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Safety beliefs, [mis]information sources & contraceptive behavior among young people who can get pregnant in the U.S.: A theory-driven, mixed methods approach

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Abstract

Safety beliefs, [mis]information sources & contraceptive behavior among young people who can get pregnant in the U.S.: A theory-driven, mixed methods approach

Approximately 45% of pregnancies in the U.S. are unintended, meaning that are unwanted or mistimed. Among 15-19-year-olds, 75% are unintended.[1-4] Young people, people of color, those with low socioeconomic status, and people in certain regions, such as the Southeast (SE), are at heightened risk of unintended pregnancy (UIP).[2, 4-9] People experiencing UIP and subsequent births are at risk of adverse health and socioeconomic outcomes, especially adolescents.[10-12] Without contraceptive use, as many as 85% of people who have penile-vaginal sex will become pregnant in one year. With effective contraception, this is as low as 0.05%.[13] Methods vary in effectiveness, side effects, and ease of use.[14, 15] They are often characterized by method effectiveness tiers by groups like the U.S. Centers for Disease Control and Prevention.[16-18] Yet, other factors, including safety, are important to users.[19, 20] Clinical research and pharmacovigilance suggest that contraceptive-related serious adverse events (SAEs) are extremely rare,[17] but research also shows consistent concerns about safety.[17, 21-42] Gaps in the literature surround how beliefs develop and translate to behavior, and data from the SE is lacking. This three-aim mixed methods dissertation sought to address these gaps.

First, I systematically reviewed published literature on contraceptive safety beliefs to characterize this literature and determine which beliefs were prevalent. Across 48 studies, concerns about infertility, adverse pregnancy and fetal outcomes, problems with long-acting reversible contraceptive (LARC) devices, menstrual changes, pain, and weight changes were common. Misconceptions about SAEs appear throughout the literature, which consists largely of low-quality, cross-sectional studies.

In the second study, I used multinomial logistic regression to assess relationships safety and side effect concerns and method use among young people who can get pregnant in Atlanta, GA (n=148). In multivariable models using baseline data, concerns about side effects, pain, bleeding, SAEs and any AE were associated with increased odds of less effective or no method use compared with LARC use. Magnitude and statistical significance of relationships differed by concerns and method use operationalization (ever vs. current use). In longitudinal models, all concerns except bleeding were associated with less effective method use.

Finally, I conducted in-depth-interviews with 29 people who could get pregnant aged 15-24 in GA. Interviews included questions about information sources, interpersonal and social influences, and contraceptive decision-making. We used a grounded theory approach to analyze data. We found three distinct pathways. One group was exposed to negative information about safety and avoided prescription methods. Another enjoyed non-contraceptive and pregnancy preventive benefits of oral contraceptive pills and avoided other methods. A third cycled through methods, using information from peers, providers, and the Internet to make decisions.

Through this research, I characterized common safety concerns, determined how concerns impact behavior among a cohort of young people, and dove deeper into drivers of behavior. Findings highlight the need for better education and counseling to correct misconceptions and empower people to make evidence-based contraceptive decisions.

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Chapter 1: Introductory Literature Review.

Introduction

Unintended pregnancy in the U.S.

Unintended pregnancies (UIPs), defined as pregnancies that are either unwanted or mistimed, are associated with increased risk for adverse maternal and child health outcomes in the United States (U.S.).[1-3] According to the most recently available estimates, approximately 45% of pregnancies in the U.S. are unintended.[2, 4] While this proportion has decreased from 51% of pregnancies in 2008, it remains higher than that of other highly developed countries.[43] About 43 million people who can get pregnant in the U.S. are considered at risk for UIP, meaning that they are sexually active, biologically female people of reproductive age who do not want to become pregnant.[6] The ability to control one's reproductive life by preventing UIP is crucial to the social and economic well-being of women and girls. Delaying childbearing and spacing pregnancies allows people to attain higher education levels, participate in the workforce, and earn higher incomes. Family planning is also associated with family stability and positive mental health.[5]

The UIP rate in the U.S. varies by age, race, socioeconomic status (SES) and geography. Young people who can get pregnant, people of color, people with low SES or low educational attainment and people in the U.S. Southern states tend to shoulder the burden of UIP.[2, 4-6]According to 2011 estimates, 65% of pregnancies among people who can get pregnant living at <100% of the federal poverty level (FPL) were unintended, compared with 30% among those at ≥ 200% FPL.[4] Forty five percent of pregnancies among individuals who had not finished high school and 54% of pregnancies among those with a high school diploma or GED were unintended, compared with 27% among college graduates.[4] Sixty percent of pregnancies among Black people who can get pregnant were unintended, compared with 38% among White people and 50% among Hispanic people.[4] Among poor people, people with low educational attainment, and people of color, pregnancies were more likely to end in births comparted with people with higher SES, more education, and White people.[4] There is also a substantial economic cost

associated with unintended pregnancy in the U.S. In 2010, the U.S. government spent ~$21 billion on births, abortions and miscarriages resulting from UIP.[2] In contrast, the U.S. spent $2.37 billion on publicly funded family planning services.[44]

UIP among adolescents and young people who can get pregnant in the U.S.:

According to 2011-2015 data from the National Survey of Family Growth (NSFG), 42.4% of never-married girls aged 15-19 (9.38 million girls) reported ever having vaginal sex with a male partner.[45] In 2013, 448,000 of these adolescents became pregnant, at a rate of 43 per 1,000 young women. An additional 7,350 girls aged 14 and under became pregnant, a rate of 3.6 per 1,000 girls. Adolescent pregnancy rates have been decreasing steadily. Among adolescents aged 15-19, the rate has decreased by 63% since its peak in 1990,[6, 46] and among girls under 14, the rate has declined by 80% since its peak in 1988.[47] Despite these declines, adolescent pregnancy and birth rates in the U.S. remain high compared with other highly developed countries.[48, 49] European adolescents, for example, have similar rates of sexual activity to U.S. adolescents but are more likely to use contraception and thus have lower pregnancy rates.[50] The majority of adolescent pregnancies (about 61%) end in live birth, with about 15% ending in miscarriage and 25% ending in abortion.[51] While some adolescents desire and plan their pregnancies, about 75% of adolescent pregnancies in the U.S. are unintended.[2, 4]

As with overall trends in U.S. UIP rates, disparities in adolescent pregnancy rates can be seen by race and socioeconomic status (SES) and geography, with adolescent birth rates highest in the South and Southwest and in rural counties throughout the U.S.[6-9] In 2013, the pregnancy rate among Non-Hispanic Black women aged 15-19 was 75.1 per 1000 young people who can get pregnant, compared with 60.8 per 1000 among Hispanic young people and 29.6 per 1000 among Non-Hispanic White young people.[6] Adolescent birth rates also reflect these demographic disparities. In 2017, the overall birth rate among young women aged 15-19 was 18.1 births per 1000 young women. Yet for non-Hispanic White people who can get pregnant, the birth rate was 13 births per 1000 young people-- less than half of the birth rates

for Black young people who can get pregnant (28 births per 1000 young women), non-White Hispanic young people (29 births per 1000 young women) and American Indian/ Alaskan Native young people (33 births per 1000 young women). The adolescent birth rate was lowest among young people who can get pregnnat who identify as Asian/ Pacific Islander, at only 3 births per 1000 young women. Birth rates are declining at disparate rates. Between 2016 and 2017, the birth rate declined by 8% for White adolescents, by 9% for Hispanic adolescents, but only by 6% for Black adolescents.[9]

UIP among adolescents remains a major public health issue in the U.S. given the health and social consequences associated with it. Pregnant adolescents and adolescent mothers are more likely to use tobacco, alcohol and other drugs compared with nulligravid adolescents.[52] Pregnant adolescents also have higher rates of adverse perinatal outcomes, including preeclampsia, preterm birth, low birth weight, stillbirth and miscarriage.[53] Thirty five percent of adolescents who have been pregnant experience a rapid repeat pregnancy, a pregnancy within two years of a prior preganncy.[54] Children born after rapid repeat pregnancy are more likely to be born pre-term and to have developmental and mental health problems compared with than those born after a spaced pregnancy.[55]

For adolescents, UIP and unintended birth are associated with adverse social and economic outcomes, such as higher rates of high school dropout.[56] About 50% of adolescent mothers graduate from high school by age 22, as compared with about 90% of females who do not have children.[56] High school dropout is associated with negative economic outcomes, like limited employment outcomes and poverty, as well as a range of adverse health outcomes.[57] Given the life-course implications of UIP for adolescents, reducing pregnancy among adolescent females has been named as a Healthy People 2020 objective by the U.S. Department of Health and Human Services.[58]

Moreover, the last decade has seen a sharp increase in enactment of state policies restricting access to abortion (as one resolution option to manage unintended pregnancy) for all people but especially minors across the country, with the Southeast region disproportionately affected. For example, in 2019 to date, 378 abortion restrictions have been introduced in the U.S., with highly restrictive abortion bans passing in Alabama, Georgia, Mississippi, Tennessee, and Missouri.[59, 60] Access to abortion for

adolescents in these states is further hindered by parental notification and consent policies, mandated waiting periods, and lack of clinic availability in these states. All states in the Southeast have parental consent or notification laws and require patients to wait 24-48 hours to receive an abortion.[61, 62] With only 17 abortion clinics throughout the state, Georgia has the largest number in the region. Mississippi has only one.[63, 64] Importantly, many of these states, including those in the Southeastern U.S., are states in which UIP rates and maternal morbidity and mortality are highest.[65, 66] Adolescents facing extreme barriers to abortion access are more likely to carry pregnancies to term or seek unsafe abortions. Overall, improved public health and clinical efforts to help young people prevent UIP is perhaps as timely than ever before.

Contraceptive use as primary prevention strategy for adolescent UIP in the U.S.

Preventing UIP by empowering women, girls, and couples to manage their reproductive lives is a public health and social justice goal.[2, 58] Correct, consistent, voluntary and medically appropriate use of effective contraceptive methods is a safe and highly effective method of primary prevention of unintended pregnancy. In 2008, only 5% of the 3.4 million UIPs in the U.S. occurred among consistent contraceptive users, defined as women who use a contraceptive method correctly during all months in which they were sexually active, with no gaps in use.[67] In contrast, 41% of UIPs occurred among inconsistent users, women who reported method use during all sexually active months, but who missed pills, incorrectly used a method, or did not use a barrier method during each instance of sexual intercourse.[67] Fifty four percent of UIPs occurred among non-users, sexually active biologically female people who report no contraceptive method use.[67] The recent decline in the UIP rate is likely attributable to increases in contraceptive use and use of more effective contraceptive methods in the U.S.[4]

Since young people who can get pregnant are generally highly fecund,[54] correct and consistent contraceptive use is essential for adolescents seeking to avoid pregnancy. Improved contraceptive uptake and greater rates of contraceptive use among young people directly impact UIP risk and help prevent

negative sequelae across the lifespan. Improving access to and providing accurate information about contraceptives can only help adolescents make informed, healthy decisions about their reproductive lives.

Contraceptive use in the U.S.

Among contraceptive users in the U.S., the oral contraceptive pill (OCP) is the most commonly used method. As of 2014, 15.6% of all women aged 15-44 in the U.S. and of all U.S. women at risk of UIP report OCP use in the past month. Female sterilization is the second most commonly reported method, with 13.4% of all women aged 15-44 and 19.5% of all women at risk of UIP reporting sterilization use in the past month. The IUD is the third most commonly used method, yet only 7.2% of all women and 10.6% of women at risk for UIP report IUD use in the past month. Only 1.6% of women and 2.3% of women at risk of UIP report implant use in the past month. OCPs, the condom, and withdrawal are among of the most commonly used reversible methods despite higher typical use failure rates associated with these methods compared with LARC methods. Additionally, many people at risk of UIP report not using contraception. While more than 99% of sexually initiated people who can get pregnant aged 15-44 reported ever using a contraceptive method in 2014, 10.5% of people at risk for UIP reported no method use in the past month.[5] This proportion is higher among young people aged 15-19 (18%), and among Black people (17%) compared with White, Hispanic and Asian people (9-10%).

Contraceptive use at first sex has increased for young people who can get pregnant, with 79% of those aged 15-19 reporting contraceptive use at first sex in 2011-2013, compared with 48% in 1982.[45] This increase in adolescent contraceptive use appears to be a major driver of declines in adolescent pregnancy and birth rates. Yet adolescents tend to use methods with higher typical-use failure rates. According to the 2011-2015 NSFG, 97.4% of adolescents reported ever using a condom, 59.7% reported ever practicing withdrawal, 55.5% reported ever using OCPs, and 22.9% reported ever using emergency contraception.[45] Conversely, only 2.8% reported ever using an IUD and only 3.0% reported ever using an implant.[45]

Safety of Contraceptive Methods available in the U.S.

