed (Ebrahim, Zeleke, & Muluneh, 2021). A recent study used “having lived in a foster care” as a proxy measure for assessing housing instability but found no significant association with the use of effective contraceptive methods(Maness et al., 2022). The same study also reported insignificant link between food insecurity and use of any contraceptive methods. Overall, some measures of economic stability are associated with contraceptive use, such as family annual income and wealth, while other measures, such as housing instability and food insecurity, are not linked with contraceptive use.

Education

Out of 41 studies, 25 studies incorporated some measures related to education. Out of 4 critical areas under education, items related to *High School Graduation, Language and Literacy,* and *Enrollment in Higher Education* are included in the studies while none of the studies explored the influence of *early childhood and development* in relation to the contraceptive use. Secondary education/higher education increased the odds of use of contraception and/or modern contraceptives in most of the studies published from Sub-Saharan African region (Ahinkorah, Hagan Jr, et al., 2020; Chola et al., 2020; Crawford et al., 2021; Hounton et al., 2015; Oppong et al., 2021). Contrarily, the level of education was not significantly associated with LARC use and dual use of contraception (Tyler et al., 2014; Wado et al., 2019). Only two studies published based on National Survey of Family Growth (NSFG) dataset in the U.S. segregated the educational level by high school graduation. According to Jaramilo et al., 2017, higher education enrollment or enrolled in some college significantly increase the use of dual contraception at the last sexual intercourse. Similarly, Fin et al., 2021 reported higher odds of consistent use of contraception among participants with some college education when compared to participants with less than high school education. A recent study published in 2020 which employed neighborhood level constructs

quantified education as the higher level of education completed by household members (Orihuela et al., 2020). Aligning to prior studies, this study too showed a significant association between highest household level education and contraceptive use. In relation to *Language and literacy*, adolescents who spoke English than Spanish in home had higher odds of using a moderate effective contraceptive methods than not using one(Maness et al., 2022). Overall, most of the studies concluded that higher education level, enrollment in higher education, and using English as their language at their homes increased the odds of contraceptive use.

Health and Health Care

Sixteen studies out of the 41 studies included items/questions related to health and health care while assessing contraceptive use in their target population. Health and Health care includes three distinct key issues: *access to health care*, *access to primary care*, and *health literacy*. In general, studies included items related to health insurance coverage, access to health care facilities, access to family planning counselling, and receipt of sex education as measures to assess health in relation to contraceptive use. Young women and adolescents who reported to have health insurance in the past 12 months increased the odds of use of prescribed contraceptive methods (Riddell, Taylor, & Alford, 2018) and are more likely to use contraception consistently (Finn, Douglas-Hall, & Jones, 2020). In studies conducted outside the US, such as Ethiopia, Ghana, and Kenya, access to health care has been measured by asking whether the location of the nearest health facility is convenient for the participants (Nyarko, 2020; Olika et al., 2021). These studies have reported that convenient location of health facility have a considerable positive effect on utilization of modern contraceptive methods.

The comprehensiveness of sex education received in the school also influences the attitude and use of contraceptive methods among adolescent and young adults. When schools

offer comprehensive sex education, in which abstinence is promoted, but also provide information and resources about contraceptive options and STIs, adolescents are more likely to have protected sexual intercourse (Isley et al., 2010). Two studies have explored the link between different types of sex education and contraceptive use. Both studies reported significant association between comprehensive education and use of reliable contraceptive use (Isley et al., 2010; Jaramillo, Buhi, Elder, & Corliss, 2017). Older adolescents who had access to family planning counselling service or visited health facilities in the past 12 months had higher odds of utilizing contraception compared to those who did not have the access (Gomes et al., 2008; Olika et al., 2021). Few studies have also accounted for interaction with health care provider as a factor under health and health care and documented that this type of interaction boosts the use of modern contraception (Ochako, Temmerman, Mbondo, & Askew, 2017; Olika et al., 2021). Overall, past studies suggest that having health insurance, access to primary care, exposure of sex education in school, and family planning counseling increase the odds of using contraceptive methods among adolescents and young adults.

Social and Community Context

Only two studies so far explored the connection between community context and contraceptive use. Community context was measured by perceived sense of belongingness in the community and its association with condom use was explored (Marshall, Koehoorn, & Shoveller, 2010). Result from cross-sectional survey taken by 3,974 Canadian adolescents shows that non-use of condom at last intercourse is significantly associated with a weak sense of belonging to the community. Another study published in 2020 used a measure of social contact to quantify social context (Orihuela et al., 2020). The number of social contacts was not found to be significant with any sexual outcomes measured including contraceptive use. Out of 4 key issues of social and community context, only *social cohesion* was assessed by

the study. None of the other three key issues were measured by any of the included 41 studies in our literature review.

Neighborhood and Built Environment

Only one study explored the link between the neighborhood and built environment and contraceptive use (Orihuela et al., 2020). This study used neighborhood disorder measures which included multiple questions related to physical disorder (e.g., trash or broken glass in neighborhood) and social disorder (e.g., people drinking alcohol openly in the neighborhood). However, this composite neighborhood disorder variable did not have any significant association with frequent use of contraception.

Contraceptive Self-efficacy

Bandura's social learning theory shed light on the importance of self-efficacy in association with change in behavior. Bandura's work on self-efficacy suggests that individuals' beliefs and expectations about their ability to execute specific activities, which reflect their control over a situation, affect their willingness to initiate and engage in the behavior (Bandura, 1992). As consistent and correct use of contraceptive use is a behavior, which needs to be repetitive, there is an essential need of planning, preparation, decision-making regarding contraceptive responsibility. Individuals with higher self-efficacy believe that they have enough control to execute the behaviors when needed to produce desired outcomes (Gecas & Schwalbe, 1983). Thus, contraceptive self-efficacy refers to "the conviction that one can control sexual and contraceptive situations to achieve contraceptive protection" (Longmore et al., 2003, p. 47). In the context of contraception, it is important to understand self-efficacy for two reasons. First, self-efficacy increases the willingness to initiate behavior and thus, it is critical for behavioral change. Second, this concept of self-efficacy is malleable, unlike demographic characteristics, and can be theoretically incorporated in intervention programs to boost behavior change (Gilchrist & Schinke, 1983).

A few published studies have explored the influence of contraceptive self-efficacy on contraceptive use. A study based on Add Health data reported that higher contraceptive self-efficacy increases the odds of using condoms and other non-condom contraceptive methods when compared to non-use of any type of contraceptive methods (Longmore et al., 2003). Similarly, a study conducted in Western Nigeria reported individual with higher contraceptive self-efficacy were 3.1 times more likely to use modern contraceptive methods compared to participants having lower self-efficacy score (Crawford et al., 2021). These results show that contraceptive self-efficacy has a positive and significant influence on the contraceptive use among adolescents and young adults.

There are multiple contextual factors that have an influence on individual's contraceptive self-efficacy. Alike chronic disease management, having self-efficacy for contraceptive use involves a series of actions, including identifying a health care provider or a pharmacy, attending health care visits, communicating with the provider, commuting to collect prescriptions, and visiting for refills or placement of a device (Hamidi et al., 2018). Most of these activities involve interaction with social domains such as health services, financial abilities, and literacy. Although there is a paucity of research exploring the predictors of contraceptive self-efficacy, three studies examined and recognized the link between contraceptive self-efficacy and social domains such as parent income, parent education and family connectedness (Kao & Manczak, 2013; Longmore et al., 2003; Shneyderman & Schwartz, 2013). One of the studies used mediational analysis to confirm that contraceptive self-efficacy acts as a mediator between parent-adolescent relationship quality and condom use at most recent intercourse (Shneyderman & Schwartz, 2013). This study suggests the possibility that self-efficacy could mediate between social factors and contraceptive use.

National Longitudinal Study of Adolescent to Adult Health (Add Health) and brief history of sex education

The National Longitudinal Study of Adolescent to Adult Health (Add Health) is a longitudinal study of a nationally representative sample of adolescents which started during the 1994-1995 school year (Harris et al., 2019). These adolescents have been followed for five waves, the latest being in 2016-2018. Over the years, Add Health collected information regarding demographic, social, behavioral, psychosocial, environmental aspects of adolescents through their growing up phase.

Regarding contraceptive use, Add Health collected information regarding contraceptive use, motivation for birth control, parents' attitudes towards participants' use of contraception, and contraception self-efficacy at Wave I (1994-1995). In those times, the concept of sex education was far different than what it is today. The pandemic of HIV/AIDS after 1981 shaped the need for formal instruction on condoms and sexually transmitted infections (Hall, Sales, Komro, & Santelli, 2016). As a result, adolescents' receipt of sex education improved greatly between 1988 and 1995 (Lindberg, Ku, & Sonenstein, 2000). However, in the late 1990s, abstinence only until marriage (AOUM) was adopted as a single approach by the federally funded program to teach adolescents about sexual and reproductive health (Boonstra, 2009). With the assistance of various domestic and foreign aid programs, 49 out of 50 states promoted AOUM in the classroom where students were taught about puberty, STDs, pregnancy prevention strategies, with the mention of abstinence (Landry, Kaeser, & Richards, 1999). Because local school boards controlled the exact content of sex education in each school district, most public schools sparsely covered the concepts of birth control methods, abortion, and homosexuality. Although no accurate information was found for the time period of 1994-1995, a study published in 2002 reported that 68% of public

schools described their sex education as “comprehensive” sex education, rather than abstinence-based education (Kaiser Family Foundation, 2002).

There has been a positive change in the field of sex education after 2000s as advocates increased their support for comprehensive sex education and strengthen the argument for school-based health clinics which provide easy access to birth control and education related to adolescent pregnancy and STD. However, comprehensive sex education is not an option for majority of schools in many states of the U.S.

Summary of Findings

Numerous studies have explored the factors related to contraceptive use and frequency of contraceptive use. Researchers have identified risk factors, protective factors and contextual factors associated with use of contraception, such as condoms, birth control pills and implants, among sexually active adolescents and young adults. Since various social domains and deep-rooted contextual factors, such as economic background, neighborhood context, educational background, and access to health care, can impact the use and frequency of contraceptive methods among the vulnerable subgroups of population, a thorough understanding of the link between these variables are needed to intervene and bring behavioral change, guided by a comprehensive framework, such as SDH. There is evidence that some social domains are associated with contraceptive use, however no study have explored all relevant social domains, and only one study employed the SDH framework to comprehensively measure the association of social domains on contraceptive use among adolescents (Maness et al., 2022). Also, as published reviews suggest that social domains and socio-economic indicators of early childhood are linked with health outcomes (such as cancers, heart diseases) and behaviors (substance use) manifesting in adulthood, this types of association may be possible and need to be studied when considering contraceptive use among young adult population (Galobardes et al., 2004). To provide evidence of longitudinal

association, there is a need to explore the link between social domains in earlier time point and contraceptive use in the later time point.

In order to address this literature gap and examine the factors associated with contraceptive use and its consistency, this study employs the Healthy People 2030 SDH framework to understand how various social determinants influence the ever-use and consistent use of contraception among young adults using a nationally representative data set. The link between 5 key domains of social determinants of health and ever-use and consistency of contraception is also explored in the longitudinal setting. As contraceptive use is a complex behavior, and past research has provided mixed results regarding social domains and contraceptive use, there is likelihood that some mediating variable might be altering the association. To explore this possibility, this study also explores whether contraceptive self-efficacy acts a mediator between social domains and contraceptive use and its consistency.

Chapter 3: Methods

The following methods section collectively outlines the research methodology for three separate studies related to social determinants of health and young adults' use and frequency of use of contraceptive methods. The methods section uniquely relevant to each study is separately described in later chapters. The purpose of Study 1 is to examine the cross-sectional association of social determinants of health and contraceptive ever-use and consistency of use among young adults (ages 18-24). Study 2 explores the longitudinal association of social determinants of health during adolescence and contraceptive ever-use and consistency of use among young adults. The purpose of Study 3 is to explore if the contraceptive self-efficacy acts as a potential mediator between each social domain and contraceptive ever-use and consistency of contraceptive use. This dissertation study utilizes the National Longitudinal Study of Adolescent to Adult Health dataset, commonly known as Add Health.

Secondary Data Source

Developed in the 1990s, the Add Health study is a longitudinal study developed by the University of North Carolina Population Center with the purpose of understanding the causes of adolescent health and health behavior by emphasizing on the multiple contexts associated with adolescent life. This is a comprehensive study which measure factors of adolescents including social, economic, psychological, and physical measures of health. Additionally, contextual information are gathered on school and family environments, peer relationship dyads, parents, siblings, neighborhoods and communities in which young people live/live with (Harris et al., 2019). Add Health is funded by grants from the Eunice Kennedy Shriver National Institute of Child Health and Human Development with co-funding from 23 different other federal agencies and foundations. With this support, the Add Health project is the largest and most comprehensive longitudinal study of adolescence and young adults that

has ever been conducted, with a total of 5 waves. More than 8,000 journal articles, presentations, manuscripts, book chapters, book and dissertation projects have been published utilizing this longitudinal dataset till date.

Add Health is a nationally representative school-based cohort study started in 1994. The primary sample frame used by Add Health is derived from Quality Education Database (QED). From this sampling frame, a stratified sample of 80 high schools with probability proportional to size were selected (Harris, 2013). Schools included must have an 11th grade and more than 30 students. For each high school selected, one of its feeder schools (typically a middle school) with probability proportional to the student size of the high school were identified and recruited. Schools were stratified by region, school type, ethnic mix, and size. Of the originally selected schools, more than 70% agreed to participate in the study. Within each stratum, replacement schools were selected until an eligible school or school-pair was found. Overall, 79% of the schools that were contacted agreed to participate in the study. The number of students varied from fewer than 100 to more than 3,000 in the chosen schools. Specific sub-populations were oversampled for the purpose of gathering enough data on vulnerable and rare populations such as twins, unrelated adolescents living in the same household, and disability samples.

Add Health has gathered five waves of data since 1994-95, the latest one collected in 2016-18 – Wave V with 12,300 respondents who were within the age range of 31 to 42 years. In the section below, I explain the details of each wave of data pertinent to my dissertation study: Wave I, II and III.

Wave I: Adolescent In-school survey

In 1994, in-school questionnaires were administered to over 90,000 students from 132 schools selected in the sample which belonged to one of 80 randomly selected communities (Harris, 2013). This data collection with students took approximately one 45-60 minutes class

period. The questions related to school context, friendship networks, school activities and a variety of health conditions were asked in the in-school questionnaire. The additional purpose for the in-school questionnaires was to identify samples of individuals who are rare but are in themselves a crucial category, for example minority population (Cuban, Puerto Rican) and adopted adolescents.

Wave I: Adolescent In-home interview

From the rosters obtained from all enrolled students in each school obtained from Adolescent in-school survey, a sample of adolescents were chosen for a 90-minute in-home interview in 1994 which constitute the Wave I in-home sample. After schools were stratified by region, urbanicity, school type, ethnic mix and size, a random selection of about 17 students from each strata were chosen to yield a total of about 200 students from each pair of schools, which consists of high school and its feeder schools –typically a middle school (Harris, 2013). A nationally representative sample of 12,105 adolescents who were enrolled in grade 7-12 are enrolled in the core in-home sample. To form this core sample, students were stratified in each school by grade and sex, followed by a random selection of about 17 students per strata which yields a total of about 200 adolescents from each school pair. Supplemental samples based on ethnicity (Chinese, Cuban, Puerto Rican), genetic (twins, full siblings, half siblings, and unrelated adolescents dwelling in same household), adoption status and disability were included in this data collection. Additionally, black adolescents with highly education parents were also oversampled. A total of 20,745 adolescents were enrolled in this wave which includes the core sample plus the supplemental samples.

Wave I: Parent In-home Survey

In addition to adolescents, a parent of the adolescent was also enrolled in Wave I for a 30 to 40 minute interviewer-assisted interview in 1995 (Harris, 2013). Of all the parents of participating adolescents contacted, over 85% of them completed the parental interview. A

parent, usually the resident mother, was interviewed regarding health conditions, marriage and relationships, their civic participations, economic situation and assistance, parent-adolescent communication and connectedness, and neighborhood characteristics.

Wave II: Adolescent In-home Survey

A follow-up study was conducted in 1996 which enrolled all students in grade 7 through 11 in Wave I in-home survey with exclusion of 12th graders and who were not a part of genetic sample at Wave I. A total of 14,738 adolescents were enrolled in Wave II (a response rate of 88.6% of Wave I in-home survey). The second wave included similar questions and items as the Wave I In-home survey.

Wave III: Adolescent & Young Adult In-home Survey

The fundamental purpose of Wave III was to understand how adolescents have transitioned to adulthood and to map early trajectories out of adolescence in health, social relationships, financial responsibility and achievements (Harris, 2013). This dataset collected in 2001-2002 also serves as a basis to document how adolescents' experiences and behaviors result in behavior, decision making and health outcomes while transitioning to the adulthood. With this motive, a total of 15,170 respondents, now aged 18-26 years, were included in Wave III, with a response rate of 76% of Wave I in-home survey (Harris, 2013). In addition to measures used at earlier waves, additional data related to young adulthood life stage on parent-child and sibling relation, children and parenting, religion and spirituality are included in Wave III. Additionally, data on physical measurements of height and weight, pubertal development, chronic illnesses, disabling conditions, and other forms of morbidity were collected in this wave of data collection.

Missing Data Analysis

Missing data is an issue that usually arises in social and behavioral science research where survey and self-administered instruments are utilized. Thus, missingness should be

Table 3

Missing data of variables of Study 1, 2, and 3

Study	Variables	N	%
Dependent variable	Past year ever-use	48	0.41
for 3 studies	Consistency of contraception	127	1.09
Study 1	Poverty	32	0.27
(Wave III)	Employment	0	0.00
	Housing instability	67	0.58
	High School Graduation	5	0.04
	Enrollment in higher education	5	0.04
	Language	1	0.01
	Incarceration	73	0.63
	Civic participation	47	0.41
	Access to health care	9	0.08
	Access to primary care	55	0.48
	Crime and violence	120	1.04
Study 1	Poverty	1,606	13.87
(Wave III)	Employment	1,577	13.62
	Housing instability	12	0.10
	Parental high school graduation	1,614	13.94
	Language	1	0.01
	Incarceration	16	0.14
	Civic participation	49	0.42
	Discrimination	234	2.02
	Social Cohesion	236	2.04

	Variables	N	%
	Access to health care	6	0.05
Study 2/3	Access to primary care	55	0.48
(Wave I)	Family planning counseling	16	0.14
	Crime and violence	75	0.65
	Environmental conditions	1,601	13.83
Study 3 (Wave II)	Self-efficacy	1,378	19.09

addressed during data analyses. The percentage of missingness was determined by frequency counts for each questions and is presented in the Table 3.

For the Study 1, the missingness was minimal (less than 1.04%). For Study 2 and 3, the missingness of the independent variables ranged from 0.01% to 13.87%. Majority of the missingness was due to non-response associated with parents' in-home interview. For Study 3, the contraceptive self-efficacy has 19.09% missing data. The dependent variables measuring contraceptive use behavior have less than 1.05% missingness. To address these missingness, Full Information Maximum Likelihood (FIML) was employed in the data analysis in all the models used in the dissertation project.

Human Subjects Protection

The data collection for all waves were initiated after IRB approval from the University of Virginia. The Add Health interviewers adhered to an IRB-approved protocol while surveying participants and measuring their biomarkers (Harris, 2013). This protocol protected the identities of participants, and steps to ensure protection of identity were also followed by interviewers and data analyzers. Access to the Add Health for this study was granted to the Add Health research team at the University of Oklahoma. The data used for this study are protected on a password protected external drive within a locked drawer. The

key to open the drawer is also placed in a password protected lockbox. All the equipment and devices used in this study such as computer and external drive are located in a locked office on the university campus accessible only to the Add Health research team members.

The methods related to each research question are compiled within Study 4, 5 and 6 separately along with the explanations of results and discussion.

Chapter 4. Study 1 (Cross-sectional Study)

This chapter discusses the methodology, results, and discussion section related to cross-sectional associations between social domains and contraceptive use (both ever-use and consistent use).

The research questions of Study 1 are:

RQ 1.1. Are the domains of Social Determinants of Health associated with young adults' ever- use of contraceptive methods cross-sectionally?

RQ 1.2. Are the domains of Social Determinants of Health associated with young adults' consistency of contraceptive use cross-sectionally?

Methods

Sample

Inclusion and Exclusion Criteria. Our sample was restricted to the respondents who had participated in Wave III in-home survey. Our analytical sample is further restricted to those who were sexually active in the 12 months prior to interview at Wave III. This resulted an analytical sample of 11575 sexually active young adults who participated in Wave III.

Instrumentation and Measurement Protocols.

To examine the cross-sectional association, both items related to SDH measures and information on contraceptive behavior (ever-use and consistency) were extracted from Wave III.

Social Determinants of Health (U.S. Department of Health and Health Services (USDHHS)) measures: Wave III includes items/questions related to all 5 domains included in the Healthy People 2030 SDH framework.

Economic Stability. Wave III includes proxy measures of economic stability for three out of five key issues*: Poverty, Employment Status and Housing Instability*.

As a proxy measure of *Poverty*, participants at Wave III were asked "Are you currently getting AFDC, public assistance, or welfare?" with response options "yes," "no," "don't know," "refused," and "not applicable." The response options were dichotomized into "yes" and "no" with else considered missing.

Employment Status was measured by asking participants "Are you currently working for pay for at least 10 hours a week?" with possible response options of "yes," "no" and "legitimate skip." For the analysis, this question was dichotomized into "yes" and "no." Those who "legitimate skipped" this question have never ever work in their life or never worked for at least 10 hours per week, which makes them eligible for "no" as their response option.

To measure *Housing Instability*, participants were asked "In the past 12 months, was there a time when {you were/your household was} evicted from your house or apartment for not paying the rent or mortgage?" with response options "yes," "no," "refused," "don't know" and "not applicable." The response options were dichotomized into "yes" and "no" with else considered missing for further analysis.

Education. Wave III include proxy measures for three out of 4 key issues which are *High School Graduation Rate, Enrollment in Higher Education, and Language and Literacy.*

In Wave III, *High School Graduation Rate* is measured by asking "What is the highest grade or year of regular school you have completed?" with response options ranging from 6th grade to 5 or more years of graduate schools as well as "refused," "don't know," "not applicable," and "missing." High school graduation rates are not available using any waves of Add health data, so response related to this item was used as its proxy measurement. The response will be categorized into "less than high school education" and "high school graduate" while all the additional response options such as "refused," "don't know" and "not applicable" were treated as missing.

To measure *Enrollment in Higher Education*, the same above-mentioned question related to high school graduation was used. If the participant chose the item response that relates to degree beyond high school diploma, it was recorded as "yes- enrolled in higher education," else it was coded as "no – not enrolled in higher education" for further analysis. If the participants have reported "refused" or "not applicable," those response were treated as missing.

As a proxy measure for *Language and Literacy*, participants were asked "What language do you use most with your family and close relatives?" with response options "English," "Spanish," "Another European language," "An Asian language," "a non-European non-Asian language," "half English and half another language," "other" and "don't know." For the analysis, the response options were narrowed down into two categorizes -- "English," and "other language" while "don't know" was considered as missing.

Social and Community Context. Out of 4 critical areas under social and community context, Wave III includes proxy measures for two critical areas which are *Incarceration and Civic Participation.*

As a proxy measure of *Incarceration*, participants were asked "Have you ever been arrested or taken into custody by the police?" with response options "no," "yes," "refused" and "don't know" and "not applicable." The response was dichotomized into "yes" and "no" with else considered missing.

Participants were asked "During the last 12 months did you perform any unpaid volunteer or community service work?" with response options "yes," "no," "refused," "don't know," and "not applicable." This item will be used as a proxy measure for *Civic Participation* and was dichotomized into "yes" and "no" with else considered missing.

Health and Health Care. Out of three key issues of health and health care, Wave III consists of items related to two key issues which are *Access to Health services and Access to Primary Care.*

Access to Health Services is also measured in Wave III by asking participants "Has there been any time in the past 12 months when you thought you should get medical care, but you did not?" with response options "yes," "no," "refused," "don't know" and "not applicable." The response options were recoded as "yes" and "no" with other options as missing for the analysis.

As a proxy measure of *Access to Primary Care*, Wave III in-home interview has included one item related to consulting a doctor which is worded as "How long ago did you last consult a doctor or nurse?" with response options ranging from "within the past 3 months" to "2 years and longer" as well as "refused," "don't know" and "not applicable." Using past 12 months as a cut-off point, this item was recoded as a dichotomous variable for further analysis. Other response options like "refused," "don't know" and "not applicable" were considered as missing for the analysis.

Neighborhood and Built Environment. Out of 4 critical areas under this domain, Wave III only had measures related to one critical areas which was *Crime and Violence*.

Wave III in-home interview includes nine statements under one question to assess *Crime and Violence* that the participants have seen happening. The question was worded as "Which of the following things happened in the past 12 months? You saw someone shoot or stab other person, pulled a gun, pulled a knife, shot you, stabbed you, beaten up, stolen from you, pulled a knife, shot/stabbed someone." The response options to each item include "never," "once," "more than once," "refused," "don't know," and "not applicable." For the analysis, "never" will be recoded as 0 and "once" or "more than once" will be recoded as 1. The total score of all the events that took place once or more than once in the past 12 months

were included in the analysis. Response options such as “refused,” “don’t know” and “not applicable” will be considered as missing.

Measures of Contraceptive Behavior. Young adults in the Wave III in-home interview were asked about their contraceptive use in the past 12 months using 1 question worded as “In the past 12 months, did you or your partner(s) use any of these methods for birth control or disease prevention?” with options “birth control pills,” “an implant,” “birth control shot,” “a diaphragm,” “emergency contraception or the morning after pill,” “natural family planning (safe periods by temperature, cervical mucus test or calendar” and “female sterilization.” If the participant has chosen any type of birth control methods, it was coded as “yes—used contraceptive methods” or else it was coded as “no.”

Consistent contraceptive use has been examined in Wave III in-home interview by asking participants “On how many occasions of vaginal intercourse in the past 12 months did you or your partner use some form of birth control or pregnancy protection?” Response options were “none,” “some,” “half,” “most,” and “all” with the additional options of “refused,” “legitimate skip,” “don’t know” and “not applicable.” Participants who were legitimately skipped for this question were those who have not ever had vaginal intercourse or who did not have had vaginal intercourse within the past 12 months, thus these participants were not included in our analysis per inclusion criteria. Participants who indicated using some form of birth control methods all the time were categorized as consistent contraceptive users while those who indicated they used birth control methods never, some, half and most of the time were categorized as inconsistent contraceptive users (Morrison et al., 2016).

Demographics. Add Health measures age by asking the birth year and month. For the purpose of our study, age will be calculated by subtracting the participant’s birth year reported in Wave III data was collected, i.e., 2002. Interviewer asked the participants about their biological sex with additional options of “refused” and “don’t know.” Biological sex

was used as a dichotomous variable with response options “male” and “female” for the purpose of the analysis. “Which one category best describes your racial background” measured the race of the participants while participants were also asked “Are you of Hispanic or Latino origin? with the possible response options of “yes,” “no,” “refused,” and “don’t know” This race question had 9 possible response options: “White,” “Black or African American,” “American Indian or Native American,” “Asian or Pacific Islander,” “other,” “refused,” “legitimate skip,” “don’t know” and “not applicable.” For both race and ethnicity, “refused,” “don’t know,” “legitimate skip,” “not applicable,” and “don’t know” were coded as missing. Combining both race and ethnicity questions, the response options were narrowed down to 4 categories which included Non-Hispanic White, Hispanic, Non-Hispanic Blacks and Other. Additionally, to identify the pregnancy status of participants at Wave III, the participants were asked “What month of pregnancy {IS SHE/ARE YOU} in now?” with response options ranging from month 1 through 9 along with “refused,” “don’t know” and “not applicable.” Only one participant chose “Not Applicable” as their response option and meaning unsure; it was considered as missing. All the response from month 1 to 9 was coded as “pregnant” while those who reported “refused,” “don’t know,” and “not applicable” were coded as missing.

Data Analysis

Using Stata v. 16.0, descriptive statistics were analyzed including basic frequencies and percentage for all contraceptive behaviors and key issues under SDH domains which were available in Wave III. Bivariate correlations were explored between all dependent and independent variables from Wave III. Collinearity among independent variables were explored using VIF. The VIF was less than 10 for all the independent variables ensuring no issues of collinearity. The adolescent level data on contraceptive use and social domains were nested within schools. To account for the nested nature of the data (ICC: 0.02-0.03 for

dependent variables and ICC: 0.01-0.14 for independent variables), multilevel models were used. Additionally, this research is only focused on exploring the contraceptive use among sexually active population at Wave III which requires subpopulation analysis. When subpopulation analysis is used, observations that are not included in the sub-sample/ subpopulation are not deleted from the data set, which provide accurate findings with correct calculation of the standard errors (Chen & Harris, 2020).

Two separate multi level logistic regressions were employed controlling for age, race/ethnicity, gender, and pregnancy status of the participants at Wave III using Mplus (version 8.7) software. The complex survey sampling of Add Health was handled using design type as with replacement, region as stratum variable, and primary sampling unit (PSU) ID as cluster variable. To account for subpopulation and nested nature of the data, the TYPE= COMPLEX command was used along with SUBPOPULATION command under variable. Further, because both of dependent variables were dichotomous, a maximum likelihood estimator with robust standard errors (MLR) using a numerical integration algorithm was used. In this study, numerical integration was used in the computations utilizing Monte Carlo integration (Muthen & Muthen, 2004). Additionally, Full Information Maximum Likelihood (FIML) was used to handle missing data.

Results

Demographics and Descriptive Statistics

Table 3 shows all descriptive statistics associated with our final analytic sample of 11,575 sexually active participants at Wave III. Majority of the participants were white (52.50%, n= 6,077) followed by African American (20.79%, 2,406) and Hispanic (15.48%, n=1,834). There was a fairly evenly split between male (46.23%, n=5,351) and female participants (53.77%, n= 6,224).

Among items measured under the domain of Economic Stability, majority of the participants at Wave III reported not receiving public assistance (94.73%, n= 10,965). Out of 11,575, a total of 8,258 participants (71.34%) were working at least for 10 hours per week at Wave III. Majority of the participants (98.26%, n=11,374) were not evicted in the past 12 months.

Among items measured under the domain of Education, a total of 10,006 participants (86.44%) reported to have graduated from a high school. There is almost an equal split between participants who have enrolled in higher education (52.33%, n=6,057) and those who have not enrolled in higher education (47.63%, n=5,513). Majority of participants (89.98%, 10,415) spoke English with their family and close friends.

Under Social and Community context, a total of 1,424 participants (12.30%) reported to have ever been arrested while one quarter of the participants (25.96%, n=3,005) reported an involvement in any unpaid volunteer or community service work in the past 12 months.

Under the domain of Health and Health care, majority of the participants (75.63%, n=8,754) accessed health care when they thought they needed the care. Additionally, 80.97% (n= 9,372) of the participants reported consulting their primary care provider within the last 1 year. The only key issue measured at Wave III under Neighborhood and built environment was Crime and violence. The mean of the crimes that participants saw happening was 0.23 (SD: 0.76, Range = 0 to 9).

Table 4 presents the correlation among the independent variables and two dependent variables – ever use and consistency of use of contraceptive methods. Bivariate correlations show that ever-use of contraception was significantly associated with most of the key issues at $p \leq 0.05$ except access to health services, incarceration, and crime. Consistency of contraceptive use was significantly associated with all the independent variables along with ever use of contraception at $p \leq 0.05$.

Table 4

Descriptive statistics of variables of Study 1 from Wave III (N= 11,575)

Variables	**N (M)**	**% (SD)**
Age	(22.02)	(1.78)
Race/ethnicity		
White	6,077	52.50
Hispanic	1,834	15.84
African American	2,406	20.79
Other	1,230	10.63
Sex		
Male	5,351	46.23
Female	6,224	53.77
Dependent variables		
Past-year ever use of contraception		
Never used	1,460	12.61
Used	8,697	75.14
Consistency of use		
Inconsistent users	6,201	53.57
Consistent users	5,247	45.33
Economic Stability		
Poverty		
Did not receive assistance	10,965	94.73
Received assistance	578	4.99
Employment		
Not employed	3,317	28.66

Variables	N (M)	% (SD)
Not employed	3,317	28.66
Employed	8,258	71.34
Housing instability		
Not evicted	11,374	98.26
Evicted	134	1.16
Education		
High school graduation		
Not Graduated	1,564	13.51
Graduated	10,006	86.44
Enrolled in higher education		
Not enrolled	5,513	47.63
Enrolled	6,057	52.33
Language spoken at home		
English	10,415	89.98
Other	1,159	10.01
Social and community context		
Incarceration		
Not arrested	10,078	87.07
Arrested	1,424	12.30
Civic participation		
Did not volunteer	8,523	73.63
Volunteered	3,005	25.96
Health and Health care		
Access to health care		

Variables	N (M)	% (SD)
Poor access	2,812	24.29
Good access	8,754	75.63
Access to primary care		
More than 1 year ago	2,148	18.56
Within the last 1 year	9,372	80.97
Neighborhood and built environment		
Crime and violence	(0.23)	(0.76)

Multi-level Logistic Regressions

Table 5 shows the results of multi-level logistic regression predicting ever-use of contraceptive methods at Wave III. After adjusting for age, race/ethnicity, sex, and pregnancy status of participants at Wave III, 7 out of 11 key issues were found to have a significant association with ever use of contraception in multilevel logistic regression (Table 5). In summary, except for Neighborhood and Built Environment domain, one or more key issues within all other domains were found to be significantly associated with ever use of contraception. Additionally, Table 6 presents the results of multilevel logistic regression predicting consistency of use of contraceptive methods at Wave III. Out of 11 key issues, 10 key issues were found to have a significant association with consistent use of contraception after controlling for age, race/ethnicity, sex, and pregnancy status at Wave III. For the consistent use of contraception, at least one key issue from each of the 5 domains of social determinants of health was found to have a significant association with consistency of contraceptive use. The details about these associations related to ever-use and consistent use of contraception are discussed below separately under each SDH domain.

Economic Stability. Participants who were employed for at least 10 hours per week were found to have 1.24 higher odds of reporting ever-use of contraception compared to those who were never or not currently employed at the time of interview at Wave III (p=0.01, 95% CI: 1.10, 1.41). Those who were evicted in the past 12 months were found to have 0.63 lower odds of reporting ever-use of contraception compared to those who were not evicted in the past 12 months (p=0.01, 95% CI: 0.40, 0.97). No significant association was found between ever-use of contraception and receiving public assistance at Wave III among young adults (Table 5).

For consistency of contraceptive use, all three measures under Economic Stability were found to have significant associations (Table 6). Young adults who received public assistance at Wave III reported lower odds of consistent use of contraception (OR: 0.58, p=0.01, 95% CI: 0.46,0.72). Participants who were employed for at least 10 hours of week were found to have 1.14 higher odds of reporting consistent use of contraception compared to those who were never or not employed at the time of interview at Wave III (p=0.01, 95% CI: 1.05, 1.23). Those who were evicted in the past 12 months were found to have 0.59 lower odds of reporting ever-use of contraception compared to those who were not evicted in the past 12 months (p≤0.01, 95% CI: 0.39, 0.87).

Education. For ever-use of contraception, all three measures under education were found to be significant (Table 5). Participants who were a recipient of high school diploma were found to have 1.54 odds of reporting ever-use of the contraceptive methods compared to those who did not graduate from high school (p≤0.01, 95% CI: 1.29, 1.82). Similarly, youths who enrolled in higher education were found to have 1.93 odds of reporting ever use of the contraceptive methods compared to those who did not enroll in higher education (p≤0.01, 95% CI: 1.65, 2.25). Compared to the young adults who spoke English with their family and close friends, those who spoke an alternative language, such as Spanish and Chinese, have

Table 5

Correlation of variables of Study 1.

Variables	1.	2.	3.	4.	5.	6.
1. Consistency of use	1					
2. Ever use of contraception	0.27†	1				
3. Poverty	-0.09†	-0.05†	1			
4. Employment	0.06†	0.05†	-0.14†	1		
5. Housing instability	-0.04†	-0.04†	0.08†	-0.04†	1	
6. High school graduation	0.13†	0.12†	-0.13†	0.12†	-0.07†	1
7. Enrollment in higher education	0.15†	0.15*	-0.13†	0.07†	-0.07†	0.41†
8. Language spoken at home	-0.06†	0.07†	-0.01	0.02	-0.01	-0.01
9. Incarceration	-0.07†	-0.01	-0.03†	-0.03†	0.04†	-0.13†
10. Civic participation	0.10†	0.08†	-0.06†	-0.02	0.00	0.13†
11. Access to health services	0.05†	0.01	-0.01	-0.00	-0.04†	0.06†
12. Access to primary care	0.03*	0.08†	0.06†	-0.04†	-0.01	0.06†
13. Crime & violence	-0.05†	-0.01	-0.01	-0.04†	0.03*	-0.09†

Table 5 continued…

	7.	**8.**	**9.**	**10.**	**11.**	**12.**
7. Enrollment in higher education	1					
8. Language spoken at home	-0.02	1				
9. Incarceration	-0.09†	-0.02*	1			
10. Civic participation	0.24†	-0.04†	-0.01	1		
11. Access to health services	0.04†	-0.03*	-0.08†	0.00	1	
12. Access to primary care	0.09†	-0.07†	-0.08†	0.08†	0.02*	1
13. Crime & violence	-0.10†	-0.00	0.25†	0.00	-0.06	-0.04†

Note: * p<=0.05, † p<=0.01

lower odds of reporting ever use of the contraceptive methods (OR: 0.71, p≤0.01, 95% CI: 0.58, 0.86).