Overview of methods available in the U.S.

According to the U.S. Centers for Disease Control and Prevention (CDC), most people who can get pregnant are medically eligible to use most contraceptive methods.[17] FDA-approved contraceptive methods vary widely in terms of ease-of-use and subsequent effectiveness. Long-acting reversible contraceptive (LARC) methods, are the most effective reversible methods under typical use conditions. LARC methods include the levonorgestrel-containing (LNG) intrauterine device (IUD), the copper (Cu) IUD, and the subdermal etonorgestrel-containing (ENG) implant. Each of these devices must be inserted by a healthcare provider and left in place for 3 (implant) to 12 (Cu IUD) years. Devices can be removed at any time, though removal requires another visit to a healthcare provider and some literature has shown that providers may be resistant to early removal.[68-70] Since LARC devices require no action from users once inserted, there is little to no difference between perfect use and typical use failure rates. Typical use failure rates for LARC devices range from 0.05 per 100 people to 0.8 per 100 people per year.[71] These methods are as effective as permanent male or female sterilization.[71]

Combined hormonal contraceptives (CHCs), are methods that contain an estrogen and a progestin. These included combined oral contraceptive pills (COCs), the vaginal ring, and the transdermal patch. CHCs, along with the progestin-containing injectable contraceptive, depo medroxyprogesterone acetate (DMPA) and progestin-only pills (POPs) are considered moderately effective contraceptive methods. Each of these methods requires users to take some action, whether daily (pills), every one to three weeks (patch and ring), or every three months (injectable). Under typical use, these methods are expected to result in 6-9 pregnancies per 100 people per year.[71] A third tier of contraceptive method effectiveness, referred to hereafter as "less effective methods," includes barrier methods (the diaphragm, the male and female condom, the contraceptive sponge), withdrawal, spermicide, and fertility awareness based methods. Typical use of these methods results in 12-28 pregnancies per 100 people per year.[71]

Contraindications to contraceptive use

The CDC issues the U.S. Medical Eligibility Criteria for Contraceptive Use (U.S. MEC), evidence-based guidelines that provide over1800 recommendations for contraceptive method use by individuals with medical conditions or personal characteristics that might cause providers to question their eligibility to use certain methods. The recommendations are designed to help providers offer high quality contraceptive counseling and ensure safety in contraceptive provision. Two stated goals of the U.S. MEC are to "address misconceptions regarding who can safely use contraception" and "remove unnecessary medical barriers to accessing and using contraception."[17, 72] From this perspective, *provider-imposed beliefs and misconceptions* about contraceptive safety may be greater barriers to method use than *actual medical contraindications*. For example, providers unsure about adolescent patients' medical eligibility for LARC methods may prescribe them with less effective methods due to misconceptions about the safety of implants and IUDs among young people. According to the US MEC, most people who can get pregnant are medically eligible to use most methods.[17] With the exception of one study finding a surprisingly high prevalence of contraindications (39.3%),[73] the literature indicates that between 4.6 – 6.3% of women seeking COCs are medically ineligible and 0.5% - 3% of women seeking progestin-only contraceptives (POCs) are ineligible.[74-76] Most conditions that serve as contraindications to method use are relatively rare and serious, including cancers, postpartum and post-abortion sepsis, severe cirrhosis, serious hypertension and pelvic tuberculosis.[17] Due to their estrogen component, CHCs, the most commonly used methods in the U.S., are the methods for which there are the most medical restrictions. There are no restrictions related to young age or nulliparity.[17]

Serious Adverse Events associated with Contraceptive Use

As with any pharmaceutical intervention, adverse events (AEs) and side effects are possible negative consequences of contraceptive method use. An AE is defined by the FDA as "any undesirable experience associated with the use of a medical product in a patient." A serious adverse event (SAE) is an AE that results in death, risk of death, hospitalization, disability or permanent damage to an individual's health or quality of life, a congenital anomaly or birth defect, or requires medical or surgical

intervention.[77] SAEs associated with contraceptive use, though rare, do occur. SAEs listed in product prescribing information labels for moderately effective and LARC methods are listed in **Table 1.1**. This list of SAEs might be daunting to a patient considering one of these methods, but absolute risk of most of these health events remains very low for healthy women of reproductive age.[78-83]

CHCs: Estimated incidence of thromboembolic events among healthy people using COCs with less than 50 μg estrogen ranges from 7 to 18 events per 10,000 women years.[78, 79, 81] Other common individual-level risk factors, including age, obesity/ overweight, cancer or autoimmune diseases, surgery, and pregnancy have greater impact on risk than CHC use.[84] In a nationally representative study of hospitalizations for acute myocardial infarction (AMI), women aged 30-35 were hospitalized for AMI at a rate of < 9 per 100,000 women per year between 2001 and 2010.[85] Despite being listed on package labels, no clear causal evidence links CHC use with breast cancer or depression.[86-89]

IUDs: Clinical trial data suggests a rate of 0.1- 0.2 ectopic pregnancy for every 1000 users per year for LNG IUD and Cu IUD use.[90-93] By contrast, in the general population, ectopic pregnancy rates are estimated to be between 3.00 and 4.50 per 1,000 woman-years.[93] Depending on IUD type, perforations occur at an estimated 1–3.6 per 1,000 insertions.[93-95] Risk of PID among users of modern IUDs is estimated to be less than less than 2% for women at low risk and less than 5% for women at heightened risk.[91, 92, 94, 96-99] For LNG and Cu IUDs, bleeding changes are the most commonly reported AEs.[94, 100] Rates of AEs for young women do not appear to be higher for either Cu IUD or LNG IUDs.[83]

Implants: Bleeding changes are the most commonly patient-reported AEs linked with implant discontinuation.[101, 102] In trials for the ENG implant Implanon, clinical trials most commonly reported non-bleeding AEs that authors concluded to be possibly, probably, or definitely drug-related were headache (15.5%), weight gain (12.0%), acne (11.8%), breast pain (10.2%), emotional lability (5.8%), and abdominal pain (5.2%).[100] A systematic review of ENG implant (Nexplanon) safety found no evidence of significant relationship between implant use and bone mineral density (BMD) loss or cardiovascular disease.[102]

DMPA: A body of research links DMPA to bone mineral density (BMD) loss, causing the FDA to issue a so-called "Black Box" warning on the product's package insert.[103-105] BMD is an important predictor of skeletal strength among post-menopausal women, and loss of BMD during the reproductive years may result in increased fracture risk later in life, though the implications for long-term bone health for DMPA users are unclear.[103, 104, 106] Population level estimates of BMD loss among DMPA user are not readily available, but in a randomized trial comparing intramuscularly administered DMPA (DMPA-IM) with subcutaneously administered DMPA (DMPA-SC) (n=554), 12.3% of DMPA-IM users experienced ≥5% BMD loss in the hip and 24.7% in the lumbar spine. By year 3, 51.9% of DMPA-IM user had lost ≥5% total hip BMD and 39.6% had lost ≥5% lumbar spine BMD.[106] Some evidence suggests that women will regain any BMD lost during DMPA use, resulting in no clinically meaningful risk across the lifecourse.[103, 104, 106] A systematic review found evidence of a relationship between DMPA use and weight gain across 21 studies but limited or evidence of a causal relationship between DMPA use and other AEs.[107]

Side Effects and Contraceptive Use

Side effects are more minor "unwanted or unexpected" events or reactions to a drug.[108] They do not result in serious injury or threat to life, but may result in discomfort, psychological distress, or impaired quality of life.[108] Side effects listed in product information labels for moderately effective and LARC methods are listed in **Table 1**. Contraceptive-related side effects are much more common than SAEs and vary across methods and among users. For many users, side effects improve within three months of initiating a contraceptive method, though user experiences differ. Clinical evidence suggests that a minority of users of moderately or highly effective methods report side effects, yet they are an important driver of method discontinuation.[109-112]

Using data from the nationally representative 2002 National Survey of Family Growth (NSFG), Moreau et al. found that side effects were the most common reasons for discontinuing OCPs, implants, and DMPA, with over 60% of contraceptive discontinuers reporting side effects as the most important

reason for method discontinuation.[113] In a frequently cited prospective cohort study of 9,000 participants in St. Louis, MO, the Contraceptive CHOICE project, among 4,078 participants followed for 3 years, 43.8% discontinued the method they chosen at baseline by 36 months. Side effects, including bleeding changes, were the most common reason for discontinuation of LNG IUD (25.4%), DMPA (33.5%), patch (41.0%), ring (26.7%), Cu IUD (35.2%) and implant (45.5%).[114] In a prospective cohort study of 775 young people aged 13-24 years receiving an IUD or implant from a Title X funded clinic in Colorado, 36.3% of IUD users and 45.4% of implant users discontinued by 30 months. The most common reasons for IUD discontinuation were pain (27%), bleeding (20.9%), "other" reasons, which included side effects and other health issues, and mispositioned or expelled device (15.7%). Implant users discontinued primarily due to bleeding (49.3%), weight changes (12.9%), "other" (10.7%), and mood changes (10.0%).[115] In another prospective study of 3688 people who can get pregnant aged 16-45 years receiving free contraceptive methods, 30.0% reported discontinuing a method by 6 months, and 12.4% reported method switching.[116] Of the 620 participants who provided a reason for discontinuing or switching a method, 73.2% reported side effects as a reason. Participants who chose short-acting methods were significantly more likely to report experiencing side effects than LARC users.[116] In a randomized trial of 1716 OCP users younger than 25-years-old, Westhoff et al. found that participants who experienced negative side effects (headache, weight changes, mood changes and sexual satisfaction) discontinued OCPs by 6 months at significantly higher rates than individuals who did not (51% vs 34%).[110]

A small body of prior qualitative research exists to better contextualize these findings. In a qualitative in-depth interview study of 16 women electing early IUD removal in the Bronx, NY, Amico et al. found that *all* participants reported side effects as a reason for considering removal.[117] Participants reported pain, bleeding, vaginal discharge, bloating, yeast infections and urinary tract infections. Several participants believed that side effects were indicative of more serious AEs, and most reported that contraceptive counseling did not adequately prepare them for the side effects they experienced.[117] In another qualitative in-depth interview study of 12 family medicine physicians in the Bronx by the same authors, providers reported that patients elected for early IUD removal due to pain, bleeding, and

discharge and tended to see these experiences as inconveniences for patients rather than concerns about serious AEs.[118] In both studies, patients and providers reported that providers tended to encourage women to keep IUDs in place, with some patients reported feeling undue pressure to do so.[117, 118]

Contraceptive method exposure and commonly attributed side effects

For some contraceptive methods, good data exists to suggest a causal relationship between use and AEs (including side effects). For example, hormonal methods and Cu IUDs have been shown to cause bleeding changes, and DMPA has been found to be associated with weight gain. For other methods, however, there is a lack of clear evidence that contraceptive methods necessarily *cause* certain SAEs and side effects that women experience during use, included those listed on product information package inserts.

The FDA requires drug manufacturers to list all adverse reactions that occur in a pre-specified proportion of users (e.g., 10% of the study sample) in safety trials. Manufacturers must also list AEs that occur at lower rates but could have been caused by drug exposure. The FDA acknowledges that users will frequently experience AEs unrelated to drug use.[119] Once a drug has been introduced to the market, manufacturers may be required to update product inserts following "spontaneous reports" of AEs experienced by users. Serious or frequently occurring spontaneous reports and those likely to be causally related to use trigger label updates, though seriousness and frequency are not well-defined by the FDA. Package inserts do not include incidence of these spontaneous events.[119] Without quantifying rates at which such events occur or providing data to support or refute a causal relationship, providers and users have little information to contextualize long lists of possible AEs. These AEs are also listed on product websites and television commercials, likely sources of contraceptive information for potential users.