Similar associations were identified for consistent use of contraception (Table 6). Participants who were a receipt of high school diploma were found to have 1.49 odds of consistently using contraception compared to those who did not graduate from high school (p≤ 0.01, 95% CI: 1.29, 1.73). Similarly, youths who enrolled in higher education were found to have 1.42 odds of consistently using contraception compared to those who did not enroll in higher education (p≤0.01, 95% CI: 1.28, 1.56). Contrarily, compared to the young adults who spoke English with their family and close friends, those who spoke an alternative language, such as Spanish and Chinese, have lower odds of reporting consistent use of contraceptive methods (OR: 0.81, p≤0.01, 95% CI: 0.68, 0.96).

Social and community context. For ever-use of contraceptive methods, one out of two measures under social and community context were found to be significant (Table 5). Although being arrested was positively associated with ever-use of contraception, the association was not significant (OR: 1.04, 95% CI: 0.87, 1.26). Those who regularly volunteered or participated in any unpaid community work in the past 12 months were found to have 1.40 odds of reporting ever-use of contraception (p≤0.01, 95% CI: 1.21, 1.62) compared to those that have not volunteered in the past year.

For consistent use of contraception, both measures under Social and Community context were found to be significant (Table 6). Being arrested decreased the odds of reporting consistent use of contraception (OR: 0.71, p=0.01, 95% CI: 0.63, 0.82). Those young adults who participated in any unpaid community work in the past 12 months were found to have 1.27 odds

Table 6

Multi-level logistic regression predicting ever use of contraception in Wave III (N= 11,575)

Variables	B	S.E.	OR (95% CI)
Economic Stability			
Poverty (Ref. Did not receive assistance)			
Received assistance	-0.03	0.01	0.80 (0.64, 1.02)
Employment (Ref. Not employed)			
Employed	0.05	0.02	1.24 (1.10, 1.41)†
Housing instability (Ref. Not evicted)			
Evicted	-0.03	0.01	0.63 (0.40, 0.97)*
Education			
High school graduation (Ref. Not Graduated)			
Graduated	0.08	0.02	1.54 (1.29, 1.82) †
Enrolled in higher education (Ref. Not enrolled)			
Enrolled	0.17	0.02	1.93 (1.65, 2.25) †
Language spoken at home (Ref. English)			
Other	-0.05	0.01	0.71 (0.58, 0.86) †
Social and Community Context			
Incarceration (Ref. Not arrested)			
Arrested	0.01	0.02	1.04 (0.87, 1.26)
Civic participation (Ref. Did not volunteer)			

Variables	B	S.E.	OR (95% CI)
Volunteered	0.08	0.02	1.40 (1.21, 1.62) †
Health and Health Care			
Access to health care (Ref. Poor access)			
Good access	0.01	0.02	1.04 (0.88, 1.24)
Access to primary care (Ref. more than 1 year ago)			
Within the last 1 year	0.09	0.02	1.56 (1.39, 1.76) †
Neighborhood and Built Environment			
Crime and violence	0.01	0.02	1.02 (0.92, 1.12)
Control Variables			
Age	-0.11	0.02	0.89 (0.86, 0.92) †
Race/ethnicity (Ref. White)			
Hispanic	-0.03	0.02	0.87 (0.74, 1.06)
African American	-0.01	0.02	0.95 (0.81, 1.12)
Other	-0.06	0.03	0.68 (0.48, 0.95)
Sex (Ref. Male)			
Female	-0.00	0.01	0.99 (0.89, 1.09)
Pregnancy Status (Ref. Not pregnant			
Pregnant	-0.10	0.01	0.36 (0.29, 0.44) †

Note: * $p \leq 0.05$, † $p \leq 0.01$; Ref: Reference category.

Table 7

Multi-level logistic regression predicting consistency of contraceptive use in Wave III (N= 11,575)

Variables	B	S.E.	OR (95% CI)
Economic Stability			
Poverty (Ref. Did not receive assistance)			
Received assistance	-0.06	0.01	0.58 (0.46, 0.72) †
Employment (Ref. Not employed)			
Employed	0.05	0.01	1.14 (1.05-1.23) †
Housing instability (Ref. Not evicted)			
Evicted	-0.03	0.01	0.59 (0.39, 0.87) †
Education			
High school graduation (Ref. Not Graduated)			
Graduated	0.07	0.01	1.49 (1.29, 1.73) †
Enrolled in higher education (Ref. Not enrolled)			
Enrolled	0.09	0.01	1.42 (1.28, 1.56) †
Language spoken at home (Ref. English)			
Other	-0.03	0.01	0.81 (0.68, 0.96) †
Social and Community Context			
Incarceration (Ref. Not arrested)			
Arrested	-0.06	0.01	0.72 (0.63, 0.82) †
Civic participation (Ref. Did not volunteer)			
Volunteered	0.05	0.01	1.27 (1.16, 1.38) †

Variables	B	S.E.	OR (95% CI)
Health and Health Care			
Access to health care (Ref. Poor access)			
Good access	0.05	0.01	1.23 (1.09, 1.37) †
Access to primary care (Ref. more than 1 year ago)			
Within the last 1 year	0.01	0.01	1.05 (0.93, 1.17)
Neighborhood and Built Environment			
Crime and violence	-0.02	0.01	0.95 (0.91, 0.99)*
Control Variables			
Age	-0.05	0.01	0.94 (0.92, 0.97) †
Race/ethnicity (Ref. White)			
Hispanic	-0.06	0.02	0.73 (0.62, 0.85) †
African American	-0.11	0.01	0.59 (0.53, 0.67) †
Other	-0.07	0.03	0.63 (0.49, 0.80) †
Sex (Ref. Male)			
Female	0.00	0.01	1.01 (0.92, 1.10)
Pregnancy Status (Ref. Not pregnant)			
Pregnant	-0.25	0.02	0.08 (0.06, 0.12) †

Note: * p≤0.05, † p≤0.01; Ref: Reference category

of reporting consistent use of contraception (p≤0.01, 95% CI: 1.16, 1.38) compared to those who have not volunteered in the past year.

Health and Health care. For both ever-use and consistent use of contraception, one out of two measures were found to be significant. Those who had good access to primary care, which includes consultation with doctor and nurse within past 12 months, had higher odds of reporting ever-use of contraception (OR: 1.56, p=0.01, 95% CI: 1.39, 1.76) compared to those who last consulted their health practitioners more than a year ago. Regarding consistent use of contraception, those who had good access to health care (got health care when they thought they needed) had 1.23 odds of reporting consistent use when compared with those who had poor access to health care (p=0.01, 95% CI: 1.09, 1.37).

Neighborhood and Built Environment. The number of crimes witnessed by participants was not significantly associated with ever-use of contraception (OR: 1.02, 95% CI: 0.92, 1.12). For consistent use of contraception, with every unit increase in the crime observed by participants, there was a lower odds of reporting consistent use (OR: 0.95, p=0.05, 95% CI: 0.91, 0.99).

Discussions

This current cross-sectional study explored and analyzed empirical associations between multiple SDH and contraceptive use among one large sample of youth representing the US youth population. Findings support the relationship between ever-use and consistent use of contraception, and several measures of SDH during young adulthood. These findings identified specific areas, such as Economic Stability, Education, and Health and Health care, where additional resources and interventions could increase the use of contraception among young adults.

Under Economic Stability, young adults' employment, and house instability (i.e., their eviction status) in the past 12 months were found to be significant predictor of ever-use and consistent use of contraception. The association between eviction status and contraceptive use has not been studied in the prior studies, however, there are numerous studies that support the relation between employment and contraceptive use (Maness et al., 2022; Olika et al., 2021; Pinchoff et al., 2017). For example, in a study conducted in Zambia in 18-24 sexually active young adults, being employed increased their use of condoms at the most recent sexual intercourse (Pinchoff et al., 2017). This current study did not find a significant association between ever-use of contraception and poverty status of young adults, however, there exists a significant association between poverty status and consistency of use of contraception in young adulthood. It is perhaps not surprising that adults who are living in poverty by seeking public assistance were more likely to use contraception inconsistently as surviving with low income/lack of income is likely to hamper the affordability of contraceptive methods, which were shown to be significant factors influencing contraceptive use (Pinchoff et al., 2017).

Our findings also align with prior studies when explaining the link between issues under the Education domain and contraceptive use. The receipt of high school diploma and subsequent enrollment in higher education significantly increase the likelihood of ever-use and consistent use of contraception. This association could be attributed to the varying level of sex education that are delivered in school settings. Even though there are differences in sex education administered in the educational settings, most educational programs address ways to prevent transmission of STI/HIV and pregnancy, thus, majority of interventions emphasized condom use (Lopez, Bernholc, Chen, & Tolley, 2016).These type of interventions discuss commonly available contraceptive methods and its benefits, which in turn can encourage adolescents and

young adults to use some forms of contraception. Additionally, language spoken at home with participants' family members and friends were significantly association with both ever-use and consistent use of contraception. This finding is also supported by a recently published study based on National Survey of Family Growth (NSFG) which documented that participants who spoke English at home had 2.92 odds of using moderately effective contraceptive methods when compared to Spanish speaking participants (Maness et al., 2022). Language is a strong determinant of preventive behaviors, such as contraceptive use and HPV vaccination, as numerous interventions and awareness campaigns are conducted primarily in English language. To reach more vulnerable populations who do not speak English, tailoring existing interventions to non-English speaking populations is warranted (Thompson et al., 2019).

Past research studies which have explored the SDH utilizing Healthy People framework have used family structure as one of the key issues of Social and Community context (Maness et al., 2016; Maness et al., 2022). However, the updated version of Healthy People 2030 framework excluded the family structure key issue from the social and community context (Healthy People 2030). Thus, in this study, even with the available of information related to family structure in Wave III, this excluded key issue was not measured under Social and Community context. For the area of Social and Community context, only history of incarceration and involvement in volunteer work in the past 12 months were measured at Wave 3, but not perceived discrimination and social cohesion in the participants' neighborhoods. While no previous studies have explored the relationship between civic participation (i.e., involvement in voluntary work) and contraceptive use yet, this cross-sectional study indicates a significant positive relationship between recent involvement in unpaid volunteer work and contraceptive use (both ever-use and consistent use) among young adults. Those young adults involved in unpaid volunteer work are

more likely to have stronger social support, protective family environments and peer influences and feel connected to community they live in. Previous research has shown positive outcomes related to the sexual activity among all teenagers who have protective family and peers, such as reducing sexual activity, delayed sexual debut, fewer sexual partners, and more consistent contraceptive use (J. Manlove, Logan, Moore, & Ikramullah, 2008; B. C. Miller, 1998; B. C. Miller, Benson, & Galbraith, 2001). Contrarily, any type of involvement in criminal activities is negatively and significantly associated with perceptions of social support (Staton-Tindall, Royse, & Leukfeld, 2007). Assessing a similar measure in this study, our findings also indicate participants who reported higher numbers of crime in their neighborhood are less likely to report consistent use of contraception. This association may have been resulted due to low perceived social support in an unsafe neighborhoods where crimes are more common.

Under Health and Health care, this study included measures related to access to health care and access to primary care from Wave III. One interesting finding is that access to health care was significantly associated with consistent use of contraception but not associated significantly with ever-use of contraception. In this study, the access of health care was measured as participants' ability to seek health care when they think it was needed. Access to health care is intrinsically associated with the insurance coverage that young adults have. Lack of or inconsistent insurance coverage can affect young adults' (especially women's) abilities to seek health care regularly and access to prescription contraceptives (Culwell & Feinglass, 2007; Nearns, 2009) while having some type of insurance during the past 12 months significantly increased the consistent use of contraception, even dual method of contraception use (Finn et al., 2020; Maness et al., 2022; Riddell et al., 2018; Tyler et al., 2014). Possibly, having good access to health care is reflective of health insurance coverage, which facilitates the use of contraceptive

methods frequently. However, having good access to health care was not associated with ever-use of contraception. On the flip side, consultation with doctors/nurses in the past year (access to primary care) was a significant predictor of ever-use of contraception in the past 12 months but not with consistency of use. Perhaps health care personnel recommended contraception use encouraged the young adults' use of contraception, but these recommendations may not be sufficient to encourage consistent use. It is also possible that this current study did not capture the specific issues related to contraceptive and family planning services under Health and Health care domain due to the secondary nature of this study. Future studies should explore if the participants consulted their primary care provider about issues related to their contraceptive needs and reproductive health in addition to access to health care and their health insurance coverage while exploring the link between health care and contraception.

Previous research documents strong influence of neighborhood related contextual factors with sexual behaviors including unprotected sex and transmission of STDs (Baumer & South, 2001; Thomas, Torrone, & Browning, 2010). In a recent study published in 2019, researchers employed Latent Class Analysis to categorize adult participants based on the risk of sexual behaviors. This study documented three classes: high risk class (those who involve in multitude of high-risk sexual behaviors), low risk class (sexually active with engagement in single risk behavior), and no risk class (not sexually active). This LCA-based study documented that neighborhood related measures such as poverty index, lifetime substance use disorder and perceived neighborhood crime/violence were substantially higher among those who were classified in high-risk class when compared to individuals in no-risk class. (Green et al., 2019). In our study, the number of crimes in the neighborhood was not a significant predictor for ever-use of contraception, however, with the increase perceived neighborhood crimes, there is a

significant decrease in the odds of consistent use of contraception. This association can be explained by conceptualizing neighborhoods as opportunity structures rather than just collection of physical structures and built environment, as residents of neighborhoods with comparatively lesser economic advantage (e.g., high poverty rates) and higher social disorder (more crimes and violence) may have less access to social and physical resources (e.g., health services, employment opportunities) needed to continue healthy behaviors such as consistent use of contraception (D. A. Cohen et al., 2003).

Strengths and Limitations

This present study makes a unique contribution to the literature by employing a comprehensive framework and exploring the contraceptive use of vulnerable populations utilizing a large sample size. Compared to a recently published study in 2022 which explored key issues related to SDH and contraceptive use (Maness et al., 2022), this current study includes more variables related to key issues of SDH including employment status, incarceration and crime and violence. Nevertheless, some limitations should be noted. First, this study is unable to include all measures related to comprehensive SDH framework as Add Health dataset lacks pertinent variables and items related to all key issues. Second, there might be some possibility of social desirability bias while reporting contraceptive use by young adults. When data were gathered for Add Health, participants were reminded that all information would be kept confidential, and their identity/name would not be linked to their responses, however, participants could have answered in a way that is more acceptable way than what reflects their reality. Third, I could not use the weights to portray the sample as the nationally representative data because weight variables associated with multilevel models were not available.

Fourth, measurement of contraceptive use consistency is another concern. Specific types of contraception were not explored when assessing consistency. It is possible that women who consistently use effective contractive methods, such as implants, differ significantly from women who consistently use less effective contraceptive methods (for example: withdrawal) in terms of social domains. Because participants who used any type of contraception were combined into a homogenous group representing consistent users, association between social domains and consistent contraceptive use could be underestimated. Finally, this study used SDH framework of Healthy People 2030 and proxy measures were used to represent key issues of each domains. Although similar proxy measures were used in the previously published studies (Maness et al., 2016; Thompson et al., 2019), these questions or items may not fully cover or asked in a manner that best describe SDH domains as described in Healthy People 2020/30 SDH framework. Thus, further development of instruments and measures are required to correctly measure the key issues associated with domains under SDH.

Overall, this study explored the SDH factors associated with past year ever-use and consistent use of contraception among young adults. Past year ever-use depict the tendency and intention of individuals to use contraception and shows how favorably do they take the concept of contraception. To increase the ever-use of contraception, this finding suggests that intervention efforts could be aimed at strengthening socio-economic, education and health aspects associated with young adults. Specifically, from a preventive standpoint, consistent use of contraception is more crucial than ever-use of contraception as consistent use is an effective way to prevent unintended pregnancies. Our findings suggest that, compared to ever use of contraceptives, young adults require additional enabling resources such as financial ability, access to health care, and neighborhood social order to sustain their consistent use of

contraception. In addition to having a job to survive, individuals need adequate funds to make them live beyond the poverty level to make consistent contraceptive use a priority. Additionally, young adults would benefit from year-round health insurance that can enable them to access health care when they need it so that various contraceptive choices are within their reach. Federal and state policies should further be focused on buttressing these resources and expanding all people's opportunities to make their own informed choices about contraception.

Chapter 5. Study 2 (Longitudinal Study)

The study 2 explore the longitudinal association between social domains in adolescence and ever and consistency of contraception use among young adults. The two main research questions are:

RQ 2.1. Are the domains of Social Determinants of Health at adolescence (Wave I) predictive of young adults' use of contraceptive methods (Wave III)?

RQ 2.2. Are the social domains of SDH at adolescence (Wave I) associated with the consistency of contraceptive use during the young adulthood (Wave III)?

Chapter 5 discusses Methods, Results and Discussions in the sections below.

Methods

Sample

Inclusion and Exclusion Criteria. Our sample was restricted to the respondents who have participated in both Wave I and Wave III in-home survey. Our analytical sample was further restricted to those who were sexually active in the 12 months prior to interview in Wave III. This resulted an analytical sample of 11,575 sexually active young adults who participated in Wave III.

Instrumentation and Measurement Protocols

Measures related to social domains were extracted from Wave I adolescent in-home survey and Wave I parent in-home survey. Since the measures related to adolescence were also asked in Wave III, few variables from Wave III are used to reflect the social domains during adolescence, for example, a question asked in Wave III was worded as "How many times were you arrested before you were 18?" The dependent variable --contraceptive behavior (ever-use and consistency) were extracted from Wave III.

Social Determinants of Health (U.S. Department of Health and Health Services (USDHHS)) measures. Wave I (Adolescents' and Parents' survey) include items/questions related to all 5 domains in the Healthy People 2030 SDH framework. When multiple proxy measures existed, the most relevant measure was selected.

Economic Stability. Wave I include proxy measures for three out of five key issues which are *Poverty, Employment Status, and Housing Instability.*

To assess *Poverty* during the adolescence period, parent of the participants at Wave I were asked "Are you currently getting AFDC, public assistance, or welfare?" with response options "yes," "no," "don't know," "refused," and "not applicable." The response options were dichotomized into "yes" and "no" for further analysis with else considered missing.

Employment Status was measured in Wave I by asking participants' parent "Do you work outside the home?" The response options of this question were "no," "yes," "refused" and "missing." The response options were recoded as "yes" and "no" with else considered missing.

Housing Instability during the adolescence was measured in Wave III by asking "Did you ever live in a foster home?" Response options available for this question are "no," "yes," "refused," "don't know" and "not applicable." The response was dichotomized into "yes" and "no" with else considered missing.

Education. Since adolescents were enrolled in the school in Wave I, proxy measures of parental education were taken from Parent Wave I survey. Out of 4 critical areas under education, only two critical areas were assessed under education which are *High School Graduation Rate, and Language and Literacy.*

For the proxy measure of *High School Graduation Rate* of parent, parent was asked "How far did you go in school?" with varied options from 8th grade to professional training, and

additional options of "refused" and "missing." This item was recoded into a dichotomous variable as "Yes" if parent has selected options such as high school graduate and above while those who have less education than high school will be coded as "No." The additional response option-- "refused" was incorporated as missing in the analysis.

To measure *Language and Literacy*, adolescents in Wave I were asked "What language is usually spoken in your home?" with response options "English," "Spanish," "other," "refused" and "don't know." These response was categorized into "English," and "other" while treating "refused" and "don't know" variables as missing.

Social and Community Context. Proxy measures for all 4 key areas of social and community context during the adolescence were identified in Wave I and Wave III.

Proxy measure of *Social Cohesion* at the neighborhood level were measured by 5 items in Wave I out of which 3 are true/false statements and remaining 2 items are questions with Yes/No responses. Additionally, all 5 items have other response options such as "refused," "don't know" and "not applicable." The three statements with true/false as their response options were asked as "You know most of the people in your neighborhood," "In the past month, you have stopped on the street to talk with someone who lives in your neighborhood.," "People in this neighborhood look out for each other." The two items with Yes/No response options are "Do you use a physical fitness or recreation center in your neighborhood?" and "Do you usually feel safe in your neighborhood?" For the analysis, all the "yes" or "true" will be coded as 1 and "no" or "false" were coded as 0 with else considered missing. The sum of these scores represents the level of social cohesion participants perceive in their neighborhood.

Perception of Discrimination was measured in Wave I by using one question "How much do you agree or disagree with the following: Students at your school are prejudiced." If the

students were interviewed during summer, students were asked about the previous year. Response options included Likert response options ranging from “strongly agree” to “strongly disagree” with “refused,” “legitimate skip” and “don’t know” as the additional options. This question was analyzed as Likert response options. Those who legitimately skipped this question did not go to school in that school year or during the past school year, thus, they were incorporated into the missing category. Other response options such as “refused” and “don’t know” were considered as missing as well.

Incarceration during adolescence was measured in Wave III in-home interview where the participants were asked “How many times were you arrested before you were 18?” Response options include listing times arrested till 30 with additional response options of “refused,” “legitimate skip,” “don’t know,” “not applicable,” and “missing.” For the listed times, this question was analyzed as a continuous variable. Participants with “legitimate skip” as chosen response option had never ever been detained or questioned by a police officer so they were coded as “0 count” with all other additional response options were treated as missing.

Civic Participation during adolescence was also measured in Wave III interview where participants were asked “At any time during your adolescence, when you were between 12 and 18 years old, did you regularly participate in volunteer or community service work?” with response options “no,” “yes,” “refused,” “don’t know,” and “not applicable.” This question was analyzed as a dichotomous variable for further analysis where “refused,” “don’t know” and “not applicable” was treated as missing.

Health and Health Care. Wave I include items/questions that relate to all three key issues of health and health care.

Access to Health Services is evaluated by 1 item where participants were asked "Has there been any time over the past year when you thought you should get medical care, but you did not?" with response options "no," "yes," "refused," and "don't know." This item was dichotomized into "yes" and "no" for analysis with else considered missing.

In order to examine *Access to Primary Care*, participants were asked "When did you last have a physical exam or routine check up?" with response options "less than a year ago," "1 to 2 years ago," "more than 2 years ago," "never," "refused," "don't know" and "not applicable." This item was dichotomized into "yes" and "no" for analysis by taking 12 months as a cut-off point with else considered missing.

As a proxy measure of *Health Literacy,* the item related to family planning counseling is used. Participants in Wave I were asked "In the past year have you received family planning counseling or services?" with response options "yes," "no," "refused" and "don't know." The response options were recoded as "yes" and "no" with else considered missing for further analysis.

Neighborhood and Built Environment. Wave I adolescent in-home interview and parent interview included items related to *Crime and Violence, and Environmental Conditions.*

Adolescents at Wave I were asked about *Crime and Violence* in their neighborhood by question worded as "During the past 12 months, how often did each of the following things happen? : You saw someone shoot or stab another person, someone pulled a knife or gun on you, some shot you, someone cut or stabbed you, you got into a physical fight, you were jumped, you pulled a knife or gun on someone, you shot or stabbed someone" with response options "never," "once," "more than once," "refused," "don't know," and "not applicable." For the analysis, "never" was recoded as 0 and "once" or "more than once" were recoded as 1. This item was

used as a count variable for the events that the participants have reporting seeing once or more than once in the past 12 months. The response options such as “refused,” “don’t know,” “not applicable” were recoded as missing.

Environmental Conditions were assessed in Wave I parent in-home survey where parent of the adolescent was asked “In this neighborhood, how big a problem is litter or trash on the streets and sidewalks?” with response options “no problem at all,” “a small problem,” “a big problem,” “refused,” and “missing.” The three response options that ascertain whether a problem exists in the neighborhood were used as a continuous measure in the analysis with the rest coded as missing.

Measures of Contraceptive Behavior (Same as Study 1). Young adults in the Wave III in-home interview were asked about their contraceptive use in the past 12 months using 1 question worded as “In the past 12 months, did you or your partner(s) use any of these methods for birth control or disease prevention?” with options “birth control pills,” “an implant,” “birth control shot,” “a diaphragm,” “emergency contraception or the morning after pill,” “natural family planning (safe periods by temperature, cervical mucus test or calendar” and “female sterilization.” If the participant has chosen any type of birth control methods, it was coded as “yes—used contraceptive methods” or else it was coded be “no.”

Consistent contraceptive use was examined in Wave III in-home interview by asking participants “On how many occasions of vaginal intercourse in the past 12 months did you or your partner use some form of birth control or pregnancy protection?” Response options were “none,” “some,” “half,” “most,” and “all” with the additional options of “refused,” “legitimate skip,” “don’t know,” and “not applicable.” Participants who were legitimately skipped for this question were those who have not ever had vaginal intercourse or who did not have vaginal

intercourse within the past 12 months, thus these participants were not included in our analysis. Participants who indicated using some form of birth control methods all the time were categorized as consistent contraceptive users while those who indicated they used birth control methods never, some, half and most of the time were categorized as inconsistent contraceptive users (Morrison et al., 2016).

Demographics. Add Health measures age by asking the birth year and month. For the purpose of our study, age was calculated by subtracting the participant's birth year reported in Wave III data was collected, i.e., 2002. Interviewer asked the participants about their biological sex with additional options of "refused" and "don't know." Biological sex was used as a dichotomous variable with response options "male" and "female" for the purpose of the analysis. "Which one category best describes your racial background" measured the race of the participants while participants were also asked "Are you of Hispanic or Latino origin? with the possible response options of "yes," "no," "refused," and "don't know" This race question had 9 possible response options: "White," "Black or African American," "American Indian or Native American," "Asian or Pacific Islander," "other," "refused," "legitimate skip," "don't know" and "not applicable." For both race and ethnicity, "refused," "don't know," "legitimate skip," "not applicable," and "don't know" were coded as missing. Combining both race and ethnicity questions, the response options were narrowed down to 4 categories which included Non-Hispanic White, Hispanic, Non-Hispanic Blacks and Other. Additionally, to identify the pregnancy status of participants at Wave III, the participants were asked "What month of pregnancy {IS SHE/ARE YOU} in now?" with response options ranging from month 1 through 9 along with "refused," "don't know," and "not applicable." All the response from month 1 to 9 was coded as "pregnant" while those who reported "refused," "don't know," and "not

applicable" were coded as missing. Additionally, a new variable "time lapse" was created to represent time lapse between Wave I and Wave III based on dates of interview at Wave I and III. This time lapse variable was also included in the model as a controlling variable.

Data Analysis

Data analysis procedure for Study 2 was similar to that of Study 1 except for the independent variables being derived from Wave I and Wave III (if the items were related to the adolescence phase of the participants) and the utilization of additional controlling variables. Using Stata v. 16.0, descriptive statistics were analyzed including basic frequencies and percentage for all contraceptive behaviors and key issues under SDH domains which were available in Waves I and III. Bivariate correlations were explored between all dependent and independent variables from Wave I and III. Collinearity among independent variables were explored using VIF. The VIF was less than 10 for all the independent variables ensuring no issues of collinearity. The adolescent level data on contraceptive use and social domains were nested within schools. To account for the nested nature of the data (ICC: 0.02-0.03 for dependent variables and ICC: 0.01-0.14 for independent variables), multilevel models were used. Additionally, subpopulation analysis was used to focus on the sexually active participants at Wave III.

Two separate multi level logistic regressions were employed controlling for age, race/ethnicity, gender, time lapse between Wave I and Wave III, and pregnancy status of the participants at Wave III using Mplus 8.7. To account for subpopulation and nested nature of the data, the TYPE= COMPLEX command was used along with SUBPOPULATION command under variable. Alike Study 1, a maximum likelihood estimator with robust standard errors (MLR) using a numerical MONTECARLO integration algorithm was used. Additionally, FIML

was used to treat the missing data which also accounted for non-independence of the data. In this type of longitudinal analysis, often the behavior at the baseline (contraceptive use) is controlled for, however, most of the participants were not sexually active during Wave I data collection; controlling for contraceptive use at Wave I would limit the data analysis to a subsample of adolescents/young adults who were sexually active at both Wave I and Wave III, which would have changed the conceptualization of the study, thus contraceptive use at Wave I was not controlled for in this study.

Results

Demographic and Descriptive Statistics

Similar to Study 1, the final analytical sample for Study 2 includes 11,575 young adults. Age, race, sex, and pregnancy status of the participants at Wave III are the same as that of the Study 1 (Table 7).

Under Economic Stability, poverty status of participants' parent, parental employment and whether participants lived in a foster care during their adolescence were included as key issues. A total of 78.46% (n=9,082) parents of the participants did not receive public assistance. Majority of the parents of the participants were employed (64.14%, n=7,424). Similarly, majority of the participants (97.43%, n= 11,278) did not live in a foster care while growing up.

Parental receipt of high school diploma and language spoken with family and close friends were included under measures related to education. Approximately three-fourth (71.29%, n=8,252) of the parents of participants graduated high school. Majority of the participants (90.59%, n=10,486) spoke English with their family members and friends.

Table 8

Descriptive statistics of variables of Study 2 from Wave I and Wave III (N= 11,575)

Variable	N (M)	% (SD)
Age at Wave III	(22.02)	(1.78)
Race/ethnicity		
White	6,077	52.50
Hispanic	1,834	15.84
African American	2,406	20.79
Other	1,230	10.63
Sex		
Male	5,351	46.23
Female	6,224	53.77
Dependent variables		
Past-year ever use of contraception		
Never used	1,460	12.61
Used	8,697	75.14
Consistency of use		
Inconsistent users	6,201	53.57
Consistent users	5,247	45.33
Economic Stability		
Poverty (Parent)		
Did not receive assistance	9,082	78.46
Received assistance	887	7.66

Variable	N (M)	% (SD)
Employment (Parent)		
Not employed	2,574	22.24
Employed	7,424	64.14
Lived in foster care		
No	11,278	97.43
Yes	285	2.46
Education		
High school graduation		
Not Graduated	1,709	14.76
Graduated	8,252	71.29
Language spoken at home		
English	10,486	90.59
Other	1,078	9.40
Social and Community Context		
Incarceration		
Number of times arrested	(0.13)	(1.29)
Civic participation		
Did not volunteer	6,692	57.81
Volunteered	4,834	41.76
Discrimination	(2.85)	(1.21)
Strongly Agree	1,678	14.50
Agree	3,233	27.93

Variable	N (M)	% (SD)
Neither agree nor disagree	2,684	23.19
Disagree	2,636	22.77
Strongly Disagree	1,110	9.59
Social Cohesion		
Social Cohesion score	(3.36)	(1.16)
Health and Health Care		
Access to health care		
Poor access	2,475	21.38
Good access	9,094	78.57
Access to primary care		
More than 1 year ago	3,721	32.15
Within the last 1 year	7,799	67.38
Family Planning counseling		
No	10,852	93.75
Yes	707	6.11
Neighborhood and Built Environment		
Crime and violence	(0.85)	(1.01)
Environment (Trash problem)	(1.52)	(0.61)
No problem at all	5,413	46.76
A small problem	3,943	34.06
A big problem	618	5.34

Under Social and Community Context, incarceration, civic participation before the age of 18, perceived discrimination and social cohesion were measured. The mean of the number of times the participants were arrested is 0.13 (SD: 1.29, Range: 0 to 30). A total of 4,834 (41.76%) participants reported to have had participated in unpaid volunteer work before the age of 18. Less than half of participants agreed (27.93, n=3,233) or strongly agreed (14.50%, n=1,678) that students at their school were prejudiced while growing up. The average score of perceived discrimination was 2.85 (SD: 2.21, Range:1 to 5) Participants in their adolescence also reported social cohesion score with a mean of 3.36 (SD: 1.16, Range: 0 to 5)

Among items measured under Health and Health care, the majority of participants reported having a good access to health care (78.57%, n=9,094) and 67.38% reported having good access to primary care in their adolescence. Only 6.11% (n=707) received some form of family planning counseling in their adolescence.

Under Neighborhood and Built Environment, the mean number of crime witnessed by participants in their adolescence is 0.85 (SD= 1.01, Range: 0 to 8). Less than 50% of the parents of participants did not have a problem with trash in their surroundings while 5.24% reported that trash was a big problem.

Table 8 presents the correlation among the independent variables from Wave I and the two dependent variables at Wave III – ever use and consistency of use of contraceptive methods. Ever-use of contraception is significantly associated with most of the key issues at Wave I except perceived discrimination, access to primary care, and receipt of family planning counseling at $p \leq 0.05$. Consistency of contraceptive use was significantly associated with all the independent variables along with ever use of contraception at $p \leq 0.05$, except living in foster care at adolescence.

Multi-level Logistic Regressions

After adjusting for age, race/ethnicity, sex, pregnancy status of participants at Wave III, and time lapse between Wave I and Wave III, 6 out of 14 key issues were found to have a significant association with ever use of contraception in multilevel logistic regression (Table 9). Similarly, after controlling for age, race/ethnicity, sex, pregnancy status and time lapse between Wave I and III, 8 out of 14 key issues were found to have a significant association with consistency use of contraception at Wave III (Table 10). For both ever-use and consistency of contraceptive use, results are discussed in detail below based on the social determinants of health domains.

Economic Stability. Compared to participants whose parents did not receive any public assistance at Wave I, participants whose parents received public assistance reported 0.73 odds of reporting ever-use of adolescence had lower odds of reporting ever-use of contraception at Wave III (OR: 0.66, p=0.05, 95% CI: 0.47, 0.92). Parental employment (OR: 1.02, 95% CI: 0.88, 1.18) was not found to be significant for ever-use of contraception. Controlling for age, sex, race/ethnicity, pregnancy status and time lapse, participants whose parents reported receiving public assistance at Wave I had lower odds of reporting consistent use of contraceptive methods at Wave III (OR: 0.77, p=0.01, 95% CI: 0.64, 0.92). Parental employment (OR: 0.97, 95% CI: 0.87, 1.09) and living in a foster care (OR: 0.93, 95% CI: 0.73, 1.18) were not found be significantly associated with consistent use of contraception.

Education. Controlling for age, race/ethnicity, sex, pregnancy status and time lapse between W1 and W3, both issues under education were found to have significant association with ever-use of contraception at Wave III. When compared to participants whose parent did not receive a high school diploma, those participants whose parents graduated high school had

higher odds of reporting ever-use of contraception (OR: 1.56, p≤0.01, 95% CI: 1.33, 1.83). On the contrary, participants who spoke language other than English with their family and friends had 0.31 odds of reporting ever-use of contraception at Wave III (p≤0.01, 95% CI: 0.26, 0.38) compared to participants who spoke English with their family and close relatives.

Similar associations were found for consistent use of contraception. Compared to participants whose parent did not have a high school diploma, participants who had a parent with high school diploma had higher odds of using contraception consistently (OR: 1.21, p≤0.01, 95% CI: 1.07, 1.38). Participants who spoke a different language other than English with their family and friends had 0.08 odds of reporting consistent use of contraception (p≤0.05, 95% CI: 0.05, 0.11), compared to participants who spoke English with their family and close relatives at Wave I.

Social and Community context. Among 4 issues under Social and Community context from Wave I, only one key issue was found to be significant in predicting ever-use of contraception at Wave III. Those participants that participated in unpaid community work before the age of 18 were found to have higher odds of reporting ever-use of contraception at Wave III (OR: 1.49, p=0.01, 95% CI: 1.33,1.68) when compared to those who never participated in any volunteer work. Incarceration (OR: 0.98, 95% CI: 0.91, 1.02), perceived discrimination (OR:0.99, 95% CI: 0.94, 1.03), and social cohesion (OR:1.03, 95% CI: 0.98, 1.08) at Wave I were not found to have significant association with ever-use of contraception at Wave III.

For consistent use of contraception, two out of 4 key issues measured at Wave I were found to have significant associations. Compared to participants who did not participate in volunteer work before age 18, those participants who volunteered had 1.28 odds of reporting consistent use of contraception at Wave III (p≤0.01, 95% CI: 1.17, 1.40). Additionally, with an increase in every unit of social cohesion score, there is 1.05 odds of reporting consistent use of

Table 9

Correlation among variables of Study 2 (Wave I and III)

Variables	**1.**	**2.**	**3.**	**4.**	**5.**	**6.**	**7.**
1.Consistency of use	1						
2.Ever use of contraception	0.27*	1					
3.Poverty (P)	-0.07†	-0.07†	1				
4.Employment (P)	0.03*	0.04†	-0.28†	1			
5.Living in foster care	-0.02	-0.03*	0.05†	-0.03†	1		
6.High school graduation(P)	0.08*	0.10†	-0.22†	0.24†	-0.01	1	
7.Language spoken at home	-0.07†	-0.06†	0.05*	-0.07†	-0.03†	-0.35†	1
8.Incarceration	-0.02*	-0.02	0.04*	-0.02	0.02	-0.02	-0.02†
9.Civic participation	0.08†	0.08†	-0.08†	0.06†	-0.01	0.12†	-0.02
10.Discrimination	-0.02*	-0.01	0.05†	-0.01	0.01	-0.04*	0.03
11.Social cohesion	0.04†	0.03†	-0.04†	0.02	0.01	0.04*	-0.11†
12.Access to health care	0.06†	0.03*	-0.03*	-0.01	-0.02*	0.04†	-0.00
13.Access to primary care	0.03†	0.02	0.01	0.02	0.01	0.07†	-0.07†
14.Family Planning counseling	-0.05†	-0.02	0.05†	-0.02	0.08†	-0.01	-0.01
15.Crime & violence	-0.09†	-0.04†	0.08†	-0.03*	0.04†	-0.05†	0.02
16.Environmental condition	-0.03*	-0.05†	0.15†	-0.06†	0.04†	-0.06†	-0.05†

Table 9 continued…

	8.	**9.**	**10.**	**11.**	**12.**	**13.**	**14.**	**15.**
8. Incarceration	1							
9. Civic participation	-0.02	1						
10.Discrimination	-0.01	0.00	1					
11.Social cohesion	0.01	0.05†	0.05†	1				
12.Access to health care	-0.02	0.01	0.07†	0.06†	1			
13.Access to primary care	0.00	0.06†	0.02*	0.08†	0.05†	1		
14.Family Planning counseling	0.03	-0.03†	-0.04†	-0.03*	-0.06†	0.05†	1	
15.Crime & violence	0.13†	-0.05†	-0.04†	0.03†	-0.11†	-0.01	0.08†	1
16.Environmental condition	0.01	-0.05†	0.03*	-0.05†	-0.01	-0.01	0.00	0.05†

Note: (P) Parent's information from Wave I, * $p \leq 0.05$, † $p \leq 0.01$

contraceptive methods at Wave III (p≤0.01, 95% CI: 1.01, 1.08). Incarceration (OR: 0.98, 95%CI: 0.94, 1.02) and perceived discrimination (OR: 0.99, 95% CI: 0.96, 1.03) during adolescence was not found to have significant associations with consistent use of contraception at Wave III.