For example, weight gain is listed as a commonly reported side effect listed in package inserts and is often reported as a reason for discontinuation,[110, 115, 116, 120] but evidence of a causal relationship is mixed for methods other than DMPA.[101, 120-123] A 2014 Cochrane review identified 49 trials assessed weight gain among CHC users compared with another COC formulation, placebo or no method. The

overall body of evidence did not point to a large effect on weight among CHC users (though authors noted serious limitations in the body of evidence). [124] In a 2014 trial, Mayeda et al., randomized 150 obese and normal weight women to COCs containing 20 μg EE / 100 μg LNG or 30 μg EE / 150 μg LNG to explore whether baseline weight status would impact weight change. Authors measured weight, body water, fat-free mass, fat mass and percent body fat at baseline and three months. No significant changes in any measure were noted overall or when stratified by baseline BMI (obese versus normal weight) or COC formulation.[122]

A Cochrane review of 22 studies comparing weight gain among POC users compared with users of different contraceptives or no method. In 15 studies, no differences were noted across groups, and five found greater weight or body fat increases among POC users (DMPA, LNG, or POP) than among comparators. Again, authors noted limitations to the quality of the evidence.[120] dos Santos et al., assessed weight gain and changes in body composition over 12 months among 149 participants from the Contraceptive CHOICE project in St. Louis, MO.[125] No statistically significant increases in weight or BMI change from between and 12 months were observed for Cu IUD, LNG IUD and ENG implant users, and changes did not differ across groups, though authors did not control for covariates in these analyses.[125] In another analysis of the same parent study, authors found that the ENG implant and DMPA were associated with weight gain over 12 months compared with the Cu IUD, but not in multivariable models. Authors found that Black race was associated with significant weight gain in adjusted models.[126]

Some evidence indicates that hormonal contraceptive users may perceive weight gain at higher rates than non-users. In another secondary analysis of the CHOICE study, Nault et al., found that perceived weight gain (n=4133), about a third of the sample perceived themselves to have gained weight, with ENG implant and DMPA users were significantly more likely to perceive weight gain than Cu IUD users. Seventy-seven percent of those reporting weight gain had actually gained > 5 pound over the study period, so for many users perceived weight gain reflected reality.[127] In another study of LNG implant users (not available in the U.S.) compared with non-users followed for three months, significantly more women in the implant group perceived that they had gained weight, though actual weight change did not

differ between groups.[128] Authors suggest that women's expectations about contraceptive-related weight gain may cause to perceive weight gains during use.[128] Further, in Lopez's review of progestin-only contraceptives and weight gain, authors found that across all studies, participants tended to gain weight over time regardless of contraceptive use status.[120] Women may experience weight gain over time while *using* contraceptives, but that weight gain may or may not be *caused* by contraceptive use.

Mood changes are reported by some users in most contraceptive safety trials. They are regularly listed as possible AEs listed on package inserts. Again, the literature on a causal relationship between hormonal contraceptive use and depression or mood changes is mixed. Hall et al. narratively reviewed the literature on hormonal contraceptive use and adverse mental health.[129] Overall, authors conclude that the literature does not support the relationship between contraceptive use and adverse mental health effects.[129] However, they note that more rigorous research on the topic is needed. In an older (2004) review of 7 small RCTs, Robinson et al. assess the likelihood that hormone exposure was a causal driver of reported mood changes among contraceptive users. They conclude that reported changes may plausibly be based on psychological factors rather than pharmacological properties of CHCs.[130] In a very large prospective study of women in Denmark (n=1, 061, 997), Skovlund et al. found that users of CHCs, LNG IUD, and POPs had higher rates of antidepressant use and depression diagnosis compared with non-users (adjusted rate ratios < 2.0 for all comparisons).[131] These findings yielded several responses; one in support of the potential biological pathway from progestin exposure to depression[132] and one suggesting that the authors did not control for potentially important confounders, including family history of depression.[133]

According to the National Institute of Mental Health over 17.3 million civilian, noninstitutionalized adults in the U.S. (7.1% of this population), had at least one major depressive episode. This number was higher among women (8.7%), young adults (13.1%) and individuals who report more than one race (11.3%). In the same year, an estimated 2.3 million U.S. adolescents aged 12 to 17 (9.4% of this population) had at least one major depressive episode with severe impairment. In the general population of women, young adults, and adolescents in the U.S., depression rates approach the

10% prevalence threshold that necessitates inclusion on package inserts. Yet rates of depression in contraceptive studies simply may reflect national statistics.

For other AEs often associated with use, literature assessing a possible causal relationship is lacking. Headache, for example, is a frequently cited hormonal contraceptive side effect that could plausibly be related to hormone exposure. Yet, literature assessing a causal relationship is essentially lacking. For other potential AEs, such as sore throat with implant use or reduced carbohydrate tolerance with CHC use (both reported in safety trials), a causal relationship seems unlikely.

Concerns about side effects and AEs as a barrier to contraceptive use

In addition to the literature on *experiencing* side effects and discontinuing contraception, there is some evidence that *concerns* about experiencing contraceptive-related SAEs and side-effects impact contraceptive decision-making among young women. Harboring concerns about a method's safety may cause potential users to avoid using or discontinue a method due to fear of a potential SAE or side effect. Given the rarity of SAEs among health young women, concerns may represent overestimations of risk based on misconceptions and misinformation, and thus might be unnecessary barriers to use.

In a survey of 144 women in Pittsburgh, PA, 47.2% of participants reported that risk of increased menstrual flow and cramping with Cu IUDs and the possibility of hormonal side effects with LNG IUD use were qualities that they strongly disliked these methods.[134] Hall et al., in a survey of female students on a Midwestern college campus (n=1,982), found that 28% of participants reported concerns about side effects as a barrier to LARC use.[25] In a 2006 survey of young pregnant women's knowledge of and interest in IUDs (n=190), Stanwood et al., found that safety and effectiveness were participants' most important characteristics in a future contraceptive method, but that 71% of the sample were not sure about IUD safety.[135] Hubacher et al. recruited 916 women aged 19-26 who had never tried LARCs presenting to a family planning clinic for short-acting reversible contraceptive (SARC) methods, here OCPs or DMPA. Women with strong method preference received their method of choice, and women with no strong method preference were randomized to either a SARC or LARC method. Women with strong SARC

preferences were significantly more likely to have concerns about pain or injury during insertion or removal and fears about side effects and health risks than those without a strong preference. For women randomized to LARC methods, negative baseline attitudes toward LARCs were not associated with discontinuation or method satisfaction at 12 months; however, these women were more like to report feeling "neutral" rather than "happy" or "unhappy" with their method at 24 months, indicating that despite baseline negative feelings, women may find LARCs acceptable. However, authors did not report continuation or satisfaction rates by specific reasons for not trying LARC.[136]

In a 2019 review of qualitative studies on U.S. perceptions, beliefs, and attitudes toward contraceptive use and pregnancy, Alspaugh et al. identified 19 studies.[137] These included several samples from populations of individuals at heightened risk for UIP, including recent immigrants,[138, 139] homeless women,[140] incarcerated women,[141] "economically disadvantaged" Black women,[142] and LGBTQ individuals.[137, 143] In eight of these studies, participants reported concerns about contraceptive-related health events or side effects as barriers to use.[137, 140-142, 144-148] In four, participants reported that *lack* of AEs and side effects were qualities that made certain non-hormonal methods (either barrier methods or sterilization) attractive compared with other methods.[137, 138, 144, 149, 150] In a meta-ethnography of qualitative studies on contraceptive decision-making among U.S. adolescents, Daley et al. found that in six out of 13 studies, participants cited concerns about side effects or illness as personal barriers to initiating or continuing contraceptive use.[151-157] In a qualitative in-depth interview study of family planning clients aged 16-24 (n=48) in two urban settings, Kavanagh found that participants valued LARC effectiveness but concerns about side effects, pain, and not wanting a foreign object in their bodies were barriers to use.[158] In a focus group study of Black women with low SES in New Haven, CT, Hodgson et al. found that women (n=44) viewed side effects as a major consideration that complicated contraceptive decision-making.[142] In the only qualitative study identified that focused on young women in the Southeastern U.S. (n= 15), Coates et al. also found that fear of side effects or future SAEs (e.g., infertility) were barriers to LARC use.[159]

Misinformation about contraceptive safety

To what extent are such concerns about contraceptive safety based on evidence and to what extent are they based on misunderstanding of risk? Concerns about SAEs like stroke may represent "heightened aversion" to rare risks but more likely represent overestimations of the likelihood of such risks.[21] Some research on the topic indicates that such misconceptions drive behavior for some young women. Russo et al. informally surveyed 200 experts in family planning to gain perspective on common myths and misconceptions about LARC methods among patients and family planning providers. Experts reported that patients believe that IUDs cause abortions, PID, infertility, and pain, and that LARCs caused ectopic pregnancy, weight gain, acne, hair loss, osteoporosis, and cancer; however, these data came from researchers and providers, not patients themselves.[123]

A nationally representative survey of 1,800 unmarried U.S. young adults aged 18-29 ("The Fog Zone") provides key evidence on the topic. In this survey, Kaye et al. found that 27% of unmarried young women believed that was quite or extremely likely that extended use of OCPs or other hormonal methods will lead to a serious health problem like cancer and 30% said it was extremely or quite likely that IUD use will cause an infection.[21] Of the women who believed that OCPs or other hormonal methods would lead to a serious health event, 50% reported that these beliefs would reduce their likelihood of using these methods. Among women who reported that they believed IUD use would lead to an infection, 54% reported that these beliefs would reduce their likelihood of IUD use.[21]Additionally, 36% of young women surveyed reported that they believed that OCP use would cause weight gain and that these beliefs reduced their likelihood of use, and 40% of respondents reported that they believed OCP use would cause severe mood swings and that this reduced their likelihood of use.[21] Forty four percent of male and female respondents who had ever used OCPs believed that women should "take a break" from pill use every few years, presumably for health reasons, a misperception that places users at risk of UIP.[21] Using the same data, Frost et al., found that participants who believed that contraceptive-related side effects were "extremely likely" were significantly less likely to use hormonal or LARC methods.[160]

As part of an RCT looking at the effect of educational text messages on COC adherence among women in New York City, Hall et al. measured baseline knowledge regarding several domains of COCs, including side effects and risks.[161, 162] At baseline, participants answered a mean of 2.3 out of 4 questions about side effects correctly (57.5%), 3.3 out of 9 questions about health risks correctly (35.6%) and a mean of 5.3 out of 13 questions about benefits correctly (40.8%).[161] Overall knowledge scores at baseline and 6-month follow up differed by age, education level, race/ ethnicity, and employment status.[161] Individuals who received a text message educational intervention were more likely to improve knowledge scores ($p<0.001$) and continue COCs at 6 months ($p=.005$) compared with those in the standard of care group.[161, 162]

In the qualitative literature, Spies et al. conducted 18 focus groups with people who can get pregnant aged 18 to 30 in a Midwestern U.S. state to assess knowledge and attitudes about LARC. They found that women lacked information and harbored misconceptions about these methods, especially implants, and that some women believed that LARC use would cause infection, infertility, as well as pain and cramping.[163] Sundstrom et al., in a series of in-depth interviews with college women aged 18-24, found that participants sought some hormonal methods (e.g., COCs) for positive side effects, like regular menstrual periods or acne control, but did not associate LARC methods with these positive outcomes. Instead, they feared infertility, perforation, ectopic pregnancy, mood changes, menstrual changes, non-specific health risks, and even death.[148] In a content analysis of contraceptive counseling transcripts from family planning visits in the San Francisco Bay area (n=342), Levy et al. assessed the role of interpersonal and social influences on contraceptive beliefs. Most frequently, patients reported learning about SAEs and side effects from these sources. Some patients were able to correctly identify that risk and side effect profiles varied across patients, but others reported concerns about blood clots, future infertility, miscarriage, ectopic pregnancy, uterine perforation, and recurrent vaginal infections, and again, death. The authors also found that negative messages were recalled with greater clarity and detail than positive messages.[164]

In another qualitative focus-group study of young people who can get pregnant (n=24) aged 15-19 in an urban center with high UIP rates, one participant reported "For all the birth controls, I know you gain weight, I'm positively 100% positive," while others talked about continuous bleeding with OCPs, and hearing that "overdoing" OCP use would lead to clogged arteries, MI, or stroke.[165] In Hodgson's study of women in New Haven, CT, [142] at least one participant spoke fatalistically about contraceptive side effects as a definite outcome ("You get blood clots; it causes you to lose hair"), though other participants correctly acknowledged that side effect profiles differed across users.[142] In Coates's study of young women in the Southeastern U.S. (n= 15), participants expressed concerns about future fertility with LARC use and believed that the long-acting nature of such methods meant that they *had* to use LARCs for years,[159] a belief documented elsewhere in the literature on LARC misconceptions.[148, 158, 159]