Health and health care. The items measured under health and health care at Wave I were not significant predictors of ever-use of contraception at Wave III. Having a good access to health care at adolescence had positive association with ever-use of contraception, however, the association was not significant (OR: 1.09, 95% CI: 0.93, 1.27). Both access to primary care (OR: 0.99, 95% CI: 0.89, 1.10) and receiving family planning counseling (OR: 0.96, 95% CI: 0.78, 1.18) at adolescence had negative association with ever-use of contraception, but the associations were nonsignificant.

Compared to those who could not afford health care when they needed at Wave I, those who got the health care when needed had higher odds of reporting consistent use of contraception at Wave III (OR: 1.20, p=0.01, 95% CI: 1.08, 1.32). Similarly, those who received some type of family planning counseling at Wave I were found to have 0.74 odds of reporting consistent use of contraception at Wave III (p=0.01, 95% CI: 0.64,0.86) compared to those who did not receive any family planning counseling. Access to primary care at Wave I (OR: 1.07, 95% CI: 0.99, 1.15) was found to have no significant association with consistent use of contraception at Wave III.

Neighborhood and Built Environment. Out of 2 key issues related to neighborhood and built environment domain from Wave I, one was found to have a significant association with ever-use of contraception at Wave III. Compared to those participants whose parent reported

Table 10

Multi-level logistic regression predicting ever use of contraception in Wave III using variables from Wave I (N= 11,575)

Variables	B	S.E.	OR (95% CI)
Economic Stability			
Poverty (Ref. Did not receive assistance)			
Received assistance	-0.05	0.01	0.73 (0.61, 0.88)†
Employment (Ref. Not employed)			
Employed	0.00	0.02	1.02 (0.88, 1.18)
Housing instability (Ref. Not lived in a foster care)			
Lived in a foster care	-0.04	0.01	0.66 (0.47, 0.92)*
Education			
High school graduation (Ref. Not Graduated)			
Graduated	0.09	0.02	1.56 (1.33, 1.83) †
Language spoken at home (Ref. English)			
Other	-0.12	0.01	0.31 (0.26, 0.38) †
Social and Community Context			
Incarceration (Ref. Not arrested)			
Arrested	-0.01	0.01	0.98 (0.94, 1.02)
Civic participation (Ref. Did not volunteer)			
Volunteered	0.11	0.02	1.49 (1.33, 1.68) †
Discrimination			

Variables	B	S.E.	OR (95% CI)
Discrimination Score	-0.01	0.02	0.99 (0.94, 1.03)
Social Cohesion			
Social Cohesion score	0.02	0.02	1.03 (0.98, 1.08)
Health and Health Care			
Access to health care (Ref. Poor access)			
Good access	0.02	0.02	1.09 (0.93, 1.27)
Access to primary care (Ref. more than 1 year ago)			
Within the last 1 year	-0.00	0.01	0.99 (0.89, 1.10)
Family Planning (Ref: No counseling)			
Counseling	-0.01	0.01	0.96 (0.78, 1.18)
Neighborhood and Built Environment			
Crime and violence			
Crime score	-0.02	0.02	0.97 (0.93, 1.01)
Environmental conditions			
Trash problem	-0.05	0.02	0.86 (0.78, 0.96) †
Control Variables			
Age	-0.09	0.02	0.91 (0.87, 0.95) †
Race/ethnicity (Ref. White)			
Hispanic	-0.03	0.02	0.86 (0.72, 1.02)
African American	0.00	0.02	1.00 (0.8, 1.21)
Other	-0.05	0.04	0.72 (0.50, 1.03)
Sex (Ref. Male)			

Variables	B	S.E.	OR (95% CI)
Female	0.01	0.01	1.04 (0.93, 1.16)
Pregnancy Status (Ref. Not pregnant			
Pregnant	-0.09	0.01	0.93 (0.90, 0.95) †
Time lapse			
Time between Wave I and Wave III	-0.01	0.02	1.00 (0.99, 1.00)

Note: * p≤0.05, † p≤0.01; Ref: Reference category.

litter being no problem in their neighborhood, participants whose parent reported litter being a big problem in their neighborhood was found to have lower odds of reporting ever-use of contraception at Wave III (OR: 86, p=0.01, 95% CI: 0.78, 0.96). The number of crimes that the participants witnessed during their adolescence, however, had no significant association with ever-use of contraception at Wave III (OR:0.97, 95% CI: 0.93, 1.01).

For consistent use of contraception, the environmental condition measured by litter problem in the neighborhood (OR: 0.98, 95% CI: 0.91, 1.04) has no significant association with consistent use of contraception. However, number of crimes in the neighborhood was significantly associated with consistent use of contraception as with every increase in the number of crimes that participants witnessed during Wave I, the odds of reporting consistent use of contraception decreased by 0.91 (p=0.01, 95% CI: 0.88, 0.94).

Discussions

This study expands the current literature by exploring the longitudinal link between social determinants of health at adolescence and contraceptive use at young adulthood. Although there are few studies that document the longitudinal link between family influences, knowledge on

Table 11

Multi-level logistic regression predicting consistency of contraceptive use in Wave III using variables from Wave I (N= 11,575).

Variables	B	S.E.	OR (95% CI)
Economic Stability			
Poverty (Ref. Did not receive assistance)			
Received assistance	-0.04	0.01	0.77 (0.64, 0.92) †
Employment (Ref. Not employed)			
Employed	-0.01	0.01	0.97 (0.87, 1.09)
Housing instability (Ref. Not lived in a foster care)			
Lived in a foster care	-0.01	0.01	0.93 (0.73, 1.18)
Education			
High school graduation (Ref. Not Graduated)			
Graduated	0.04	0.01	1.21 (1.07, 1.38) †
Language spoken at home (Ref. English)			
Other	-0.26	0.01	0.08 (0.05, 0.11) †
Social and community context			
Incarceration (Ref. Not arrested)			
Arrested	-0.01	0.01	0.98 (0.94, 1.02)
Civic participation (Ref. Did not volunteer)			
Volunteered	0.06	0.01	1.28 (1.17, 1.40) †
Discrimination			

Variables	B	S.E.	OR (95% CI)
Discrimination Score	-0.00	0.01	0.99 (0.96, 1.03)
Social Cohesion			
Social Cohesion score	0.03	0.01	1.05 (1.01, 1.08) †
Health and Health care			
Access to health care (Ref. Poor access)			
Good access	0.03	0.01	1.20 (1.08, 1.32) †
Access to primary care (Ref. more than 1 year ago)			
Within the last 1 year	0.02	0.01	1.07 (0.99, 1.15)
Family Planning (Ref: No counseling)			
Counseling	-0.04	0.01	0.74 (0.64, 0.86) †
Neighborhood and built environment			
Crime and violence			
Crime score	-0.07	0.01	0.91 (0.88, 0.94) †
Environmental conditions			
Trash problem	-0.01	0.01	0.98 (0.91, 1.04)
Control Variables			
Age	-0.04	0.01	0.96 (0.93, 0.98) †
Race/ethnicity (Ref. White)			
Hispanic	-0.06	0.02	0.74 (0.65, 0.85) †
African American	-0.10	0.01	0.61 (0.54, 0.69) †
Other	-0.06	0.02	0.70 (0.56, 0.86) †
Sex (Ref. Male)			

Variables	B	S.E.	OR (95% CI)
Female	-0.00	0.01	0.99 (0.90, 1.08)
Pregnancy Status (Ref. Not pregnant)			
Pregnant	-0.09	0.02	0.93 (0.91, 0.95) †
Time lapse			
Time between Wave I and Wave III	0.01	0.01	1.00 (1.00, 1.01)

Note: * p≤0.05, † p≤0.01; Ref: Reference category.

contraception, and parental education, and contraceptive use (Kao & Manczak, 2013; Kim et al., 2011) this study is unique as it gathers measures pertinent to all domains within an established SDH framework from the adolescence, including the economic status of participants' parents, and their neighborhood and social context. This study exclusively captures two distinct developmental stages of human life trajectories—adolescence and young adulthood. Second only to early childhood, developmental theorists have identified adolescence as a crucial period of both psychological and biological growth (Viner et al., 2012). Adolescents imbibe experiences and behaviors directly from their close ones, particularly from their parents, through modeling positive behaviors or risk behaviors. These experiences over adolescence are accumulated, and their cumulative effects affect their intervening experience, health, wellbeing, and competence in young adulthood and over the life course (Hertzman, 1999). Thus, health compromising conditions, exposures and vulnerabilities experienced in adolescence are important enough to be studied as they have been documented as the major determinants of health and inequalities relating to substance misuse, sexual behaviors, exercise, and the self-management of chronic disorders (Hawkins, Catalano, & Miller, 1992; Herrenkohl et al., 2000; Mackenbach et al.,

2008). Furthermore, when these adolescents transition to young adults, they solidify their values and identity related to health behaviors, such as risky sexual behaviors, which they might adhere to for the rest of their lives.

Family income has been used as one of the prominent measures while measuring preventive behaviors such as contraceptive use. Parent's receipt of public assistance or any kind of social welfare indicate low income or lack of income in the family. Previous research has shown cross-sectional association between higher family income with greater likelihood of reporting use of birth control (Kao & Manczak, 2013) and dual method of contraception (Jaramillo et al., 2017). This longitudinal study further documents the longitudinal link between parent's economic status in adolescence with past year ever-use and consistency of use of contraceptives in young adulthood. This suggests that socio-economic condition during adolescence is a significant predictor of adults' involvement in preventive behaviors, such as contraceptive use. This study also documents a significant link between living in a foster care and reporting ever-use of contraception in the past 12 months. Although this association was not significant for consistent use of contraception, it is understandable adolescents in foster care may have missed opportunities in schools and family to learn about sexual health education amidst all the life circumstances they were in (Combs, Brown, Begun, & Taussig, 2018), which as shown in this study, had prolonged effects that lasted in young adulthood. Obtaining some forms of formal sex education have been documented to have a significant association with using contraceptive methods at sexual debut, using effective contraceptive methods, and frequent use of birth control methods (Isley et al., 2010; Kwon, Kang, & Kim, 2020; J. Manlove, Ikramullah, et al., 2008). Therefore, child welfare programs should consider integrating sexual health

education and pregnancy prevention strategies specifically targeting these marginalized population to promote contraceptive use, both in the short term and long term.

Measures related to education have not been explored to document a longitudinal link with contraceptive use, nevertheless, items related to parental education have been previously explored in cross-sectional settings. There are mixed results associated with the link between parental education and contraceptive use. One research study found no significant association between parental education and contraceptive use among male adolescents aged 15-19 years (J. Manlove, Ikramullah, et al., 2008) while other cross-sectional studies have indicated that adolescent with parent having more than 12 years of formal education are more likely to use contraceptive methods (Ford & Forthofer, 2010; Longmore et al., 2003). Our longitudinal study suggests that parental receipt of high school diploma is a significant predictor of both ever-use and consistent use of contraception among young adults. Parental educational status has also been previously used as a proxy measure of socio-economic status of a family. Increase in maternal education have been linked with positive changes in family environment where parent-child communication about sex are fostered (J. Manlove, Terry, Gitelson, Papillo, & Russell, 2000). This type of family environment promotes family connectedness and communication which are linked with delayed sexual debut, increased contraceptive use, and reduced odds of adolescent pregnancy (Hogan, Sun, & Cornwell, 2000; J. Manlove, Ikramullah, Mincieli, Holcombe, & Danish, 2009; J. Manlove et al., 2000). Increase in parental education can subsequently influence contraceptive use among adolescents and young adults as educated parents facilitate and support healthy behaviors by enhancing communication and decision-making skills. For association of language and contraceptive use, this current longitudinal study also demonstrated a significant association between English language used at homes with both

ever-use and consistent use of contraception. The language spoken at home may determine their participation in family planning-based educational interventions at adolescence, which may in turn influence their contraceptive use at young adulthood. Educational interventions at schools and communities that are tailored to non-English speaking populations should be implemented to reach such minority populations to increase contraceptive use.

Under Social and community context, a history of civic participation and perceptions of social cohesion during adolescence were found to have significant association with consistent use of contraception in young adulthood. Involvement in unpaid volunteer work in a community signifies greater perceived belongingness to the community. In such type of knit community, neighbors get along and trust each other enhancing the social cohesion in the community. This type of community harbors less stressful situations for the adolescents while growing up where risky behaviors such as unprotected sex, involvement in violent and delinquent activities are discouraged. Due to the social support and cohesive environment during adolescence, adolescents are more likely to involve in less risky behaviors and continue to engage preventive behaviors, such as contraceptive use, as they grow into adults.

Our findings did not find any longitudinal link between measures of health and health care at adolescence and past year ever-use of contraception at young adulthood after controlling for other SDH domains. The results of bivariate correlation suggest a significant relationship between access to health care at adolescence and past year ever-use of contraception among young adults, but this association was not found significant in the final regression model. The relationship between access to health care may have been accounted for by other social domains (e.g., poverty status or employment status), thus when included in the same regression model, the association of access to health care did not appear significant. However, adolescents who were

able to access health care in adolescence were more likely to use contraceptive methods consistently as young adults. It is interesting to find that this measure related to access to health care was not related to ever-use of contraception in the past 12 months of the interview at Wave III but were significantly associated with consistent use of contraception at Wave III. Future studies should explore more details about access to health care, particularly for sexual and reproductive services, to explain this association. This study used family planning counseling as a proxy measure for health literacy. The family planning counseling at adolescence was also significantly associated with consistency of contraceptive use at adulthood, but not in a direction that was expected. Although only a small percentage (6.11%) of the participants received family planning counseling during their adolescence, counselling at adolescence was found to have a significant negative association with consistent use of contraception at young adulthood. Contrarily to the previous literature that emphasized sharing of comprehensive information and educational material during effective adolescent friendly family planning counseling programs to positively impact attitudes, self-empowerment and safe sex behaviors (Bonny, 2021; Dahl, Allen, Wilbrecht, & Suleiman, 2018; Mahamed, Parhizkar, & Shirazi, 2012), this study indicated an unexpected association. Future research should explore the pathways on how family counseling at adolescence affect contraceptive use at adulthood with more focus on what types of counseling and education materials were shared between recipient and providers.

Under Neighborhood and Built environment domain, one out of two measures were found to be significant for each of the dependent variables. Parental report of trash problem was associated with participants' ever-use of contraception in young adulthood, but the number of crimes observed in neighborhood was not related to ever-use of contraception. It is plausible to assume that the neighborhood that have litter or trash problem are poor and medically

underserved neighborhoods where family planning interventions were not provided or accessible to the residents. This disadvantage could lead to discouragement of knowledge, positive practices, and positive attitude towards family planning methods (Xu et al., 2020), thus discouraging ever-use of contraception in young adulthood. However, it is interesting to note that crimes in the neighborhood were not related to ever-use of contraception even when crimes also denote social disorder and neighborhood disorganization, which are more prevalent in poor and low-income communities. Therefore, future research should explore mechanisms of how various neighborhood-related contexts during adolescence affect contraceptive use in young adulthood. The amount of trash, on the other hand, was not significant for consistent use of contraception, but this current study indicates that adolescents who grow up in a neighborhood where crimes are common are less likely to use contraception consistently. Prior research has speculated some mechanisms that explain the associations between neighborhood disorder and crimes and adolescent risky sexual behavior. Studies published in 2010 explain how social and physical disorders in neighborhoods provide a pathway for youth to engage in risky behaviors via stressors that stem from living in poverty (McLaughlin et al., 2010; Obradović, Bush, Stamperdahl, Adler, & Boyce, 2010). Additionally, although the specific mediating factor was not specified, another study published in 2018 indicated that youth who are exposed to crimes are more likely to engage in risky sexual behavior (James, Donnelly, Brooks-Gunn, & McLanahan, 2018). Additional studies are warranted to explain the link between crimes and contraceptive use behavior.

Strengths and limitations

Using a large sample, this study is the first longitudinal study that explores the link between SDH domains and contraceptive use by utilizing a comprehensive SDH framework.

However, there are numerous limitations to be noted. Alike Study 1, there might be a possibility of the social desirability bias as participants might have answered in a way that is more acceptable way than what reflects their reality. Because of the unavailability of weight variables associated with multilevel models, I could not use the weights to portray the sample as the nationally representative data. Additionally, measurement of contraceptive use consistency is another concern. Specific types of contraception were not explored when assessing consistency. It is possible that women who consistently use effective contractive methods, such as implants, differ significantly from women who consistently use less effective contraceptive methods (for example: withdrawal) in terms of social domains. Because participants who used any type of contraception will be combined into a homogenous group representing consistent users, association between social domains and consistent contraceptive use could be underestimated.

Another limitation is the use of proxy measures to represent key issues under SDH domains. Questions were selected in the study to best represent the key issues under each determinants but may not fully cover or asked in a manner that best describe the social determinants of health. Though the proxy measures used in the study have been previously used in the similar studies published using SDH (Maness et al., 2016; Thompson et al., 2019), the variables may not completely measure how the domains have been described in Healthy People 2030 SDH framework. For example, as a proxy measure for health literacy related to contraceptive use, the item related to family planning counselling was used in this study because there are no items related to education on contraception included in the Add Health dataset. Past research has used family planning counselling as a measure to quantify the exposure of adolescents to information about contraception and its use (Pritt et al., 2017; Sserwanja et al., 2021). Additionally, because Add Health data incorporated few questions/items related to

adolescence in Wave III, items from Wave III have been used to reflect social domains of the earlier wave -- Wave I. This could have bought along some recall bias in the data.

Finally, despite the longitudinal nature of the study, contraceptive use at baseline (Wave I) was not controlled for in the study when analyzing the link between Wave I social domains and Wave III contraceptive ever-use and consistency of use. Because of this, we cannot ascertain if the longitudinal associations were due to Wave I social domains cross-sectionally associated with Wave I contraceptive use, which further predicted Wave III contraceptive use. Further testing of this longitudinal association is needed with different datasets.

Overall, the findings of the longitudinal study linked key issues of all social domains except health and health care with ever-use of contraceptive methods among young adults. For consistency of contraceptive use, one or more key issues of all SDH domains at adolescence were found to be associated with consistent use of contraception. The findings of this study connect the link between SDH domains at adolescence and contraceptive use behavior at young adulthood measured approximately 8 years apart. With numerous significant associations, this study adds its findings to a mounting evidence that indicate how socioeconomic, neighborhood and community related contextual factors during the early years of life are an important determinant of later health behaviors. It is because the socioeconomic circumstances the children grow in establish psychosocial trajectories that persist over the rest of their lives (G. Miller & Chen, 2007). Our results highlight the need of appropriate interventions sooner in adolescence to increase contraceptive use among vulnerable population

Chapter 6. Study 3 (Mediation study)

Study 3 extended Study 2 to explore contraceptive self-efficacy as a potential mediator of the longitudinal association between social domains and use and frequency of contraception among young adults. The two main research questions associated with this study are:

RQ 3.1. Does contraceptive self-efficacy act as a mediating factor between each domain of SDH in adolescence and contraceptive ever-use in adulthood?