Young people may also underestimate the well-documented health benefits associated with contraceptive use (e.g., reduced risk of ovarian or endometrial cancer, relief from adverse menstrual symptoms, and reductions in endometriosis-associated pain),[81, 166-173] and health risks associated with pregnancy (e.g., anemia, depression, gestational diabetes, high blood pressure, and cardiovascular risk during the puerperal period).[81, 174-176] Both factors are important when weighing the risks and benefits of contraceptive method use. For example, in the Fog Zone only 24% of participants reported that COC use could reduce risk of certain kinds of cancer despite evidence of a protective relationship between CHC use and endometrial and ovarian cancer, while 37% of respondents thought OCP use was riskier than pregnancy.[21]

The nocebo effect and contraceptive use

Minor adverse health events and SAEs events may occur *during* contraceptive use but may not be *caused* by contraceptive use. In the Fog Zone, Kaye et al. suggest that a conflation of cooccurrence and causation may explain why so many young people believe that contraceptive methods are associated with SAEs.[21] The concept of the "nocebo effect" is highly relevant to this topic. The nocebo effect can be conceptualized as a "reverse placebo effect." Individuals who are told that an intervention can cause

negative effects may experience these effects, even if the intervention is a placebo.[177] In this case, individuals who expect contraceptive-related AEs because they have been exposed to messaging about these AEs may be more likely to report these events. A systematic review of sex differences in placebo and nocebo effects suggests that females may exhibit nocebo effects more strongly than males, though none of the interventions included in the review included contraceptive exposures.[178]

The literature on the nocebo effect in contraception is limited, but Grimes and Schulz suggest that it may drive reports of certain side effects among contraceptive users. They site evidence from three placebo-controlled trials of OCPS in which no differences in side effects were found between intervention and control groups, and common occurrences of "non-specific" health complaints among the general population. They go on to state that messaging about contraceptive side effects from providers or other sources can cause users to expect and thus perceive these outcomes.[179] A growing literature focuses on the possible role of providers and researchers in eliciting a nocebo effect through patient counseling and informed consent.[180-182]

Though informed consent and full knowledge provision is essential, Grimes and Schulz suggest that non-specific side effects that are not causally supported in the literature should not be mentioned during contraceptive counseling. Withholding information from women in a clinical encounter to prevent a nocebo effect would be inappropriate and paternalistic. However, the literature shows information that women receive may be inaccurate and may overemphasize risks, as described below. Thus, improving general knowledge received via formal and informal sources by creating effective evidence-based health communication interventions is an essential step in ensuring that potential users can make fully informed decisions based on the best available evidence.

Sources of [mis]information about contraceptive safety

Adolescents in the U.S. learn about sex from a variety of sources, including peers, teachers, parents, providers, and the media, including increasingly via social media and other Internet sources.[21, 159, 183-194] Primary information sources appear to differ by gender, race/ ethnicity, and SES.[21, 188, 189, 194] In-

school education on contraception has been found to be significantly associated with contraceptive use and condom use at first sex among young women,[195] and with dual protection use among young men in the U.S.[196] However, fewer than one-third of U.S. schools have sex education curricula that cover contraception and dual protection.[197] Most U.S. high schools require only 4 hours of sex education, which may focus only on abstinence.[185] Further, significant declines in adolescents' reporting receipt of formal sex education in schools have been noted.[21, 185, 186] These substantial gaps make informal sources extremely important,[21, 185, 186] yet informal sources are potential sources of misinformation for adolescents seeking contraceptive information.[160, 193, 198] Based on theoretical considerations, two potential sources of misinformation have been selected to assess as potential moderators in this dissertation research (Aim 2): peers (an interpersonal factor) and the media (a social factor). Further, qualitative evidence points to the importance of these two factors. In Levy's content analysis of transcripts from contraceptive counseling sessions,[164] authors found that social (including interpersonal) influences were discussed in 42% of sessions. Conversations about these influences were frequently raised by patients rather than providers. Friends were the most commonly cited source, followed by the media.[164]

Peers: Learning about and discussing sex with peers has been found to be associated with adolescent sexual activity,[188, 199] positive attitudes about sex,[183, 190] sexual risk taking behavior,[183, 200] and beliefs that high rates of sexual activity are the norm among peers.[183] For many young people, peers are important drivers of normative beliefs, which, can be powerful drivers of behavior.[201, 202] Young people often value peer acceptance, and may seek to align their behavior with perceived peer expectations (injunctive norms).[201, 202] Perceptions of peer behavior can be associated with sexual risk-taking (e.g., early sexual debut)[203-207] or protective behavior (e.g., condom use),[191, 208] depending on what an individual perceives normative behavior to be. van de Bongardt et al. conducted a meta-analysis of 58 multi-national studies on the relationship between perceived peer norms and adolescent sexual activity.[192] Authors found that across included studies, greater levels of perceived sexual activity of peers (descriptive norms), more perceived peer approval of sexual activity (injunctive norms), and more peer pressure to have sex were significantly related to self-reported sexual activity.[192]

Regarding contraceptive information, among Fog Zone participants, individuals who received contraceptive information primarily from friends reported significantly lower levels of contraceptive knowledge than those receiving information from healthcare providers.[194] In a cross-sectional survey of 1067 young women aged 15-24 in an urban setting in Colorado, Hoopes et al. found that having a friend who disliked a method was associated with low personal method acceptability for DMPA, LNG IUD, and the implant, but not for OCPs.[209] Low implant acceptability was also associated with having a family member who disliked a method.[209] Hall et al., however, did not find hearing negative messages about a method from friends and family served as a significant barrier to IUD or implant use among college women.[25]

In the qualitative literature, adolescents discuss peers' negative experiences with or opinions of contraceptive methods, including heavy bleeding with OCPs and LNG IUDs,[165, 210] and perforation with IUD use.[210] For others, positive messages, including from method users in their social network led to positive attitudes about or comfort using a particular method.[165, 210] Some adolescents were able to detect when friends provided incorrect information about contraception and pregnancy,[193] or understood that friends' negative experiences did not necessarily predict their own.[210]

In Hodgson's study of Black women with low-SES in New Haven, CT, women reported initiating COCs because they were the norm in their social networks—that "everybody" was using them.[142] Others reported that they based their decisions after watching the experiences of others or discussing methods with friends or relatives.[142] Similarly, in their qualitative study of young women in school-based health centers, Hoopes et al. found that participants' views of LARC methods were largely based on others' experiences, but that information from healthcare providers could counteract negative attitudes developed through interaction with peers.[211] We see from the qualitative literature that peer experiences are important drivers of young women's attitudes toward and use of LARC. However, we also see that young women seek information from multiple sources and gauge the quality of sources when making decisions.

Media Sources: Media sources are an increasingly important source of information about sex, including contraceptive information for young people.[185, 186, 189] Exposures to sexual content in the media

can influence adolescents' views of sex and sexual activity and their behavior.[190, 212-215] Generally, "the media," or "mass media" is defined as "a medium of communicationn (such as newspapers, radio, or television) that is designed to reach the mass of the people,"[216] and "social media" is defined as "forms of electronic communication (such as websites for social networking and microblogging) through which users create online communities to share information, ideas, personal messages, and other content (such as videos)."[217] The roles of entertainment media, news media, and social media have all been studied.

Traditional news media: Since the introduction of the first OCP, Enovid, in the U.S. in 1960, news reporting of contraceptive safety has varied widely in quality and clarity, reflecting an evolving evidence base, changing social and political environments, and biases and misinformation among reporters and social media posters.[218, 219] In a 2012, content analysis of 50 years of COC-related reporting in the *New York Times*,[219] Kruvand found that almost half the COC-related news stories focused on safety and health.[219] Much of this reporting was related to the connection between COC use and cardiovascular disease. In her words, COC-related headlines during that period were a "virtual rollercoaster of encouraging and worrisome news" about COC safety.[219] In a 1999 review of COC-related reporting in *The New York Times, Washington Post, Chicago Tribune, and Los Angeles Times*, Lebow observed a pattern of "neglect," in coverage of COC-related studies. He further notes that these news sources generally focused on negative findings and highlighted potential risks (e.g., risk of breast cancer among COC users), without balancing these by discussing more reassuring results from other studies.[218] The result, he argues, is a decade of alarmist and incomplete reporting in major U.S. news sources. While young women making contraceptive decisions today are unlikely to have been exposed to these news sources, other referent individuals, including parents and teachers, may have been.

Representations of the OCP "Yaz," (a COC containing 2 μg estrogen ethinyl estradiol and 3 mg drospirenone), introduced to the U.S. market by Bayer in 2006, present an illustrative case study. Yaz was the first COC containing drospirenone, a so-called "fourth generation progestin"[220] introduced to the U.S. market. Fourth generation progestins were intended to minimize negative side effects of progestins.[220] Initially, Bayer promoted the product with commercials that indicated to lay audiences that Yaz could

treat mood disorders, increased appetite, bloating, fatigue, headaches, muscle aches, and acne.[221] Yaz quickly became the best-selling COC in the U.S., perhaps in part due to these ads. However, in 2009, Bayer was ordered by the FDA, as part of a lawsuit initiated by 27 U.S. attorneys general, to drop the ads, which were deemed to be misleading because they overstated the drug's indications and understated health risks. Bayer spent $20 million running more appropriate ads.[222] Within years, cases of blood clots or venous thromboembolism (VTE) among Yaz users began to arise, leading to class-action lawsuits against Bayer.

A recent search for newspaper articles containing the terms "Yaz AND (contraception OR contraceptive OR (birth control))" between 2006 and present yielded 889 results from Emory University electronic repositories.[223] Between 2006 and 2010, these articles generally covered FDA approval, Bayer's patent of a new contraceptive formulation, including for premenstrual dysphoric disorder (PMDD), and Bayer's financial gains. After 2010, however, the content of headline shifts dramatically to contraceptive safety and coverage of lawsuits, with hundreds of articles on the topic appearing. These themes also appeared on televised news media and in commercials for personal injury lawyers recruiting plaintiffs for class action lawsuits.

A 2016 WHO-commissioned systematic review and meta-analysis of 22 studies by Dragoman et al. found that COCs containing cyproterone acetate, desogestrel, drospirenone, or gestodene were associated with a small (pooled risk ratios 1.5–2.0) but statistically significant increased risk of VTE compared with LNG-containing COCs.[78] This increased risk results in an estimated additional 5-10 events per 10,000 women years. These findings did not cause WHO to change recommendations for COC safety based on formulation.[78] Yet, based on discussion of such COCs in the media, a non-scientific audience unexposed to these clinical data would quite understandably believe that such COCs carry considerable risk. For the IUD, a similar search from 1980 to present reveals considerable news coverage related to risks associated with the Dalkan Shield, a flawed device that was linked to infection and recalled in 1984. While the Dalkan Shield bears virtually no resemblance to the IUDs available in the U.S. today, the

legacy of this media coverage might impact the messages that young women receive from others, such as older family members.

The Internet and social media: Adolescents and young women today are much more likely to access information via the Internet and social media rather than traditional news media sources.[224] Regarding social media, a content analysis of YouTube videos depicting user experiences found that, of 86 videos identified, 34% included "false claims," 66% mentioned side effects and 27.4% portrayed an overall negative view of IUDs.[225] A similar analysis of 52 YouTube videos about implants found that *all* videos mentioned side effects and 26% presented misinformation.[226] Data on information gleaned from social media contacts via Facebook, Instagram, or other platforms is lacking, but quality of information may mirror that of information gained from peers in face-to-face interactions, as described above. From a different perspective, social media can be a powerful tool for providing confidential evidence-based information to young people, as evinced by an evaluation of a program that facilitated chatting a well-informed health educator, launched by Planned Parenthood Federation of America.[227]

Internet searches for contraceptive information can yield a wide spectrum of sources in terms of quality. The top five results from a recent Google search of the term "birth control" were websites affiliated with the U.S. Department of Health and Human Services (n=2), the FDA, and the Mayo Clinic. Yet, the next 20 results identified represented a mix of reputable and non-evidence-based sources. Evidence-based websites designed to educate about contraceptives (e.g., Bedsider.org) are excellent sources for young women but individuals seeking information may just as easily encounter websites of anti-family planning "pregnancy resource centers," which present as reputable but have been found to supply inaccurate information overemphasizing contraceptive risk.[228, 229]

Reproductive injustice in the U.S.