RQ 3.2. Does contraceptive self-efficacy act as a mediating factor between each domain of SDH in adolescence and consistency of contraceptive use in adulthood?

The methods, results, and discussions of the mediation study are discussed in separate sections below.

Methods

Sample

Inclusion and Exclusion Criteria (Same as Study 2) Our sample was restricted to the respondents who have participated in both Wave I and Wave III in-home survey. Our analytical sample is further restricted to those who were sexually active in the 12 months prior to interview in Wave III.

Instrumentation and Measurement Protocols

For Study 3, measures related to social domains were extracted from Wave I adolescent in-home survey and Wave I parent in-home survey. Since measures related to adolescence were also asked in the Wave III, few variables from Wave III are also used to reflect the social domains during adolescence. The measures related to our potential mediator -- contraceptive self-efficacy—were taken from Wave II. The dependent variable --contraceptive behavior (ever-use and consistency) were extracted from Wave III. SDH measures and contraceptive measures

used in Study 3 are the same as in Study 2 and are described again below. This section describes additional measures used in Study 3 such as contraceptive self-efficacy.

Social Determinants of Health (U.S. Department of Health and Health Services (USDHHS)) measures (same as Study 2): Wave I (Adolescents' and Parents') include items/questions related to all 5 domains included in the Healthy People 2030 SDH framework. When multiple proxy measures existed, the most relevant measure was selected.

Economic Stability. Wave I include proxy measures for three out of five key issues which are *Poverty, Employment Status, and Housing Instability.*

To assess *Poverty* during the adolescence period, parent of the participants at Wave I were asked "Are you currently getting AFDC, public assistance, or welfare?" with response options "yes," "no," "don't know," "refused," and "not applicable." The response options were dichotomized into "yes" and "no" for further analysis with else considered missing.

Employment Status was measured in Wave I by asking participants' parent "Do you work outside the home?" The response options of this question were "no," "yes," "refused" and "missing." The response options were recoded as "yes" and "no" with else considered missing.

Housing Instability during the adolescence was measured in Wave III by asking "Did you ever live in a foster home?" Response options available for this question are "no," "yes," "refused," "don't know" and "not applicable." The response options were dichotomized into "yes" and "no" with else considered missing.

Education. Since adolescents were enrolled in the school in Wave I, proxy measures of parental education were taken from Parent survey. Out of 4 critical areas under education, only two critical areas were assessed under education which are high school graduation rate, and language and literacy.

For the proxy measure of *High School Graduation Rate* of parent, parent was asked "How far did you go in school?" with varied options from 8th grade to professional training, and additional options of "refused" and "missing." This item was recoded into a dichotomous variable as "Yes" if parent has selected options such as high school graduate and above while those who have less education than high school were coded as "No." The additional response option-- "refused" were incorporated as missing in the analysis.

To measure *Language and Literacy*, adolescents in Wave I were asked "What language is usually spoken in your home?" with response options "English," "Spanish," "other," "refused" and "don't know." These responses were categorized into "English" and "Other language" while treating "refused" and "don't know" variables as missing.

Social and Community Context. Proxy measures for all 4 key areas of social and community context during the adolescence were identified from Wave I and Wave III.

Proxy measure of *Social Cohesion* at the neighborhood level were measured by 5 items in Wave I out of which 3 are true/false statements and remaining 2 items are questions with Yes/No responses. Additionally, all 5 items have other response options such as "refused," "don't know" and "not applicable." The three statements with true/false as their response options were asked as "You know most of the people in your neighborhood," "In the past month, you have stopped on the street to talk with someone who lives in your neighborhood.," "People in this neighborhood look out for each other." The two questions with Yes/No response options are "Do you use a physical fitness or recreation center in your neighborhood?" and "Do you usually feel safe in your neighborhood?" For the analysis, all the "yes" or "true" were coded as 1 and "no" or "false" were coded as 0 with else considered missing. The sum of these scores represents the level of social cohesion participants perceive in their neighborhood.

Perception of Discrimination was measured in Wave I by using one question "How much do you agree or disagree with the following: Students at your school are prejudiced." If the students were interviewed during summer, students were asked about the previous year. Response options included Likert response options ranging from "strongly agree" to "strongly disagree" with "refused," "legitimate skip" and "don't know" as the additional options. This question was analyzed as a continuous measure. Those who legitimately skipped this question did not go to school in that school year or during the past school year, thus, they were incorporated into missing category. Other response options such as "refused" and "don't know" were considered as missing.

Incarceration during adolescence was measured in Wave III in-home interview where the participants were asked "How many times were you arrested before you were 18?." Response options include listing times arrested till 30 with additional response options of "refused," "legitimate skip," "don't know," "not applicable," and "missing." For the listed times, this question was analyzed as a continuous variable. Participants with "legitimate skip" as chosen response option had never ever been detained or questioned by a police officer so they were coded as "0 count" with all other additional response options were treated as missing.

Civic Participation during adolescence was also measured in Wave III interview where participants were asked "At any time during your adolescence, when you were between 12 and 18 years old, did you regularly participate in volunteer or community service work?" with response options "no," "yes," "refused," "don't know," and "not applicable." This question was analyzed as a dichotomous variable for further analysis where "refused," "don't know" and "not applicable" were treated as missing.

Health and Health Care. Wave I include items/questions that relate to all three key issues of health and health care.

Access to Health Services is evaluated by 1 question where participants were asked "Has there been any time over the past year when you thought you should get medical care, but you did not?" with response options "no," "yes," "refused," and "don't know." This item was dichotomized into "yes" and "no" for analysis with else considered missing.

In order to examine *Access to Primary Care,* participants were asked "When did you last have a physical exam or routine check up?" with response options "less than a year ago," "1 to 2 years ago," "more than 2 years ago," "never," "refused," "don't know" and "not applicable." This item was dichotomized into "yes" and "no" for analysis by taking 12 months as a cut-off point with else considered missing.

As a proxy measure of *Health Literacy,* the item related to family planning counseling is used. Participants in Wave I were asked "In the past year have you received family planning counseling or services?" with response options "yes," "no," "refused" and "don't know." The response options were recoded as "yes" and "no" with else considered missing for further analysis.

Neighborhood and Built Environment. Wave I adolescent in-home interview and parent interview included items related to *Crime and Violence, and Environmental Conditions.*

Adolescents at Wave I were asked about *Crime and Violence* in their neighborhood by question worded as "During the past 12 months, how often did each of the following things happen? : You saw someone shoot or stab another person, someone pulled a knife or gun on you, some shot you, someone cut or stabbed you, you got into a physical fight, you were jumped, you pulled a knife or gun on someone, you shot or stabbed someone" with response options "never,"

"once," "more than once," "refused," "don't know," and "not applicable." This item was used as a count variable for the events that the participants have reporting seeing once or more than once in the past 12 months. The response options such as "refused," "don't know," "not applicable" were recoded as missing.

Environmental Conditions were assessed in Wave I parent in-home survey where parent of the adolescent was asked "In this neighborhood, how big a problem is litter or trash on the streets and sidewalks?" with response options "no problem at all," "a small problem," "a big problem," "refused," and "missing." The three response options that ascertain whether a problem exists in the neighborhood were used in the analysis as a continuous variable with the rest coded as missing.

Measures of Contraceptive Behavior (Same as Study 2). Young adults in the Wave III in-home interview were asked about their contraceptive use in the past 12 months using 1 question worded as "In the past 12 months, did you or your partner(s) use any of these methods for birth control or disease prevention?" with options "birth control pills," "an implant," "birth control shot," "a diaphragm," "emergency contraception or the morning after pill," "natural family planning (safe periods by temperature, cervical mucus test or calendar" and "female sterilization." If the participant has chosen any type of birth control methods, it was coded "yes—used contraceptive methods" else it was coded as "no."

Consistent contraceptive use has been examined in Wave III in-home interview by asking participants "On how many occasions of vaginal intercourse in the past 12 months did you or your partner use some form of birth control or pregnancy protection?" Response options were "none," "some," "half," "most," and "all" with the additional options of "refused," "legitimate skip," "don't know" and "not applicable." Participants who were legitimately skipped for this

question were those who have not ever had vaginal intercourse or who did not have vaginal intercourse within the past 12 months, thus these participants were not included in our analysis. Participants who indicated using some form of birth control methods all the time were categorized as consistent contraceptive users while those who indicated they used birth control methods never, some, half and most of the time were categorized as inconsistent contraceptive users (Morrison et al., 2016).

Measures of Contraceptive Self-efficacy. Adolescents in Wave II were asked about contraceptive self-efficacy with three questions "If you wanted to use birth control, how sure are you that you could stop yourself and use birth control once you were highly aroused or turned on?," "How sure are you that you could plan ahead to have some form of birth control available?**,"** and, "How sure are you that you could resist sexual intercourse if your partner did not want to use some form of birth control?" The Cronbach's alpha was found to be 0.66.The response options for each item are very sure (1), moderately sure (Healthy People 2030), neither sure or unsure (Healthy People 2030), moderately sure (4), and very unsure (5) along with an additional sixth option of "I never plan to use birth control." The response options were reverse coded such as greater score would mean higher contraceptive self-efficacy. For the analysis, participants who responded, "I never plan to use birth control" (n = 200) were considered as missing because choosing this option did not provide any information about participants' perceived self-efficacy. Following the procedure used by Longmore and DeMaris (Longmore & DeMaris, 1997), the mean of the items answered was calculated and multiplied by 3 to calculate total score, only if participants have answered at least 2 questions of self-efficacy items, such that the self-efficacy scores ranged from 3 to 15. Keeping the score range within 3-15 would

make the results comparable to past published studies. This score was used in the analysis depicting self-efficacy of the respondents.

Demographics. Add Health measures age by asking the birth year and month. For the purpose of our study, age will be calculated by subtracting the participant's birth year reported in Wave III data was collected, i.e., 2002. Interviewer asked the participants about their biological sex with additional options of "refused" and "don't know." Biological sex will be used as a dichotomous variable with response options "male" and "female" for the purpose of the analysis. "Which one category best describes your racial background" measured the race of the participants while participants were also asked "Are you of Hispanic or Latino origin? with the possible response options of "yes," "no," "refused," and "don't know" This race question had 9 possible response options: "White," "Black or African American," "American Indian or Native American," "Asian or Pacific Islander," "other," "refused," "legitimate skip," "don't know" and "not applicable." For both race and ethnicity, "refused," "don't know," "legitimate skip," "not applicable," and "don't know" were coded as missing. Combining both race and ethnicity questions, the response options were narrowed down to 4 categories which included Non-Hispanic White, Hispanic, Non-Hispanic Blacks and Other. Additionally, to identify the pregnancy status of participants at Wave III, the participants were asked "What month of pregnancy {IS SHE/ARE YOU} in now?" with response options ranging from month 1 through 9 along with "refused," "don't know" and "not applicable." All the response from month 1 to 9 was coded as "pregnant" while those who reported "refused," "don't know," and "not applicable" were coded as missing. Two time lapse variables were created to represent the time lapse between Wave I and III, and between Wave I and II. These time lapse variables were used as a control variables in the mediation model.

Data Analysis

The descriptive statistics are similar to that of Study 2 where all the independent variables are from Wave I and Wave III (if the items were related to the adolescence phase of the participants) and dependent variables were from Wave III. The potential mediator variable for this study—contraceptive self -efficacy—was taken from Wave II. Similar to that of the Study 2, the nested nature of the data is accounted by utilizing multilevel models. The mediation models were tested by assuming contraceptive self-efficacy at Wave II as a potential mediator between Wave I social domains, and Wave III contraceptive ever-use and consistency of use.

A mediation model was tested including both dependent variables using path analysis in Mplus (version 8.7). To account for subpopulation and nested nature of the data, the TYPE= COMPLEX command was used along with SUBPOPULATION command under variable. Similar to Study 2, the robust maximum likelihood estimation method was used along with MONTECARLO integration algorithm. For both mediation models, mediation effects was assessed using bias corrected bootstrapping confidence intervals based on bootstrapping of 10,000 resamples (MacKinnon, 2012). Missing data were treated with FIML. In both mediation models, age, sex, race/ethnicity, time lapse between Wave I and Wave III were controlled for Wave III dependent variable, time lapse between Wave I and Wave II, and participants' pregnancy status were controlled for Wave II self-efficacy. The contraceptive use at Waves I and II were not controlled for in the mediation analysis because, alike Study 2, most participants were not sexually active at those time periods. Thus, controlling for contraceptive use at Waves I and II would limit the data analysis to a subsample of adolescents who were sexually active at prior waves, which would have changed the conceptualization of the study.

Results

Table 11 shows the correlation between all variables including contraceptive self-efficacy and all other dependent and independent variables. Contraceptive self-efficacy is significantly correlated with all the variables except parental education, history of living in a foster care, and receipt of family planning counseling in adolescence.

A multilevel path analysis model was employed to explore the mediating effect of contraceptive self-efficacy between key issues under social domain and contraceptive use – ever-use and consistent use, separately. As like in Study 2, the key issues are social domains when the participants were in their adolescence representing prior social, economic and neighborhood characteristics of participants, thus key issues include characteristics of participants' parental education, employment, and neighborhood context, and participants' access to health care, family planning counseling, and involvement in various unpaid volunteer work before they were of age 18.

Direct Pathways

Figure 5 shows the direct effects of key issues related to social domains, contraceptive self-efficacy, and contraceptive ever-use and consistent of use. As shown, out of 14 key issues, 7 key issues are significantly associated with contraceptive self-efficacy. Parental high school graduation (*B*=0.099, p=0.04), history of civic participation (*B*=0.078, p=0.014), perceived social cohesion (*B*=0.034, p=0.003), access to health care (*B*=0.103, p=0.000), and access to primary care (*B*=0.059, p=0.039) were positively associated with contraceptive self-efficacy. On the

Table 12

Correlation among variables of Study 3 (Wave I, II, and III)

Variables	1.	2.	3.	4.	5.	6.	7.
1.Contraceptive Self-efficacy	1						
2.Consistency of use	0.11†	1					
3.Ever use	0.06†	0.04†	1				
4.Poverty (P)	-0.02	-0.01†	-0.01†	1			
5.Employment (P)	0.02*	0.01*	0.01†	-0.04†	1		
6.Living in foster care	-0.00	-0.00	-0.00*	0.00†	-0.00†	1	
7.High school (P)	0.07†	0.02†	0.01†	-0.02†	0.04†	0.00	1
8.Language	-0.07†	-0.01†	-0.01†	0.00*	-0.01†	-0.00†	-0.04†
9.Incarceration	-0.09†	-0.01*	-0.01	0.01*	-0.01	0.00	-0.01
10.Civic participation	0.06†	0.02†	0.01†	-0.01†	0.01†	-0.00	0.02†
11.Discrimination	-0.11†	-0.01	-0.00	0.02†	-0.00	0.00	-0.02*
12.Social cohesion	0.08*	0.02†	0.01†	-0.01†	0.01	0.00	0.02*
13.Access to health care	0.03†	0.01†	0.01*	-0.00*	-0.00	-0.00*	0.01†
14.Access to primary care	0.05†	0.01†	0.00	0.00	0.00	0.00	0.01†
15.FP counseling	0.01	-0.01†	-0.00	0.003†	-0.00	0.00†	-0.00
16.Crime & violence	-0.26†	-0.07†	-0.02†	0.03†	-0.02*	0.01†	-0.03†
17.Environmental condition	-0.03	-0.01*	-0.01†	0.03†	-0.02†	0.00†	-0.02†

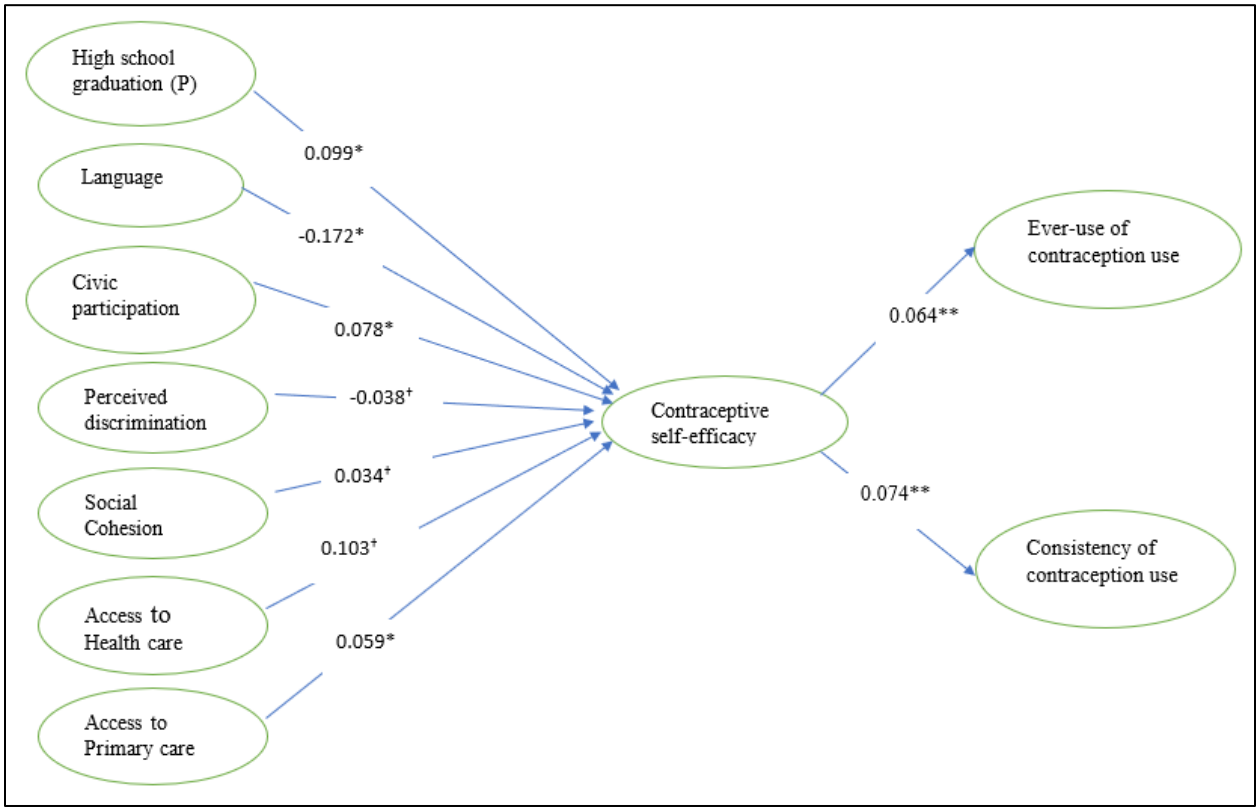
Table 12 continued….