The importance of structural determinants of contraceptive-related outcomes can be seen in the notable and persistent disparities between contraceptive use, UIP and teen pregnancy and birth rates across racial and ethnic groups and socioeconomic strata. These inequities in family planning outcomes

are, at least in part, the result of macro-level exposures that disproportionately burden more vulnerable women, including women of color, young women, and women with low SES. Throughout U.S. history, women of color have experienced the impact of systems of oppression restricting their reproductive autonomy. The legacy of institutionalized racism and generational poverty have created sustained health disparities that contribute to worse reproductive health among Black women in the U.S.[230] The long history of state-sanctioned coerced sterilization of U.S. women (and men) deemed "unfit" for parenthood according to eugenic ideals.[231-233] Women (and men) of color, individuals with disabilities, mental illness, low SES, criminal records, immigrants, sexual minorities, immigrant and indigenous people (and people at the intersection of these identities) shouldered the burden of these policies.[231, 233, 234] In the words of Harris and Wolfe, the disproportionate burden of this forced sterilization among women from vulnerable groups represents "differential valuing of reproduction," where the reproductive rights of affluent, White women have been historically valued by those in power more than those of other women in the U.S.[231]

Sterilization without consent during birth or an unrelated medical procedure is well-documented, including among Mexican American women in California, Black women in Mississippi, and Native American women through the Indian Health Service.[235, 236 237] These practices caused harm to the individual women whose rights were violated and had implications for their communities.[237] Community-level effects included threats to economic and cultural survival (e.g., of Native American tribes), and distrust of government and medical professionals.

In the 1940s and 1950s, major contraceptive companies conducted contraceptive research using Puerto Rican women as participants.[238] COCs, Depo Provera, and IUDs were all tested using Puerto Rican women as test subjects. Participants included students, women living in subsidized housing, and hospital patients. Simultaneously, Margaret Sanger ran trials using women at a Massachusetts mental hospital as participants.[238] Many of these women experienced unacceptable side effects and pregnancy due to discontinuation.[238] Use of women of color and those with mental illness are further evidence of the tendency to devalue of reproductive lives of these women among researchers and drug companies.

Evidence of racial bias in family planning provision persists. Dehlendorf et al., used videos of standardized patient videos to assess provider bias in LNG IUD recommendations by patients' race and SES among 524 family planning providers recruited from academic meetings. They found that providers were significantly more likely to recommend IUDs to high income versus low income women ($p = 0.01$) and to Black rather than White women ($p = 0.04$). No statistically significant differences in IUD recommendations for Latina versus White women were observed.[239] Perhaps most disturbingly, evidence suggests that coerced sterilization persists today. An estimated 150 women in California prisons were sterilized between 2006 and 2013; evidence suggests that many felt pressured into consenting.[240]

Family planning researchers must recognize their work within the context of these historical legacies and the long-standing political and legal systems, and social structures. A 2017 commentary by Mengesha and 53 U.S. fellows in family planning (family doctors and ob-gyns receiving specialized training in family planning) called for providers to view family planning through a reproductive justice lens.[241] Defined as "the human right to maintain personal bodily autonomy, have children, not have children, and parent the children we have in safe and sustainable communities," Reproductive Justice (RJ) is a framework for understanding the roles of intersecting systems of oppression in the lives of women of color, trans women, and other marginalized groups.[242] Inequities in family planning outcomes are, at least in part, the result of macro-level exposures that disproportionately burden communities of color. Identifying root causes of group differences is essential to developing effective interventions to address misconceptions about contraception. From a RJ perspective, it is important to collect data on macrosocial influences of contraceptive behavior, which may differ across racial and ethnic groups based on exposures unique to women of color. Such structural exposures may create meaningfully different perspectives on contraceptive use.

Gaps in the Research addressed by this dissertation research

<u>Synthesis of the literature on contraceptive safety beliefs and use</u>

When individuals avoid contraceptive due to concerns about safety that are not supported by clinic research, their choices are unnecessarily limited. Such concerns may be a highly modifiable factor that could be addressed via education and improve contraceptive care. To my knowledge, prior to completing Aim 1 of this dissertation, the literature on the relationship between contraceptive safety beliefs and factors related to these beliefs had not been systematically synthesized. While a sizable literature documents the existence of contraceptive safety and side effect concerns, this work advances that literature by the systematically by assessing the quality of published research and documenting which safety beliefs are most commonly reported, the frequency of such beliefs, and variables associated with these beliefs. This information can help develop evidence-based interventions that address the informational needs of those considering contraceptive use.

Methodological limitations in the available literature

Much of the prior research on psychosocial predictors of contraceptive use has used cross-sectional designs, with data on contraceptive use based on static measures. Through Aim 1, we identified that an overwhelming majority of the literature on contraceptive safety beliefs is cross-sectional. Static measures collected cross-sectionally fail to capture patterns of use, including inconsistent use. Through my Aim 2 analysis, I improved on previous contraceptive measures by operationalizing contraceptive use in three ways: ever use, current use, and monthly use. Inconsistent method use results in greater risk of UIP, so capturing data on use over time is vital for understanding risk. I used a strong repeated measure longitudinal design and prospectively assessed relationships between baseline concerns and subsequent method use. By defining exposures at baseline, we ensured that they temporally preceded contraceptive outcomes. Our measures of independent variables and moderators were developed based on a thorough review of the literature, pilot tested, and used to collect data in a large survey of college women. Further, we asked participants about a range of concerns about SAEs and side effects, allowing us to assess nuanced relationships.

Finally, we used a mixed methods approach that involved three distinct methods: systematic review, quantitative analysis, and qualitative methods. The mixed methods approach allowed us to understand our research findings better than use of a singular methodological approach could have. The results from Aims 1 and 2 helped inform the questions that I asked in the qualitative interviews (Aim 3), and the qualitative results helped me to better understand the results of my quantitative analysis and systematic review.

Overemphasis on LARC methods in the current literature

Most of the literature focuses on barriers to LARC use among young women. While LARC methods are highly effective and proven to be acceptable to many young people,[243, 244] many feel more comfortable using SARC methods, a finding made clear in analysis of Aim 3 data.[25, 136, 148, 245, 246] Further, people report feeling pro-LARC bias from providers,[117, 245, 246] and there is evidence that racial biases exist in LARC provision among family planning providers.[239] This is especially troubling given a long history of reproductive coercion directed toward women of color, women with disabilities, and low income women in the U.S.[68] Thus, research focused on all FDA-approved methods is necessary to develop high-quality evidence-based contraceptive counseling protocols and educational interventions that fit the needs of young women. In this dissertation research, I: systematically characterize how safety concerns differ across methods (Aim 1), assessed whether concerns about contraceptive safety differentially influence the likelihood of using methods in different contraceptive effectiveness tiers (Aim 2). In our qualitative interviews, we asked participants to discuss any contraceptive methods that came to mind, which resulted in data that included beliefs on barrier, behavioral, and pharmaceutical contraceptives.

Lack of clear theoretical underpinnings of prior research

With a few notable exceptions, the literature reviewed is largely atheoretical. Using behavioral theories helps point researchers to constructs that might be associated with behaviors of interest. Theory helps investigators move "beyond intuition" when attempting to understand and intervene upon health behaviors.[247] Using theory also helps researchers identify modifiable intervention targets. A review of the

use of behavioral theory and the social ecological perspective in contraceptive research follows. As described below (*Theoretical Orientation*), the dissertation research was informed by the Health Belief Model (HBM) and the Social Ecological Model.

A dearth of research on young people who can get pregnant in the Southeastern U.S.

This dissertation research focused on an important population—people who can get pregnant in the U.S. SE. Only one study identified in the preliminary literature review and only two identified in the systematic review conducted for Aim 1 focused on the experiences of young people in the SE. This is a major research gap, because the SE is a region with high UIP rates, especially among young women. As of 2014, UIP rates were higher than the U.S. median in all SE states, with more than 40% of all pregnancies reported as being unwanted or occurring too soon in Alabama, Georgia, Louisiana, Mississippi, Tennessee, Florida, South Carolina, and North Carolina.[65] Each of these states also had an adolescent pregnancy rate greater than the national average in 2013,[6] and low rates of LARC and moderately effective contraceptive use.[248] SE states rank worst in the U.S. for maternal mortality, low birthweight, preterm birth, neonatal mortality, and infant mortality.[66] In Aim 3, we sought to purposively sample individuals who did not identify as cisgender females, in order to understand whether beliefs and experiences differ based on gender identity. This helped fill a further literature gap, by data that intentionally includes non-cisgender people in the U.S. SE.

Theoretical Framework

I took an integrated theoretical approach to this dissertation work, using the Health Belief Model (HBM) to understand individual-level determinants of contraceptive use and the Social Ecological Model (SEM) to contextualize individual behavior within higher level influences. In Aim 1, I drew on the SEM and reviewed the literature for multi-level predictors of beliefs about contraceptive safety beliefs. In Aim 2, I operationalized HBM constructs and drew on the SEM, to assess whether interpersonal and social exposures moderated the relationships between these constructs and behavior. In Aim 3, I asked young

people directly about how HBM constructs (e.g., perceived susceptibility, perceived severity, perceived benefits) and higher-level factors (SEM) impact their contraceptive method use. A conceptual model depicting how theory guided this research can be found **Figure 1.1**. The pathways explored in Aim 1 are printed in yellow, the pathways explored in Aim 2 are green, and the pathways explored in Aim 3 are in blue.

Health Belief Model

The Health Belief Model (HBM) is one of the most commonly used theories for understanding behavior and developing behavioral interventions.[249] The HBM was originally developed in the 1950s by U.S. Public Health Services scientists seeking to understand why individuals chose not to uptake tuberculosis screening, despite the availability of free, convenient mobile screening services.[249] The HBM evolved from value-expectancy theory, which posits that individuals' behaviors result from the interplay between how much they *value* a potential outcome, and how much they *expect* an action to influence that outcome. Such theories conceptualize humans as rationale beings, capable of weighing costs, benefits, values and expectations to make decisions about their health. The HBM can be a useful theoretical framework to understand: 1) how individual-level beliefs about susceptibility to contraceptive-related adverse events drive contraceptive behavior, 3) decision-making processes that involve weighing risks and benefits of a given contraceptive method with the risks and benefits of another or no method use, and 3) communication strategies that may help women make informed, voluntary decisions about contraceptive uptake and adherence by addressing their perceived susceptibility to contraceptive-related AEs.

Six key constructs underlie the HBM. They are: perceived susceptibility, perceived severity, perceived benefits, perceived barriers, cues to action, and self-efficacy.[249] The theory posits that an individual must believe that they are *susceptible* to a health outcome and must believe that that this outcome is *severe* enough to warrant action. If these two conditions are not satisfied, then an individual simply may not be motivated to take preventative action. Further, individuals must believe that some

effective course of action is available to them, and that the benefits of taking this action outweigh the costs or barriers. Individuals may not to take preventive action if they believe it to be ineffective, or if there are social, physical, or psychological barriers to a proposed preventive action. Additionally, an individuals' behavioral-specific self-efficacy influences the likelihood they will take preventative action. Self-efficacy is defined as confidence in one's ability to successfully perform a behavior. Cues to action are external stimuli may prompt an individual to complete a behavior.[249] The HBM posits that the relationships between these constructs and behavior can be influenced by other modifying factors, but its authors are not specific on whether these factors are at the individual level or external to the individual. An example of operationalization of each of these constructs in the contraceptive use literature can be found in **Table 1.2.**

Given its origin in understanding prevention-related health behaviors, the HBM is well-suited to guide research on contraceptive use, which is inherently preventive. The theory acknowledges that qualities of both the adverse health event that one seeks to avoid and characteristics of the *means of prevention* (here, benefits and barriers to contraceptive use) influence behavior. Finally, by incorporating perceived barriers and modifying factors, the HBM acknowledges that individual behavior is facilitated and constrained by factors external to the individual. In the case of contraceptive use, the constructs of perceived benefits, barriers, and modifying factors are relevant. Perceived benefits to contraceptive use can include the ability to finish school, secure employment, and avoid family conflict or social stigma. Other benefits can include contraceptive-related health benefits or avoidance of health risks associated with pregnancy. Perceived barriers can include access barriers (e.g., cost, clinic availability), information barriers (e.g., lack of awareness of certain methods, misconceptions about contraceptive safety), social barriers (e.g., social pressure to have children young based on cultural, familial, or partner influence, beliefs that contraceptive use is non-normative and therefore unacceptable in one's family or social network), or psychological barriers (e.g., risk aversion, fear of using an unfamiliar method).