	8.	**9.**	**10.**	**11.**	**12.**	**13.**	**14.**	**15.**	**16.**
8.Language	1								
9.Incarceration	-0.01*	1							
10.Civic participation	-0.00	-0.01	1						
11.Discrimination	0.01	-0.01	0.00	1					
12.Social cohesion	-0.04†	0.01	0.03†	0.06†	1				
13.Access to health care	0.00	-0.01	0.00	0.03†	0.03†	1			
14.Access to primary care	-0.01*	0.00	0.02†	0.01*	0.04†	0.01†	1		
15.FP counseling	-0.00	0.01	-0.00†	-0.01†	-0.01*	-0.01†	0.01†	1	
16.Crime	0.01	0.18†	-0.04†	-0.07†	0.04†	-0.06†	-0.01	0.03†	1
17.Environmental condition	-0.01*	0.01	-0.01†	0.03*	-0.03†	-0.00	-0.00	0.00	0.04†

Note: (P) Information from Parent Wave I; FP: Family Planning; * p≤0.05, † p≤0.01

Figure 5

Mediation model of ever-use & consistency of contraceptive use (n=7,217)



Note: Only significant pathways are shown. Numbers are standardized coefficients. *p≤0.05, † p≤0.01.

Table 13

Indirect effects: standardized coefficients of multilevel model predicting ever-use and consistent use of contraception among young adults. (n=7,217)

	Model 1: Ever-use			Model 2: Consistent use		
Variables	**β**	**SE (Boot)**	**Boot 95% CI [LL, UL]**	**β**	**SE (Boot)**	**Boot 95% CI [LL, UL]**
Economic Stability						
Poverty (Ref. Did not receive assistance)						
Received assistance	-0.002	0.00	[-0.009, 0.005]	-0.002	0.00	[-0.009, 0.007]
Employment (Ref. Not employed)						
Employed	0.002	0.00	[-0.001,0.007]	0.002	0.00	[-0.002, 0.006]
Housing instability (Ref. Not lived in a foster care)						
Lived in a foster care	-0.001	0.01	[-0.016, 0.011]	-0.001	0.01	[-0.018, 0.012]
Education						
High school graduation (Ref. Not Graduated)						
Graduated	0.01	0.00	[0.001, 0.017]	0.01	0.00	[0.001, 0.017]
Language spoken at home (Ref. English)						

Variables	β	SE (Boot)	Boot 95% CI [LL, UL]	β	SE (Boot)	Boot 95% CI [LL, UL]
Other	-0.01	0.01	[-0.025, -0.001]	-0.013*	0.01	[-0.026, -0.001]
Social and Community Context						
Incarceration (Ref. Not arrested)						
Arrested	-0.001	0.00	[-0.005, 0.000]	-0.002	0.00	[-0.005, 0.000]
Civic participation (Ref. Did not volunteer)						
Volunteered	0.005*	0.00	[0.001-0.011]	0.006*	0.00	[0.001, 0.012]
Discrimination						
Discrimination Score	-0.002*	0.00	[-0.005, -0.001]	-0.003†	0.00	[-0.005, -0.001]
Social Cohesion						
Social Cohesion score	0.002*	0.00	[0.001, 0.005]	0.002†	0.00	[0.001, 0.005]
Health and Health Care						
Access to health care (Ref. Poor access)						
Good access	0.007*	0.00	[0.002, 0.015]	0.008†	0.00	[0.003, 0.014]
Access to primary care (Ref. more than 1 year ago)						

Variables	β	SE (Boot)	Boot 95% CI [LL, UL]	β	SE (Boot)	Boot 95% CI [LL, UL]
Within the last 1 year	0.004	0.00	[0.001, 0.010]	0.004	0.00	[0.001, 0.010]
Family Planning (Ref: No counseling)						
Counseling	-0.005	0.00	[-0.016, 0.002]	-0.006	0.01	[-0.016, 0.003]
Neighborhood and Built Environment						
Crime and violence						
Crime score	-0.001	0.00	[-0.003, 0.000]	-0.001	0.00	[-0.003, 0.000]
Environmental conditions						
Trash problem	-0.002	0.00	[-0.007, 0.000]	-0.003	0.00	[-0.007, 0.000]

Note: *p≤0.05, †p≤0.01, Boot= Bootstrapped output, UL = Upper Limit, LL = Lower limit of 95% CI.; Ref: Reference category

other hand, language used at home (*B*= -0.172, p=0.029) and perceived discrimination during adolescence (*B*= -0.038, p=0.001) were negatively and significantly associated with contraceptive self-efficacy. Interestingly, for contraceptive self-efficacy, although significant bivariate correlations were found for parental employment (r=0.02, p=0.038), history of incarceration (r= -0.09, p=0.008), and number of crimes observed in neighborhood (r= -0.26, p=0.000), the associations became nonsignificant in the final model. In both models, contraceptive self-efficacy was positively associated with contraceptive ever-use (*B*=0.064, p=0.001) and consistency of use (*B*=0.074, p=0.000).

Indirect Pathways

Table 12 shows the mediating effect of contraceptive self-efficacy between social domains at Wave I and contraceptive use at Wave III. Contraceptive self-efficacy shows a mediating effect between key issues of health and health care, and social and community context while predicting ever-use of contraception at young adulthood (as shown in Model 1 in Table 12).

Under Social and Community Context, contraceptive self-efficacy significantly mediated the effects between both history of civic participation (*B*=0.005, p≤0.05) and perception of social cohesion (*B*=0.002, p≤0.05) in the neighborhood and contraceptive ever-use. That is, both history of civic participation and perception of higher social cohesion in neighborhood were associated with increased self-efficacy, which in turn resulted in increased ever use of contraceptive use. Significant mediation effect of contraceptive self-efficacy was also identified for the relationship between perceived discrimination and ever-use of contraception (*B*= -0.002, p≤0.05). This result indicates that perceived discrimination decreases contraceptive self-efficacy, which in turn decrease ever-use of contraception.

Under the domain of Health and Health Care, contraceptive self-efficacy was found to mediate the effects of access to health services (B=0.007, p≤0.05) reported at Wave I and ever-use of contraception reported at Wave III. This suggests that participants who were able to access health care when they thought they needed had higher contraceptive self-efficacy which in turn increased ever-use of contraception. The indirect effects of key issues measured under Economic Stability, Education, and Neighborhood and Built Environment on ever-use of contraception via contraceptive self-efficacy were not statistically significant.

Model 2 from Table 12 shows how contraceptive self-efficacy mediates the relationship between components of Education, Social and Community context, and Health with consistent use of contraception among young adults. Under Education domain, the indirect effect of contraceptive self-efficacy for language and contraception use consistency was found to be significant (B= -0.013, p≤0.05). That is, speaking a different language than English at home is associated with decrease in contraceptive self-efficacy, which in turn decreases frequent use of contraception.

Contraceptive self-efficacy had a significant mediating influence on history of civic participation (B=0.006, p≤0.05) and social cohesion (B=0.002, p≤0.01) in the neighborhood. This suggests that participating in unpaid community work and having higher perception of social cohesion in the neighborhood increased contraceptive self-efficacy, which subsequently increased the frequent use of contraception among young adults. As like in Model 1, contraceptive self-efficacy negatively mediated the relationship between perceived discrimination at adolescence (B= -0.003, p≤0.01) and consistency of contraceptive use at young adulthood. That is, participants who have perceived discrimination while growing up tend to have lower contraceptive self-efficacy, which resulted in less frequent use of contraception.

Similarly, contraceptive self-efficacy was found to mediate the effects of access to health services (B=0.008, $p \leq 0.01$) reported at Wave I and ever-use of contraception reported at Wave III. This suggests that having access to health services when needed increases participants' contraceptive self-efficacy, which in turn increases the consistency of contraceptive use. The indirect effects of key issues measured under Economic stability, and Neighborhood and Built environment on ever-use of contraception via contraceptive self-efficacy were not statistically different from 0 at 95% confidence interval.

Discussions

This study 3 identified a series of direct effects from key issues of SDH domains to contraceptive self-efficacy, and from contraceptive self-efficacy to both contraceptive ever-use and consistency of use. Furthermore, indirect effects of contraceptive self-efficacy were identified, such that contraceptive self-efficacy mediated the link between a few key issues of adolescence SDH domains and contraceptive use behaviors at young adulthood.

As like in Study 2, this study focuses on two distinct developmental stages of human life which are adolescence and young adulthood. Adolescents acquire knowledge, attitudes, and beliefs, and build their experiences through their opportunities and interactions with their close ones. Based on the positive and negative life experiences, they build their general or behavior specific self-efficacy which they carry along while they transition to young adulthood. Self-efficacy has been reported as one of the critical constructs of behavioral change. Bandura argues that people not only need reasons to initiate behavioral change, but they also must firmly believe that they have a capacity, ability, and efficacy to exercise the personal control over the behavior they need to change (Bandura, 1992). Numerous studies conducted in cross-sectional settings have reported the association between self-efficacy and contraceptive use, but our study is the

first one to have explored a link between self-efficacy and contraceptive use in longitudinal setting. The findings of this study align with prior studies in concluding that contraceptive self-efficacy is positively and significantly associated with contraceptive use (Longmore et al., 2003; Ryan, Franzetta, & Manlove, 2007). For example, Longmore et al., 2003 concluded that contraceptive self-efficacy increases the odds of using condoms and non-condom methods versus no method of contraception. In another study conducted among Pennsylvania women aged18 to 40 years, women with higher self-efficacy score reported an increased use of prescription contraceptive methods such as OCPs (Hamidi et al., 2018). This study reports that there is a significant association between perceived contraceptive self-efficacy and contraceptive use that are measured almost 6 years apart. This might be due to the fact that those who have higher perceived self-efficacy at adolescence continue to boost their self-efficacy with regular engagement in safe and protected sexual activities over time. Thus, this indicates that it might be beneficial for the program planners to implement self-efficacy-based interventions earlier in the adolescence than later in adulthood.

Although studies have not extensively evaluated the connection between demographic characteristics and contraceptive self-efficacy, there is strong support for the idea that the type of social structure person is in influence their self-efficacy (Lauby, Semaan, O'Connell, Person, & Vogel, 2001; Longmore et al., 2003; Ryan et al., 2007). Past research findings suggest that increasing improvement in financial situations increase efficacy scores over time (Downey & Moen, 1987) while lower level of education is associated with lower self-efficacy score (Longmore et al., 2003). Aligning with the conclusion of these studies, our study also suggests significant link between social domains and contraceptive self-efficacy. For example, parental high school completion and good access to health care positively influence contraceptive self-

efficacy, while perceived discrimination and speaking a non-English language at home decreases the self-efficacy score of the adolescents.

This present mediation study also found some significant mediation effects of contraceptive self-efficacy between key issues of SDH domains and contraceptive use behavior. Particularly, contraceptive self-efficacy played a significant mediating role between some key issues related to Education, Social and Community context, and Health and Health care. Under Education domain, speaking a non-English language at home decreased contraceptive self-efficacy, which in turn decreased the consistency of contraception use in adulthood. Our study 2 also suggested that there is a significant association between language used at home during adolescence and contraceptive use in young adulthood. The mediation results provide a possible explanation for that relationship: the language could act as a barrier or facilitator to participate in sexual education where adolescents learn how to correctly use contraceptives, which in turn increases contraceptive self-efficacy. If adolescents missed the opportunity to participate in sex education/interventions, these participants are less likely to have higher perceived contraceptive self-efficacy, thus, decreasing their ability to engage in safe sex practices such as contraceptive use. Surprisingly, contraceptive self-efficacy did not play a mediating role between language spoken at home and ever-use of contraception. Future research should further explore the mechanism how language affect the psychosocial aspects related to contraceptive use.

Significant indirect effects of contraceptive self-efficacy were observed for perceived discrimination, civic participation, and social cohesion. It is possible that having a strong social support and knitted neighborhood enhances the overall general efficacy of an individual by providing opportunities to engage in efficacious actions. In social psychology, there is a prevalent concept called “looking glass shelf” which describes how individuals have a limited

view of the development of self-evaluation based on what is perceived by other (Gecas & Schwalbe, 1983). Since social-structural conditions enable and constrain efficacious action, it influences the meanings that individuals give to themselves. If the environment around an individual is full of support, social cohesion and belongingness, these conditions bolster the concept of general self-efficacy which might also translate into contraceptive self-efficacy during adolescence and young adulthood, which in turn increase contraceptive use in later years. Previous research also supports the idea that involvement in volunteer work (civic participation) is related to general self-efficacy, self-esteem, and social connectedness (Brown, Hoye, & Nicholson, 2012). The overall increase in general self-efficacy also translates into increase in family planning self-efficacy (Peyman et al., 2009) which in turn increases contraceptive use among young adults. Perceived discrimination during adolescence, on the other hand, diminish the self-confidence and self-esteem of individuals which might affect general self-efficacy and contraceptive self-efficacy, which in turn result in decreased ever-use and consistent of contraceptive use in young adulthood. It is important to note that, despite the mediation effects, there are no significant direct associations between perceived discrimination or social cohesion at adolescence and contraceptive use at young adulthood. One possible explanation for this relationship is that perceived discrimination and perceived social cohesion during adolescence do not necessarily associate with contraceptive use behavior, unless it first affects psychosocial factors such as contraceptive self-efficacy, that then predicts contraceptive ever-use and frequency of use. Thus, irrespective of the neighborhood characteristics such as cohesiveness or neighborhood disorganization, short behavioral skill interventions that boost contraceptive self-efficacy can increase safe sex practices such as contraceptive use.

This study found an indirect effect between access to health care at adolescence and contraceptive use behavior at young adulthood via contraceptive self-efficacy. Particularly, in case of prescription contraceptive use, past research has found a significant association between contraceptive self-efficacy and contraceptive use (Hamidi et al., 2018). In addition to having access to health care, adolescents and young adults should feel that they have the capacity and control over their sexual and contraceptive situation such that they can seek a health care provider, obtain prescriptions, refill prescriptions before supplies run out (e.g., OCPs) and remember to use/take contraceptive devices correctly and consistently. This mediation study indicates that having access to health care when they think they needed increase adolescents perceived contraceptive self-efficacy, which eventually leads to increased contraceptive ever-use and consistent use in young adulthood.

Incorporating family planning counseling and improving counseling messages during primary care visits has been one of the strategies used to increase contraceptive use by the Office of Family Planning withing the U.S Department of Health and Human Services (U.S. Department of Health and Health Services (USDHHS)) Office of Population Affairs (OPA) (Benatar, Howell, Adams, & Rogers, 2016). Even though the research exploring this relationship is very limited, one randomized trial-based study indicated that family planning counseling led by community health nurse improved self-efficacy in using contraception, but did not report a significant change in contraceptive use at 12 months follow up visit (Melnick, Rdesinski, Creach, Choi, & Harvey, 2008). This study explored mediation through contraceptive self-efficacy as an alternative path to explore the relationships between family planning counseling and subsequent contraceptive use. However, our mediation study still did not find any direct and indirect effect between the provision of family planning counseling and contraceptive use. Our study could not

delve deeper into the specifics about topics dealt and the depth of explanations and demonstrations delivered during family planning counseling due to the secondary nature of the study. Additionally, only a small number of sample (6.11%) reported receiving family planning counseling at adolescence. Future research should explore more details about family planning counseling services that participants have received while analyzing the longitudinal link between family planning counseling and contraceptive use.

Strengths and limitations

Exploring the mediation effect of contraceptive self-efficacy utilizing the longitudinal design expands the current literature of contraceptive use and provides the evidence that contraceptive self-efficacy is an important construct associated with contraceptive use. Additionally, the use of large sample data and utilization of complex multilevel analysis to explore the associations are the strengths of this mediation study. Nevertheless, some limitations should be noted. As like Study 2, there is a possibility of social desirability bias as participants could have answered in a way that is more acceptable way than what reflects their reality. Similarly, because weight variables associated with multilevel models were not available, the frequencies and percentages of the variables were not weighted.

Measurement of contraceptive use consistency is another concern. Specific types of contraception were not explored when assessing consistency. It is possible that women who consistently use effective contractive methods, such as implants, differ significantly from women who consistently use less effective contraceptive methods (for example: withdrawal) in terms of social domains. Because participants who used any type of contraception will be combined into a homogenous group representing consistent users, association between social domains and consistent contraceptive use could be underestimated.

Another limitation is the use of proxy measures to describe key issues of SDH domains. Although similar proxy measures were used in the previously published studies (Maness et al., 2016; Thompson et al., 2019), these questions or items may not fully cover or asked in a manner that best describe SDH domains as described in Healthy People 2020/30 SDH framework. For example, as a proxy measure for health literacy related to contraceptive use, the items about family planning counselling was used in this study because there are no items related to education on contraception included in the Add Health dataset. Past research has used family planning counselling as a measure to quantify the exposure of adolescents to information about contraception and its use (Pritt et al., 2017; Sserwanja et al., 2021). Additionally, because Add Health incorporated few questions/items related to adolescence in Wave III, items from Wave III were used to reflect social domains of the earlier wave -- Wave I. This could have bought along some recall bias in the data. Finally, due to data limitations, we were restricted to use the self-efficacy score measured 6 years prior to the behavior (contraceptive use). Also, this study did not control for Wave II contraceptive use as using Wave II contraceptive use variable would have limited our analysis to subpopulation of adolescents who were sexually active at Wave II and III, which would have changed the conceptualization of the study. Not accounting for Wave II contraceptive use in the model limited our ability to confirm how contraceptive self-efficacy at Wave II is related to Wave III contraceptive use.

Overall, this study shed light on a prominent malleable concept which can be altered via short behavioral skills interventions in varied settings such as schools and community. Findings of this study are aligned with other mediation-based study where contraceptive or birth control self-efficacy mediates the effect between contextual factors (e.g., parent-adolescent relationship, school connectedness, partner support, social influences) and numerous risky sexual behaviors

including use/non-use of condoms and being diagnosed with a sexually transmitted infection (Prata, Bell, Fraser, Carvalho, & Neves, 2017; Shneyderman & Schwartz, 2013; Wang, Cheng, & Chou, 2008). There is enough rationale that change in SDH domains (Ahinkorah, Hagan Jr, et al., 2020; Chola et al., 2020; Gomes et al., 2008), such as providing easy access to health care and better education opportunities, can improve contraceptive use among young adults. In addition to that, based on the mediation effects identified in the present study, focus on interventions that can boost contraceptive self-efficacy can better empower young adults to use contraception more frequently.

Chapter 7. Conclusions

This dissertation study concludes that there is a significant relationship between social determinants of health and contraceptive use among young adults both cross-sectionally and longitudinally. Identifying these significant social determinants for contraceptive use among young men and women, including education, social and community factors, and neighborhood characteristics, may contribute to interventions aimed at promoting health equity in the use of contraceptive methods. This framework-based approach indicates the priority areas that are linked with contraceptive use and has the potential to direct future intervention research to increase ever-use and consistent use of contraception to prevent unintended pregnancies and transmission of STDs in vulnerable populations such as young adults.

Additionally, this dissertation study also indicates the role of contraceptive self-efficacy as a mediator between SDH domains and contraceptive use. The confirmation of the longitudinal link between self-efficacy and contraceptive use behavior measured almost 8 years apart indicates that contraceptive self-efficacy plays an important role in determining the use and frequency of contraception. Amidst all unalterable social domains such as language spoken at home and perceived discrimination in the past, interventions can focus on boosting contraceptive self-efficacy, which is a malleable concept, while targeting adolescents and young adults. Self-efficacy is situation-specific and is amenable to short behavioral skills training interventions; therefore, health care providers and health educators should focus on approaches that boost contraceptive self-efficacy of young adults such that they are empowered and well-informed to make their own choices for contraception.(Hamidi et al., 2018; Heinrich, 1993) .

Implications and Future Directions

The implications of this research can inform future public health research and practice as well as policies related to federal funding associated with contraceptive use and pregnancy prevention. The implications of this dissertation study in terms of future research, practice and policy are further discussed below.

Research

There is a paucity of research that has utilized the social determinants of health frameworks in analyzing the association with health behaviors. The present study provides valuable information regarding the link between key issues under SDH domains and contraceptive use, however, additional studies are necessary to better explain processes how these domains shape contraceptive use behavior among young adults. Future research can further examine the pathways between specific key issues of SDH domains and contraceptive use utilizing other publicly available large datasets. To bolster the findings and ascertain the relationship, future research can utilize community and societal level data (such as percentage of households with incomes below the federal poverty threshold, neighborhood composition, neighborhood disorder score) while exploring the connection between SDH domains and contraceptive use. Additional research in this area can help develop a better understanding of pathways through which key issues under SDH domains relates to use and frequency of contraceptive use, resulting in more opportunities to expand, tailor or inform the development of interventions that increase contraceptive use among young adults. Multisectoral and multilevel interventions that address multiple levels of social determinants, such as education and access to health care, can make contraception accessible, affordable, and acceptable choice for young adults.

The term “Social determinants of health” has been widely used for a few decades, yet it is still poorly defined and measured. Future research should focus on defining and operationalizing each measure of social determinants of health, such that there is consensus in its meaning and a rigid demarcation of what items should be included or excluded in measuring a key issue. Future research can involve in creating a firm definition and measures to quantify the key issues in such a way that the common definition and tool can be utilized in area beyond sexual and reproductive health area and should encompass broader arena of public health. In this way, the results utilizing social determinants of health framework can be compared across multiple public health issues and significant key areas for health behaviors can be prioritized.

Practice

It is vital to understand which social determinants of health are associated with contraceptive use in order to design, plan and implement interventions in the most effective way. Findings of this research can provide rationale behind prioritizing significant key issues over other non-significant key issues while developing interventions to increase contraceptive use among vulnerable populations. As a result, programs can be tailored to address the key domains of social determinants of health that have been found to be associated with increasing contraceptive use rather than addressing a multitude of determinants at once or those determinants that have no established associations.

Collaborative efforts utilizing social determinants of health approach have the potential to enhance current programs to help eliminate the health disparities in contraceptive use, and subsequent unintended pregnancy and rates of STDs in the U.S. The field of public health cannot take on the challenge of reducing health disparities in these issues single-handedly. Effective collaborations with other sectors, such as housing, education, and health care, are important to

address the underlying social determinants of contraceptive use (Penman-Aguilar, Carter, Snead, & Kourtis, 2013). Finally, more emphasis needs to be given to enhancing access to health services, including family planning counseling, while developing interventions that increase contraceptive use among adolescents and young adults. Interventions should also integrate short behavioral skills training interventions to boost the negotiation skills, sexual communication skills and overall self-efficacy related to contraceptive use.

Policy

The majority of federal programs that target contraceptive use are designed to intervene at individual or interpersonal level. Sex education programs are laid out at middle schools and high schools to educate adolescents about safe sex. Unfortunately, amidst all the evidence that shows no improvement in safe sex behavior due to abstinence only sex education, federal programs waste approximately $110 million per year on misleading educational programs that only cover abstinence (Guttmacher Institute, 2021). Only 30 states and the District of Columbia require sex education to be taught in school, and fewer states require the school curricula to include key sex education topics related to safe sex and use of effective contraceptive methods (Guttmacher Institute). This shows how policy largely determines the modalities of federally funded programs that can easily increase health disparities related to unintended pregnancies and STDs, if right information and interventions are not provided to vulnerable populations.

Beyond sex education and individual level factors, this dissertation study identified social determinants that have influence contraceptive use of young adults. The previous implications regarding future research and practice can only be effective if policy is in place to provide national attention, which in turn guarantees adequate funding for programs aimed to reduce unintended pregnancies and transmission of STDs through interventions that aim to increase use

of effective contraceptive methods. Federal funding which fosters collaboration between various agencies (e.g., education, health care) is warranted to reduce unintended pregnancies and is vital to narrow down existing health disparities in this area.

Overall, incorporating components of social determinants of health to existing programs, policies and research aimed to increase contraceptive use has the potential to enhance the current pregnancy prevention as well as STD prevention interventions and decrease health disparities in sexual and reproductive health areas. Additionally, given the significant link between SDH domains at adolescence and contraceptive use at later years, it is important to organize family planning-based interventions sooner than later. Necessary mechanisms (e.g., easy access to health care, interventions in multiple languages) should be employed to ease the socio-economic and environmental conditions of adolescents so that they are capable of accessing knowledge and resources required to involve in safe sex practices. Specifically, interventions should target improving self-efficacy related to sexual communication skills and condom use, as self-efficacy is a crucial factor that determines behavior change and has a long-term effect on sustainability of the behavior.

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Appendix A: Domains and Variables related to Study 1

Critical components/ Key issues	**Variables used**	**Response option included**	**Variable name**	**Add Health Wave and survey**
DEPENDENT VARIABLE				
Contraceptive use	In the past 12 months, did you or your partner(s) use any of these methods for birth control or disease prevention?	birth control pills an implant birth control shot a diaphragm emergency contraception or the morning after pill natural family planning (safe periods by temperature, cervical mucus test or calendar) female sterilization Male condom Male sterilization	SE29A SE29B SE29C SE29D SE29E SE29F SE29G SE30A SE30B	Wave III in-home survey
Consistency of	On how many occasions of vaginal	0 none 1 some 2 half	SE7	Wave III in-home survey

contraceptive use.	intercourse in the past 12 months did you or your partner use some form of birth control or pregnancy protection?	3 most 4 all 6 refused 7 legitimate skip 8 don't know 9 not applicable		
ECONOMIC STABILITY				
Poverty	Are you currently getting AFDC, public assistance, or welfare?"	1 yes 0 no 6 refused 8 don't know 9 not applicable	EC26	Wave III in-home survey
Employment Status	Are you currently working for pay for at least 10 hours a week?"	0 No 1 Yes 7 Legitimate skip	LM7	Wave III in-home survey
Housing Instability	In the past 12 months, was there a time when {you were/your household was}	0 No 1 Yes 6 Refused 8 Don't know 9 Not applicable	EC20	Wave III in home survey

	evicted from your house or apartment for not paying the rent or mortgage?			
EDUCATION				
High school graduation	What is the highest grade or year of regular school you have completed?	6 6th grade 7 7th grade 8 8th grade 9 9th grade 10 10th grade 11 11th grade 12 12th grade 13 1 year of college 14 2 years of college 15 3 years of college 16 4 years of college 17 5 or more years of college 18 1 year of graduate school 19 2 years of graduate school 20 3 years of graduate school 21 4 years of graduate school	ED1	Wave III in-home survey

		22 5 or more years of graduate school 96 refused 98 don't know 99 not applicable		
Higher education enrollment	What is the highest grade or year of regular school you have completed?	6 6th grade 7 7th grade 8 8th grade 9 9th grade 10 10th grade 11 11th grade 12 12th grade 13 1 year of college 14 2 years of college 15 3 years of college 16 4 years of college 17 5 or more years of college 18 1 year of graduate school 19 2 years of graduate school 20 3 years of graduate school 21 4 years of graduate school 22 5 or more years of graduate school	ED1	Wave III in-home survey

		96 refused 98 don't know 99 not applicable		
Language and literacy	What language do you use most with your family and close relatives?	1 English 2 Spanish 3 Another European language 4 an Asian language 5 a non-European non-Asian language 6 half English and half another language 7 other 8 don't know	OD9	Wave III in-home survey
SOCIAL AND COMMUNITY CONTEXT				
Incarceration	Have you ever been arrested or taken into custody by the police?	0 No 1 Yes 6 Refused 7 Legitimate skip 8 don't know 9 not applicable	CJ3	Wave III in-home survey

Civic participation	During the last 12 months did you perform any unpaid volunteer or community service work?	0 No 1 Yes 6 refused 8 don't know 9 not applicable	CC3	Wave III in-home survey
HEALTH AND HEALTH CARE				
Access to health services	Has there been any time in the past 12 months when you thought you should get medical care, but you did not?	0 No 1 Yes 6 Refused 8 Don't know 9 Not applicable	HS6	Wave III in-home survey
Access to Primary care	How long ago did you last consult a doctor or nurse?	1 within the past 3 months 2 4 to 6 months ago 3 7 to 9 months ago 4 10 to 12 months ago 5 longer than 1 year ago but less than 2 years ago 6 2 years ago or longer 96 refused 98 don't know	HS11	Wave III in-home survey

		99 not applicable		
NEIGHBORHOOD AND BUILT ENVIRONMENT				
Crime and violence	Which of the following things happened in the past 12 months?	You saw someone shoot or stab other person	DS18A	Wave III in-home survey
		Someone pulled a gun on you.	DS18B	
		Someone pulled a knife on you.	DS18C	
		Someone shot you.	DS18D	
		Someone stabbed you.	DS18E	
		You were beaten up, but nothing was stolen from you.	DS18F	
		You were beaten up and something was stolen from you.	DS18G	
		You pulled a knife or gun on someone.	DS18H	
		You shot/stabbed someone	DS18I	

Appendix B: Domains and Variables related to Study 2

Critical components/ Key issues	**Variables used**	**Response option included**	**Variable name**	**Add Health Wave and survey**
DEPENDENT VARIABLE				
Contraceptive use	In the past 12 months, did you or your partner(s) use any of these methods for birth control or disease prevention?	birth control pills an implant birth control shot a diaphragm emergency contraception or the morning after pill natural family planning (safe periods by temperature, cervical mucus test or calendar) female sterilization	SE29A SE29B SE29C SE29D SE29E SE29F SE29G	Wave III in-home survey
Consistency of contraceptive use.	On how many occasions of vaginal intercourse in the past 12 months did you or your partner use	0 none 1 some 2 half 3 most	SE7	Wave III in-home survey

	some form of birth control or pregnancy protection?	4 all 6 refused 7 legitimate skip 8 don't know 9 not applicable		
ECONOMIC STABILITY				
Poverty	Are you currently getting AFDC, public assistance, or welfare?	1 yes 0 no 6 refused	PA21	Wave I **Parent** in-home survey
Employment Status	Do you work outside the home?	0 No 1 Yes 6 Refused	PA13	Wave I **Parent** in-home survey
Housing Instability	Did you ever live in a foster home?	0 No 1 Yes 6 Refused 8 Don't know 9 Not applicable	OD31	Wave III in home survey
EDUCATION				

High school graduation	What is the highest grade or year of regular school you have completed?	1 8th grade or less 2 more than 8th grade, but not graduate from high school 3 went to a business, trade, or vocational school instead of high school 4 high school graduate 5 completed a GED 6 went to a business, trade, or vocational school after high school 7 went to college, but not graduate 8 graduated from a college or university 9 professional training beyond a 4-year college or university 10 never went to school	PA12	Wave I **Parent** in-home survey

		96 refused		
Language and literacy	What language is usually spoken in your home?	1 English 2 Spanish 3 Other 4 refused 8 don't know	GI10	Wave I in-home survey
SOCIAL AND COMMUNITY CONTEXT				
Incarceration	How many times were you arrested before you were 18?	1-30 96 Refused 97 Legitimate skip 98 don't know 99 not applicable	CJ5	Wave III in-home survey
Civic participation	At any time during your adolescence, when you were between 12 and 18 years old, did you regularly participate in volunteer or community service work?	0 No 1 Yes 6 refused 8 don't know 9 not applicable	CC1	Wave III in-home survey
Discrimination	How much do you agree or disagree with the following: Students at	1 strongly agree 2 agree 3 neither agree nor disagree	ED21	Wave I in-home survey

	your school are prejudiced.	4 disagree 5 strongly disagree 6 refused 7 legitimate skip 8 don't know		
Social Cohesion	1. You know most of the people in your neighborhood. 2. In the past month, you have stopped on the street to talk with someone who lives in your neighborhood. 3. People in this neighborhood look out for each other 4. Do you use a physical fitness or recreation center in your neighborhood? 5. Do you usually feel safe in your **neighborhood**?	1 True 2 False 6 refused 8 don't know 9 not applicable 0 No 1 Yes 6 Refused 8 Don't know	H1NB1 H1NB2 H1NB3 H1NB4 H1NB5	Wave I adolescent in-home survey
HEALTH AND HEALTH CARE				

Access to health services	Has there been any time in the past 12 months when you thought you should get medical care, but you did not?	0 No 1 Yes 6 Refused 8 Don't know	GH26	Wave I in-home survey
Access to Primary care	In the past year have you had a routine physical examination?	1 less than a year ago 2 1 to 2 years ago 3 more than 2 years ago 4 never 6 refused 8 don't know 9 not applicable	GH24	Wave I in-home survey
Health literacy	In the past year have you received family planning counseling or services?	0 No 1 Yes 6 refused 8 don't know	HS7	Wave I adolescent in-home survey
NEIGHBORHOOD AND BUILT ENVIRONMENT				
Crime and violence	Which of the following things happened in the past 12 months?	You saw someone shoot or stab other person	FV1 FV2 FV3	Wave I in-home survey

		Someone pulled a gun on you. Someone pulled a knife on you. Someone shot you. Someone stabbed you. You were beaten up, but nothing was stolen from you. You were beaten up and something was stolen from you. You pulled a knife or gun on someone. You shot/stabbed someone	FV4 FV5 FV6 FV7 FV8	
Environmental conditions	In this neighborhood, how big a problem is litter or trash on the streets and sidewalks	1 no problem at all 2 a small problem 3 a big problem 6 refused	PA33	Wave I **Parent** in-home interview

Appendix C: Domains and Variables related to Study 3

Critical components/ Key issues	**Variables used**	**Response option included**	**Variable name**	**Add Health Wave and survey**
DEPENDENT VARIABLE				
Contraceptive use	"In the past 12 months, did you or your partner(s) use any of these methods for birth control or disease prevention?"	birth control pills an implant birth control shot a diaphragm emergency contraception or the morning after pill natural family planning (safe periods by temperature, cervical mucus test or calendar) female sterilization	SE29A SE29B SE29C SE29D SE29E SE29F SE29G	Wave III in-home survey
Consistency of contraceptive use.	"On how many occasions of vaginal intercourse in the past 12 months did you or your partner use some	0 none 1 some 2 half 3 most 4 all	SE7	Wave III in-home survey

	form of birth control or pregnancy protection?"	6 refused 7 legitimate skip 8 don't know 9 not applicable		
MEDIATING VARIABLE				
Contraceptive Self-efficacy	If you wanted to use birth control, how sure are you that you could stop yourself and use birth control once you were highly aroused or turned on?"	1 very sure 2 moderately sure 3 neither sure nor unsure 4 moderately unsure 5 very unsure 6 I never want to use birth control	SE1	Wave II adolescent in-home survey
	"How sure are you that you could plan ahead to have some form of birth control available?	96 refused 97 legitimate skip 98 don't know 99 not applicable	SE2	
	"How sure are you that you could resist sexual intercourse if your partner did not want to use some form of birth control?"		SE3	
ECONOMIC STABILITY				

Poverty	Are you currently getting AFDC, public assistance, or welfare?"	1 yes 0 no 6 refused	PA21	Wave I Parent in-home survey
Employment Status	Do you work outside the home?	0 No 1 Yes 6 Refused	PA13	Wave I Parent in-home survey
Housing Instability	Did you ever live in a foster home?	0 No 1 Yes 6 Refused 8 Don't know 9 Not applicable	OD31	Wave III in home survey
EDUCATION				
High school graduation	"What is the highest grade or year of regular school you have completed?"	1 8th grade or less 2 more than 8th grade, but not graduate from high school 3 went to a business, trade, or vocational school instead of high school 4 high school graduate	PA12	Wave I Parent in-home survey

		5 completed a GED 6 went to a business, trade, or vocational school after high school 7 went to college, but not graduate 8 graduated from a college or university 9 professional training beyond a 4-year college or university 10 never went to school 96 refused		
Language and literacy	What language is usually spoken in your home?	1 English 2 Spanish 3 Other 4 refused 8 don't know	GI10	Wave I in-home survey
SOCIAL AND COMMUNITY CONTEXT				
Incarceration	How many times were you arrested before you were 18?	1-30 96 Refused 97 Legitimate skip	CJ5	Wave III in-home survey

		98 don't know 99 not applicable		
Civic participation	At any time during your adolescence, when you were between 12 and 18 years old, did you regularly participate in volunteer or community service work?	0 No 1 Yes 6 refused 8 don't know 9 not applicable	CC1	Wave III in-home survey
Discrimination	How much do you agree or disagree with the following: Students at your school are prejudiced.	1 strongly agree 2 agree 3 neither agree nor disagree 4 disagree 5 strongly disagree 6 refused 7 legitimate skip 8 don't know	ED1	Wave I in-home survey

Social Cohesion	1. You know most of the people in your neighborhood. 2. In the past month, you have stopped on the street to talk with someone who lives in your neighborhood 3. People in this neighborhood look out for each other 4. Do you use a physical fitness or recreation center in your neighborhood? 5. Do you usually feel safe in your neighborhood?	1 True 2 False 6 refused 8 don't know 9 not applicable	H1NB1 H1NB2 H1NB3 H1NB4 H1NB5	Wave I adolescent in-home survey
HEALTH AND HEALTH CARE				
Access to health services	Has there been any time in the past 12 months when you thought you	0 No 1 Yes 6 Refused 8 Don't know	GH26	Wave I in-home survey

	should get medical care, but you did not?			
Access to Primary care	In the past year have you had a routine physical examination?	1 within the last 12 months 2 1 to 2 years ago 3 more than 2 years ago 4 never 6 refused 8 don't know 9 not applicable	GH24	Wave I in-home survey
Health literacy	In the past year have you received family planning counseling or services?	0 No 1 Yes 6 refused 8 don't know	HS7	Wave I adolescent in-home survey
NEIGHBORHOOD AND BUILT ENVIRONMENT				
Crime and violence	Which of the following things happened in the past 12 months?	You saw someone shoot or stab other person Someone pulled a gun on you. Someone pulled a knife on you. Someone shot you. Someone stabbed you.	FV1 FV2 FV3 FV4 FV5 FV6 FV7 FV8	Wave I in-home survey

		You were beaten up, but nothing was stolen from you. You were beaten up and something was stolen from you. You pulled a knife or gun on someone. You shot/stabbed someone		
Environmental conditions	In this neighborhood, how big a problem is litter or trash on the streets and sidewalks	1 no problem at all 2 a small problem 3 a big problem 6 refused	PA33	Wave I Parent in-home interview