Generally, operationalizations of HBM in contraceptive research look at how perceived susceptibility to pregnancy influences behavior. However, in my research, I looked at the relationship

between contraceptive use and perceived susceptibility to contraceptive-related SAEs and side effects. I believe that this application is highly appropriate and a novel use of HBM to study contraception. The literature demonstrates that individuals regularly perceive themselves to be susceptible to a range of contraceptive-related health risks and that such concerns influence use.

By focusing on concerns about health risks, I did not have to account for changing attitudes or ambivalence about pregnancy, a criticism of using the HBM to understand contraceptive behavior. Individuals are unlikely to oscillate between negative and positive attitudes about outcomes like blood clots, infection, or weight gain, all of which are common contraceptive-related concerns. The literature shows that perceived susceptibility to contraceptive-related health risks and perceived severity of such risks may frequently be based on misconceptions about risk. Thus, the pathways from these constructs to contraceptive behaviors are excellent intervention targets. Prior research on the relationship between perceived susceptibility to contraceptive-related AEs and contraceptive use is limited.

Hall has called for use of HBM to guide modern research on contraceptive use.[250] The theory's adaptable and holistic nature make it applicable to a diverse set of complex behaviors, including contraceptive behavior.[250] She notes that differences between contraceptive methods (e.g., side effect profiles, duration of use), differences in user preferences, and differences in method-related behavioral requirements (e.g., daily pill use, returning to a clinic every three months, using a condom at each sex act), yield different cost-benefit analyses. The HBMs acknowledges the interplay of these considerations and is thus ideal to study the relationships between these constructs.

Hall conducted a systematic review and identified 10 studies in which the HBM was used to understand contraceptive use. In a cross-sectional study from the 1980 of college women (n=171), Hester and Macrina found that measures of perceived benefits and barriers and perceived susceptibility were associated with contraceptive user measures. Other HBM constructs were not.[251] In another older study (1985), Eisen et al. compared an HBM- based educational intervention designed to reduce UIP risk with a comparison group. This is the one study identified in which authors operationalized perceived susceptibility to contraceptive-related AEs, with one item asking participants to rate their agreement with

the statement “the side effects of good birth control methods are a real problem.” Eisen et al. found significant improvements in beliefs, knowledge, and contraceptive behavior for intervention group participants in a control study (n=120), but not in a larger randomized trial of the intervention (n=1,444).[250, 252]

In the more recent literature, Brown et al., in a survey of males and females access care at a Federally Qualified Health Center, reported that effectiveness, cost, and side effects were the most important drivers of contraceptive decision-making. Perceived benefits were operationalized through questions about effectiveness, and perceived barriers were operationalized through questions about cost and side effects.[253] Frohwirth et al., through in-depth interviews with individuals post abortion, found low levels of perceived susceptibility to pregnancy among respondents.[254] In a prospective study of low-income young women aged 16-24 (n=1155), Rahman et al. found that perceived susceptibility to pregnancy was not associated with COC continuation, condom use at last sex, dual method use, or pregnancy risk over 12 months.[255]

A 2016 Cochrane review identified 25 RCTs that tested theory-based interventions designed to promote contraceptive use and prevent pregnancy.[256] Of these, nine interventions were primarily based in Social Cognitive Theory, [257] seven in motivational interviewing,[258] four in the Transtheoretical model of change, [259] and three in the Theory of Reasoned Action/ Theory of Planned Behavior.[202] Despite calls for its use, only three of the studies identified utilized HBM.[256] None of these operationalized the model as a whole, but rather incorporated select HBM constructs in intervention design.[249] Two were based in the U.S.[260, 261] and one was based in South Africa.[262] Each of these focused on young people (ages 14 – 24).

In one study, Kirby et al (2010), used motivational interviewing, incorporating perceived barriers and self-efficacy in a phone intervention designed to increased condom and contraceptive use and decrease STI and pregnancy incidence among a sample of teenagers (aged 14-18) in San Francisco, CA.[261] Study staff made 9 follow-up phone calls to study participants who sought reproductive health services at a target clinic. These staff used motivational interviewing to help participants identify risky reproductive health behaviors and opportunities for behavioral change. Calls addressed benefits and

barriers to behavioral change but did not operationalize all HBM constructs. The intervention was assessed with an RCT (n=805). No differences between the intervention and control groups were noted. However, only 30% of scheduled calls were completed, and only a select number of HBM constructs were addressed in the intervention.[261]

Berenson and Rahman (2012) also mobilized HBM in an RCT designed to increase OC continuation, correct OC use, and condom use, and to decrease pregnancy and STI incidence among a sample of 1155 young women (aged 16-24). Participants drawn from publicly funded reproductive health clinics in Texas were randomized to receive either: a supplementary in-clinic contraceptive counseling session, the supplementary counseling session plus follow-up phone calls from study staff, or standard of care.[260] Authors state that the contraceptive counseling session was designed using "educational and behavioral techniques" based on the HBM. Specifically, they discussed risk of pregnancy (presumably to prime participants' perceived susceptibility), non-contraceptive benefits of OC use, contraceptive side effects (to address barriers to action), and helped participants develop daily cues to action to incorporate into their routines to support consistent OC use. Authors did not observe significant between-group differences in OC use, condom use, dual use, pregnancy rates, or STI rates at any point during the 12 month follow-up period.[260]In the study of South African adolescents, Taylor et al. delivered a 12-week in-school intervention for 816 high school students nested within 16 high schools. Facilitators used role play, group discussions, debates, and videos. The intervention integrated perceived susceptibility and cues to actions, but authors did not explain how these constructs were operationalized. At follow-up, authors found that students exposed to the intervention had significantly lower positive attitudes toward teen pregnancy, significantly higher intentions to abstain from sex and to communicate with partners, and significantly higher self-reported condom use, but lower condom use consistency from baseline to follow-up. However, they did not find significant differences between the intervention and control groups.[262]

The literature on using HBM to explain and change contraceptive use behavior is mixed; some studies find constructs to be predictive of behavior and some do not. Serious limitations to this body of research exist. First, most of the research is old, having been published prior to 2000. Contraceptive

method availability, evidence on contraceptive safety, and contraceptive use patterns have changed dramatically since then. Second, only one study identified looked at perceived susceptibility to contraceptive-related AEs, the main focus of this dissertation research.

Social Ecological Model

While the HBM is appropriate for understanding individual-level cognitive determinants of contraceptive behavior, it is non-specific about higher level drivers of these behaviors ("modifying factors"). Contraceptive behavior is the result of a dynamic interplay between individual, interpersonal, and social, structural, and physical environmental exposures. Influences at multiple levels facilitate or constrain individuals' abilities to make choices about their reproductive lives. In order to contextualize individual behavior within these layers of influences, I will integrate the SEM into this dissertation research.

Based in Bronfenbrenner's work,[263] the social ecological model posits that behavior is shaped by multiple levels of influence. Factors at each of these levels facilitate and constrain human behavior, and influences can interact across levels. These layers of influence have been defined differently by different theorists. Bronfenbrenner, for example, discussed micro-, meso-, exo- and macro-systems,[263] while McLeroy et al. discussed intrapersonal, interpersonal, institutional, community, and public policy factors.[264] These levels are often described as being hierarchically situated, interconnected (forming a "web" of influence). Glass and McAtee describe a stream of causal influences flowing from distal (upstream) social influences on behavior to proximal (downstream) individual-level influences. The stream metaphor is further situated within time and within a topography of influences, at the intra-individual (cellular) and extra-individual (global, macro, mezzo and mico-levels). [265] Sallis and Owens state that a major principle of ecological models of health behavior is that "multilevel interventions should be most effect in changing behavior. [266] Behavioral change interventions that neglect context reflect overly simplistic understandings of public health problems and can lead to ineffective programs.[265, 267] However, health promotion programs, including interventions designed to change family planning

behavior, are much more likely to focus on individual determinants of behavior than on "higher levels" of the social ecological model.[268]

Schölmerich and Kawachi conducted a systematic review of 63 family planning interventions to assess the proportion that focused on multi-level change or included intervention targets at levels other than the individual level. They found that 45 focused on one level and 17 focused on exacting change on multiple levels. Of the single level studies, authors frequently situated intervention *activities* within higher levels of the SEM (e.g., education within schools, radio or television programs), but focused on *outcomes* at the individual level.[267] However, this review focused on interventions in developing countries, with none of the included studies based in the U.S.[267, 269] Further, Schölmerich and Kawachi noted that while many of the interventions identified focused on multiple levels of influence, authors tended not to explicitly situate their interventions within a social ecological framework or any theoretical frameworks at all. Select predictors of contraceptive behavior and UIP risk at different levels of the SEM can be found in **Table 1.3.**

Examples of the role of higher-level influences on contraceptive behavior and pregnancy outcomes are plentiful. At the interpersonal level, the influence of peers, family members, partners and relationship characteristics have been found to be important.[21, 142, 186, 190, 195, 270-273 4, 274-277] Within healthcare systems, factors like funding, counseling protocols, and provider characteristics (e.g., skill levels, knowledge, and biases), shape young women's access, experiences, and outcomes. [243, 278-284] At the sociocultural and policy levels, perceived norms about sex and contraception, media exposures, and policies related to contraceptive coverage and abortion access influence UIP risk and pregnancy outcomes. On the physical environmental level, geography drives family planning outcomes. About 40% of U.S. women live in a county with no abortion provider,[285] and 19.5 million women in the U.S. live in so-called "contraceptive deserts," without reasonable access to the full-range of FDA-approved contraceptive methods.[286] When women and girls cannot physically access services, they are deprived of the ability to make decisions about their reproductive lives.

To integrate the SEM in Aim 1 of this research, I documented factors associated with beliefs at any level to determine what the research said about higher-level influences. Unfortunately, but unsurprisingly, most of the research focused only on individual-level factors. In Aim 2, I assessed whether interpersonal (friends and family) and social (media exposure) factors moderated the relationship between perceived susceptibility to contraceptive-related AEs (contraceptive safety concerns) and method use. In Aim 3, I asked participants to describe how external factors, including conversations with peers, family and providers, and social factors, including traditional and social media exposures influence belief development and, in turn, contraceptive decision-making.

Table 1.1 SAEs and Side Effects Listed in Package Labels of FDA-Approved Contraceptive Methods

Contraceptive Method	Serious Adverse Events	Side Effects
CHCs	Arterial thrombotic events, including ischemic stroke and myocardial infarction (MI),[81, 287] thromboembolic events, including deep vein thrombosis (DVT) and pulmonary embolism (PE),[78, 28875] cerebrovascular events (thrombotic and hemorrhagic strokes), and (liver tumors), gallbladder disease, increased blood pressure.[79, 81, 289, 290]	Nausea, vomiting, other gastrointestinal symptoms (such as abdominal cramps and bloating), menstrual changes, including breakthrough bleeding, spotting, and amenorrhea, temporary infertility after COC discontinuation, edema, melasma, breast changes, including tenderness, enlargement and secretion, weight changes (increase or decrease), changes in cervical erosion and secretion, diminished lactation, cholestatic jaundice, migraine, allergic rash, depression, reduced tolerance to carbohydrates, vaginal candidiasis, change in corneal curvature, and intolerance to contact lenses,[81, 110, 290-293] application site skin reactions, upper respiratory infection (patch),[290] device-related events (e.g., expulsion or discomfort) (ring)[294]
LNG IUDs	Post-insertion infection, including Group A streptococcal sepsis and pelvic inflammatory disease (PID), ectopic pregnancy, intrauterine pregnancy with the device *in situ*, ovarian cysts, expulsion and uterine perforation, anemia, hypertension.[92, 96]	Abnormal/ irregular menstrual bleeding, abdominal/pelvic pain, vaginal discharge, nausea, headache nervousness, vaginal bacterial infections, vulvovaginitis, dysmenorrhea, uterine spasm, back pain, weight increase, breast pain/tenderness, acne, decreased libido, depressed mood, cervicitis.[91, 92, 96, 295]
Cu IUDs	Intrauterine pregnancy, septic abortion, ectopic pregnancy, pelvic infection, perforation, embedment.[296]	Anemia, backache, dysmenorrhea, dyspareunia (pain during sexual intercourse), vaginal discharge, prolonged menstrual flow, spotting, pain and cramping, allergic skin reaction, vaginitis.[296]
Implant	Neural or vascular injury, paraesthesia, migration of the implant, intravascular insertion if device is inserted too deeply, ectopic pregnancy, possible risk of arterial thrombotic and venous thromboembolic events (causal relationship not clear), possible risk of hepatic adenomas (causal relationship not clear). [297]	Menstrual bleeding changes, headache, vaginitis, vaginal discharge, weight increase, acne, breast pain, abdominal pain, sore throat, dizziness, hypersensitivity, insertion site pain mood changes (emotional lability, nervousness, depressed mood), *in situ* broken or bent implant resulting in slightly increased rate of etonogestrel release.[297]
DMPA	Loss of bone mineral density (risk increases with duration of use and loss may not be completely reversible), possible increase in increase the risk for osteoporotic fracture in later if used during adolescence and early adulthood, anaphylaxis and anaphylactoid reaction, thromboembolic events (causal relationship not clear), convulsions (causal relationship not clear).[105]	Menstrual bleeding changes (bleeding or spotting), abdominal pain/discomfort, weight gain, dizziness, headache, nervousness, decreased libido.[105]
POPs	Ectopic pregnancy, ovarian cysts, possible risk of hepatic adenomas (causal relationship not clear).[298]	Menstrual bleeding changes (frequent or irregular bleeding), headache, breast tenderness, nausea, and dizziness, acne, hirsutism, and weight gain occur rarely.[298]

Table 1.2. Operationalization of HBM Constructs in Contraceptive Use Literature

Construct		Example in Contraceptive Use Literature
Perceived threat: construct formed by combining perceived susceptibility and perceived severity	**Perceived susceptibility**: Individuals' beliefs about whether they are **at risk** for a given health condition	Perceived susceptibility to pregnancy: 59% of female Fog Zone respondents reported believing that it was at least slightly likely that they were infertile; 19% believed that it was extremely likely.[21] Perceived susceptibility to contraceptive-related SAE: 27% of Fog Zone respondents reported believing that it was quite or extremely likely that extended use of OCPs or other hormonal methods will lead to a serious health problem like cancer.[21] Perceived susceptibility to contraceptive side effects: "For all the birth controls, I know you gain weight, I'm positively 100% positive" - participant in Greenberg's qualitative study of contraceptive beliefs among young women in Rochester, NY[165]
	Perceived severity: Beliefs about how *serious* a health outcome is	Perceived severity of social consequences of pregnancy: "I live with my grandparents and it's our house is full so it's kind of, 'God, if I get pregnant I might be kicked out.'"[142] – participant in Hodgson's study of Black women with low SES in New Haven, CT Perceived severity of menstrual-related changes associated with hormonal contraception: Participants report believing that IUD-related side effects like bleeding changes were indicative of more serious AEs.[117] – Amico's study of women seeking early IUD removal in the Bronx, NY.
Perceived benefits: Beliefs about the effectiveness/ benefit of taking action to change a health condition		Perceived benefits of LARC: In a focus group study of school-based health center users, high school students view not having to return to a clinic for birth control as a benefit, based on their precarious living situations and or plans to relocate or attend college after high school.[211] Perceived benefits of SARC: In an RCT looking at SARC vs. LARC acceptability, Hubacher found that 10% of women with strong SRC preferences liked health benefits of SARC methods.[136]
Perceived barriers: Beliefs about material/ psychological costs of taking action		Perceived cost barrier to LARC use: Insured college women were aware that under the ACA, OCPs were free, but were not sure if LARCs were covered. – Sundstrom's in-depth interview study of college students' perceptions of LARC[148]
Cues to action: Factors that influence readiness to change		Cues for contraceptive uptake: "My best friend had [the implant] and she was like, you should get that one. I was like, okay! So I just got it." -[165] participant in Greenberg's qualitative study of contraceptive beliefs among young women in Rochester, NY Cues for contraceptive continuation: Castaño et al. found that daily text message reminders improved consistent COC use compared with standard of care over 6 months.[162]
Self-efficacy: Belief that one is able to take action successfully		Self-efficacy regarding correct and consistent OCP taking: In Sundstrom's qualitative study of college women, participants believed they were "responsible enough" to take OCPs at exactly the same time every day.[148] Lack of self-efficacy regarding returning to a provider every three months for DMPA shots: "I would have missed all my shots because I got a horrible memory." - participant in Greenberg's qualitative study of contraceptive beliefs among young women in Rochester, NY

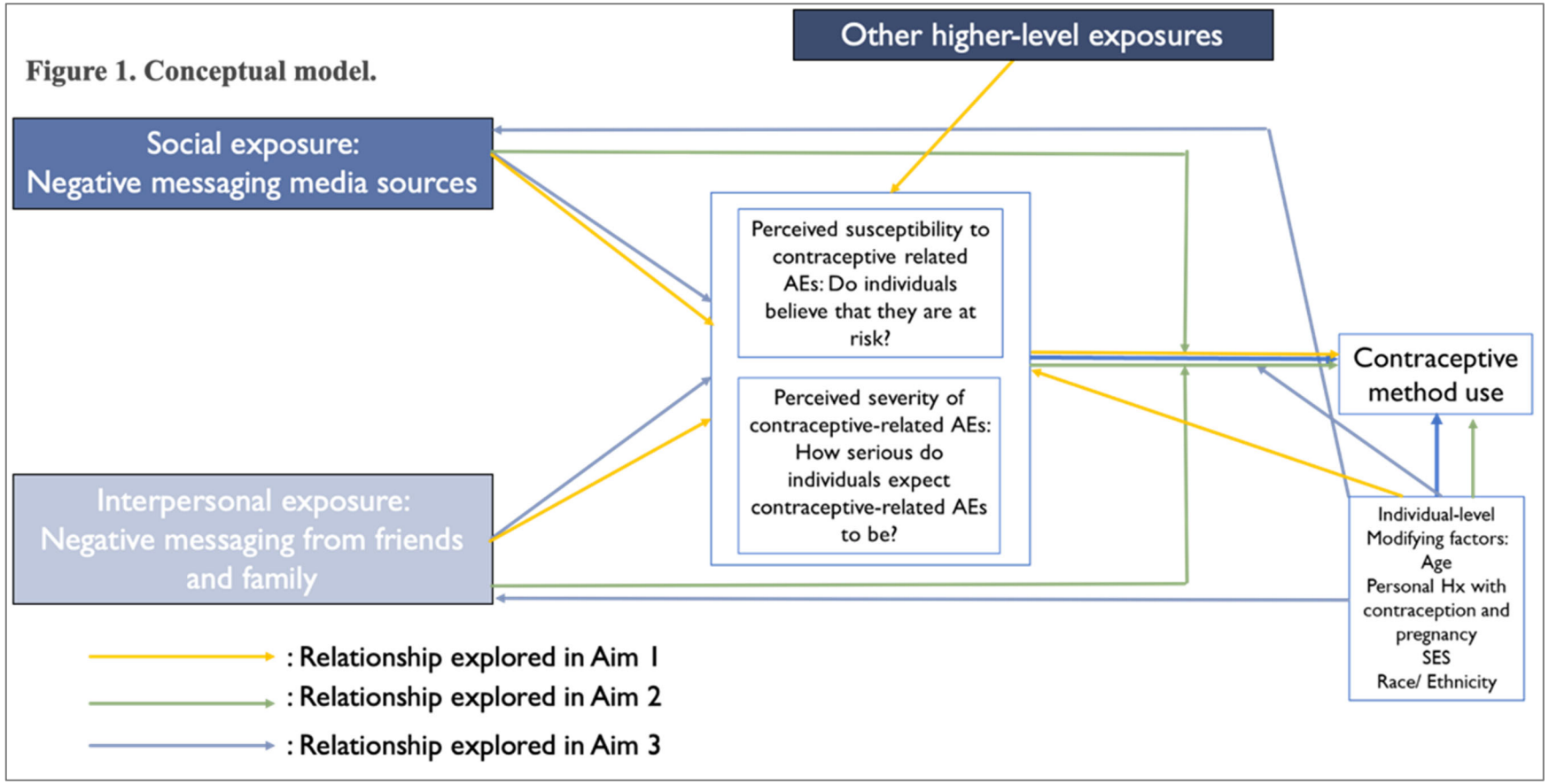
Table 1.3. Multi-level influences on contraceptive use.

SEM level	Factor	Example from contraceptive literature
Environmental Level	Geographic factors	- Across U.S. states, substantial variation exists in the availability of publicly funded clinics providing contraception; state of residence thus impacts access to affordable family planning[2] - Rural versus urban county residence may impact availability of services and contraceptive methods used[299] (e.g., rural women in Georgia found to be more likely to use sterilization than counterparts in more urban counties)[300] - 19.5 million women in the U.S. live in so-called "contraceptive deserts," defined as areas without reasonable access to a healthcare provider that offers full range of FDA-approved contraceptive methods.[286] - Women in states (e.g., Mississippi) and counties without family planning providers may not be able to access abortion or contraception[59, 63]
	Clinic location	- Among community college students, locating clinic on campus (with free LARCs) not associated with increased use or interest in LARC[301, 302] - Sexually active adolescents with access to School-based health centers may be more likely to use contraception, but evidence is mixed[303, 304]
	Neighborhood factors	- Cohesive neighborhood associated with dual use[305]
Policy Level	Abortion policy	- Restrictive abortion policies can cause individuals who experience UIP to carry pregnancies to term
	Education policies	- Comprehensive sex education positively associated with contraceptive use[195] and negatively associated with adolescent pregnancy risk[306] - Abstinence-only education ineffective at promoting healthy behavior;[307] exposed adolescents may engage in riskier sexual behaviors[308]
	Insurance-related policies	- ACA associated with lower costs for contraceptive methods and small but significant uptake in LARC methods in the U.S.[309] - Women with full or partial LARC coverage under ACA more likely to uptake post-abortion LARC[310] - Uninsured women, women with plans that do not cover contraception, and women unaware of their contraceptive benefits are less likely to use due to cost concerns[311]
	OTC contraceptive availability access	- Women accessing COCs over the counter (OTC) may have higher continuation rates; women in the U.S. are interested in OTC COC access[312] - Access to OTC emergency contraception (EC) does not influence sexual risk-taking;[313] OTC access may not influence adolescents' likelihood to use EC within 24 hours of unprotected sex[314]
Sociocultural Level	Political climate	- Women express concern about contraception and abortion access after 2016 presidential election[315]
	Immigration	- Immigrant women face additional barriers to family planning based on language, lack of insurance, and other factors[316]

		- The migration experience may place women at risk for sexual assault and UIP
	Religious influences	- In a convenience sample of Muslim American women in CA (n=276), 82.2% believed that all forms of reversible contraceptives were allowable but only 64.8% believed that permanent methods were appropriate[317] - Participants reported lower rates of male condom, withdrawal, injectable, EC, and sterilization use than national averages, higher rates of IUD and natural family planning use, and similar rates of OCP use;[317] another study (n=224) found women who identify as Shia or Muslim in general were more likely to use contraceptives that those identifying as Sunni.[318] - Using NSFG data, Catholic participants were more likely to use non-coitally dependent contraceptive methods than protestant respondents.[319]
	Media exposures	- Perceptions of contraceptive safety can be influenced by television, print media, or Internet sources[185, 186, 189] - LARC methods rarely discussed in televised news coverage of contraception, possibly contributing to low levels of awareness of such methods[320] - Contraceptive use rarely portrayed in primetime television depictions of sex, which could influence perceptions about use[321] - Primetime television rarely depicts negative consequences of risky sexual behavior, which may influence adolescents' behavior[321, 322] - Youtube videos about IUD and implants focus on side effects, which could influence perceptions about methods[225, 226]
	Perceived social norms	- Beliefs about peer normative behavior can drive sexual risk-taking (e.g., early sexual debut)[203-207] or protective behavior (e.g., condom use)[191, 208] - Perceived norms about contraceptive methods most frequently used by peers can drive method selection[142]
Healthcare system level	Provider skill, knowledge and attitudes	- Lack of training, comfort, and experience with LARC insertion can cause providers to not offer LARC to young or nulliparous patients[278] - Provider beliefs that adolescents will not want LARCs can lead them not to offer[278] - Providers who are not specialized in family planning may have discomfort discussing pregnancy and contraception with patients, lack of knowledge about methods, and misinformation about medical eligibility[279-281] - Providers may recommend LARC methods at higher rates for patients of color and with low SES[239]
	Clinic characteristics	- Catholic and Christian hospitals offer significantly fewer family planning services than non-religious hospitals[323, 324] - Availability of full range of FDA approved methods at family planning clinics influences use; survey of local health departments in the Midwest the U.S. found that < 10% offered IUD or implant insertion[302] - Receipt of Title X funding associated with greater onsite provision of LARC and permanent methods among California family planning provision sites[325] - VA outpatient clinics less likely to offer IUD than inpatient hospital settings in metropolitan settings[326] - CDC provides guidelines on teen-friendly clinics to improve quality of care for adolescents[327]

	Counseling	- Tiered counseling approaches (more effective methods discussed first) to contraceptive counseling associated with more effective method use[243, 282] - Women value provider input, but find autonomy to be highly important in contraceptive decision-making [283] - Providers who use "foreclosed approach" rather than interactive informed choice or shared decision-making approaches may miss an opportunity to discuss drivers of patients' preferences for certain methods and to educate patients about others[284] - In directive counseling, where providers emphasize certain methods over others, women report feeling that their voices are not heard and that they are being deprived of autonomy [117, 328]
	Cost	- Removal of cost barriers associated with greater LARC uptake[243, 282, 329, 330] and reductions in UIP rates[331]
Interpersonal level	Role of partners	- Multiple partners associated with dual method use[305] - Relationship style associated with dual method use[271] - Partner communication about contraception/ pregnancy associated with consistent use of hormonal method and dual method use[271-273] - Cohabitation associated with higher UIP risk[4, 274] - Being single and divorced associated with higher UIP risk[274] - Women experiencing intimate partner violence less likely to use post-partum contraception, COCs, condoms[275-277 271-273 4, 274-277]
	Role of friends	- Individuals receive information about contraceptive methods and sexual health generally from friends[183, 188, 190, 199] - Positive or negative messages about contraceptive methods can influence attitudes toward method and method use[142, 211] - Having friends who are parents associated with repeat pregnancy among adolescents[332] - Friends might provide material information and support (e.g., information about clinic location, transportation)[270]
	Role of family members	- Parental communication about sex negatively associated with dual use[305] - Positive parental norms about sex associated with dual use[305] - Parents, sisters, sisters-in-law and other female relatives are important sources of information about sex and contraception for women[21, 142, 186, 190, 195, 270]

Figure 1.1 Conceptual Model.



Chapter 2: Contraceptive Safety Beliefs among People who can get Pregnant in the U.S.: A Systematic Review.

Abstract

Background: Beliefs about contraceptive safety may impact contraceptive decision-making. These beliefs may be evidence-based or based on misconceptions serious adverse events (SAEs), side effects, and non-contraceptive benefits.

Objectives: We sought to describe the literature on contraceptive use safety beliefs among people who can get pregnant in the U.S. from 1990 to present, to assess the quality of this literature, assess factors associated with such beliefs and determine which beliefs were evidence based and which were not.

Methods: We searched the PubMed, CINAHL, PsychInfo and Cochrane Library databases for peer-reviewed, English-language literature published from 1990 to 2021. We included articles that reported quantitative primary data about SAEs, side effects, and benefits of contraceptive methods from people who could get pregnant. We used a standardized data abstraction sheet, assessed study quality using the US Preventive Services Task Force evidence grading system, and used PRISMA guidelines for reporting.

Results: We identified 48 studies, including 39 cross-sectional surveys, 4 prospective cohort studies, four randomized controlled trials (RCTs), and 2 quasi-experimental intervention studies. We identified 30 studies reporting beliefs about SAEs. The most commonly identified beliefs were fertility problems, adverse pregnancy and fetal outcomes, and problems with LARC devices. We identified 25 studies reporting beliefs about side effects, including menstrual changes, pain, and weight changes. We identified 20 articles reporting beliefs about non-contraceptive benefits, including STI protection, improved menstrual symptoms, and cancer protection.

Conclusions: Misconceptions related to SAEs, especially fertility problems, and adverse pregnancy appeared throughout the literature. We found that small proportions of samples repeatedly believed that methods other than condoms offered STI protection, but accurate knowledge of non-contraceptive benefits may be lacking. Beliefs about side effects were more evidence-based than those about the other outcomes.

Implications: Contraceptive counseling and sexuality education should address misconceptions identified here and fill gaps related to non-contraceptive benefits in order to reduce unnecessary barriers based on safety misconceptions.

Introduction

Unintended pregnancies (UIPs), defined as pregnancies that are either unwanted or mistimed, account for about 45% of U.S. pregnancies and 27% of U.S. births.[1-4] UIPs can result in health risks for the pregnant person and fetus, as people who do not plan to become pregnant are less likely to engage in preconception health behaviors or access prenatal care, and may be more likely to engage in risky behaviors, like alcohol or drug use.[10-12] Some people experiencing UIPs and subsequent births may also experience adverse socioeconomic effects, like disruption of educational or career plans, especially among younger pregnant people.[56, 333]

For sexually active individuals at risk of pregnancy (i.e., engaging in penile-vaginal sex with no known infertility) who wish to prevent or time pregnancies, regular use of a contraceptive method is key to realizing reproductive health goals. There are at least 18 contraceptive methods options available to people in the U.S., which differ in terms of effectiveness, mechanism of action, side effect profile, cost, and ease of use.[14, 334, 335] These methods are often grouped in terms of typical use effectiveness rates by groups including the U.S. Centers for Disease Control (CDC) and Planned Parenthood Federation of America.[71, 335] The lowest typical use effectiveness group include the following methods, which can account for 14-32 pregnancies per 100 women per year: spermicide, the cervical cap, the contraceptive sponge, fertility awareness-based methods (FAB), withdrawal, and internal and external condoms.[71, 335] Moderately effective methods, which have annual typical-use failure rates of 6-12% include: the diaphragm, the depot medroxyprogesterone acetate (DMPA) injection (intramuscular and sub-cutaneous), and the oral contraceptive pill (OCP), the contraceptive vaginal ring (CVR) and the transdermal contraceptive patch.[71, 335] The most effective methods, resulting in < 1 pregnancy per 100 women per year include: long-acting reversible (LARC) methods, the Copper (Cu) and Levonorgestrel-containing (LNG)

intrauterine devices (IUDs), and the subdermal contraceptive implant, permanent male and female sterilization, and abstinence or outercourse (non-penetrative sex).[71, 335] Some methods, like abstinence, withdrawal, and FAB methods, are based entirely on behavior. Others are medical interventions that require a healthcare provider to prescribe or insert.

There are many factors that a person or couple consider when selecting and using a contraceptive method, including individual-level factors (e.g., knowledge, beliefs, and attitudes toward methods, values related to method use or mechanism of action, feelings about pregnancy), interpersonal factors (e.g., relationship factors, provider influence, or conversations with family and friends), social factors (e.g., exposure to information/ misinformation via social media), and structural barriers and facilitators (e.g., insurance coverage or ability to access a healthcare facility that offers a range of contraceptive options).[158, 316, 336-339] Knowledge and perceived importance of method effectiveness are only two of these factors. In recent years, family planning providers and researchers have been criticized for narrowly focusing on method effectiveness and promoting LARC methods, rather than considering the holistic needs and desires of individuals.[340-343] This discourse must be understood within a centuries-long legacy of coerced contraception and sterilization, violence, and inadequate sexual and reproductive health (SRH) care targeted towards Black, Indigenous, and People of Color (BIPOC) communities,[231, 232, 237, 344-346] individuals with disabilities,[347, 348] LGBTQ+ communities,[349-351] and other historically marginalized groups in the U.S., and in the context of the reproductive justice (RJ) movement that emerged in response to these injustices.[242, 352]

Values and preferences of those seeking contraception must be considered by providers, educators, and policy makers.[19, 20, 353] Method characteristics other than effectiveness, including method safety and side effect profiles, are important considerations for many individuals considering contraceptive method use but not all dimensions or characteristics have been given equal empirical attention in research over the last three decades, especially in the context of understanding patient-centered barriers to preferred and effective method use.[19, 20, 354-356] As with most medications, serious adverse events (SAEs) are possible with use of non-behavioral contraceptive methods, particularly

hormonal methods and IUDs.[357] Any adverse event that may be associated with use of a method will be found in the product's package label, as required by the U.S. Food and Drug Administration (FDA).[358]

Such package inserts contain important information that may help users decide if a method is right for them, including common side effects, contraindications and information about drug interactions. They also list SAEs that have been observed among users during clinical studies and through pharmacovigilance. All potential users have the right to clear information about possible side effects and SAEs associated with method use. However, information contained in package labels may be outdated or non-evidence based.[359] Often strong evidence demonstrating that SAEs were *caused* by contraceptive use is lacking. For example, package labels for combined hormonal contraceptives (CHCs) contain information about risks of serious cardiovascular side effects, including myocardial infarction, thromboembolism, stroke, hepatic neoplasia, breast cancer, liver disease and gallbladder disease.[290, 293, 294] Yet, evidence linking these events to CHC exposure is variable based on the particular outcome, the amount of estrogen or type of progestin in the formulation, and users' personal characteristics and health history. These package inserts also include information about mortality risk among women using combined OCPs in the 1970s, without describing the methods through which these data were collected or clarifying the differences between older and newer CHC formulations.[290, 293, 294] Grossman et al. argue that such "alarmist" packaging over-medicalizes contraception, serves to protect drug companies, and acts as a deterrent to use.[359] While these lists of possible SAEs may reasonably be quite alarming to a potential user, the best scientific evidence suggests that the absolute risk of such events among healthy users is low.[357] This is especially true for users considered medically eligible for use of a particular method, as designated by the CDC's U.S. Medical Eligibility Criteria for Contraceptive Use, which provides recommendations for method use among individuals with medical conditions or personal characteristics that might put them at higher risk for contraceptive-related SAEs.[17]

Method-associated side effects are much more common with hormonal method or Cu IUD use. Common side effects include menstrual bleeding changes, cramping, mood changes, weight gain or loss, and headaches.[335, 357] Hormonal contraceptive use is also associated with non-contraceptive benefits,

including more regular menstrual periods, lessening of pain and cramping associated with menstruation, and clearer skin.[335, 357]

For many users, negative side effects are non-existent or tolerable, if unpleasant, and resolve after a few months of method use. For others, side effects negatively impact quality of life and are unacceptable. Similarly, some users may accept small increases in absolute risk of certain SAEs, given other benefits of method use; others may want to avoid any increased risk.[360] To make informed decisions, all individuals considering contraception should have access to high-quality evidence on contraceptive safety and side effect profiles, so they can select the best method given their needs and values (which may include no method).[19] However, evidence-based sexuality education is severely lacking in many U.S. schools,[185, 361] providers may hold and share misconceptions about contraceptive safety themselves,[362-364] and misinformation about deleterious effects of hormonal contraception increasingly appears on social media and elsewhere online.[225, 226, 228] Family and friends sharing contraceptive-related information and experiences are important influences on individuals' contraceptive use, but these people may not be equipped with the most accurate information available.[365] Individuals exposed to such messaging may make decisions about contraceptive use based upon misconceptions about safety or side effects or lack of knowledge about health benefits of contraceptive use.[29, 32, 366, 367] Alternatively, individuals empowered with accurate information about methods, including safety profiles, can make informed decisions about method use.

Misconceptions may be corrected, and reliable information shared via evidence-based contraceptive counseling and comprehensive sexuality education. In order to develop more patient-centered, effective interventions for contraceptive educational materials, counseling strategies, and public messaging campaigns, we must first gain a more nuanced and comprehensive understanding of commonly held beliefs about contraceptive safety and side effects, the multilevel influences that shape those beliefs, and how contraceptive beliefs and perceptions influence decisions and behaviors. Although a multitude of individual-level research studies in the last 30+ years have identified concerns like bleeding, mood changes, and weight gain as of importance to reproductive aged people at risk for unintended pregnancy,

the challenge of these reported concerns as precluding method use remains. To our knowledge, no systematic review of the literature on beliefs about contraceptive safety in the U.S. has been published. A synthesis of the evidence is warranted.

The purpose of this review was to systematically compile and describe the literature, and evaluate the quality of evidence on beliefs about contraceptive safety and side effects among people who can get pregnant in the U.S. We also sought to compare the findings to clinical data on contraceptive safety and side effects to determine whether reported beliefs are consistent with the best available evidence. This systematic review protocol was registered with Prospero, the International Prospective Register of Systematic Reviews (CRD42020151271).[368] We report this review according to PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) guidelines (**Appendix 2.A**).[369]

Methods

We searched the PubMed, CINAHL, PsychInfo and Cochrane Library databases for English-language peer-reviewed published articles dated from 1990- 2021. We chose this start date because by the early 1990s, high dose (≥50 mcg estrogen) had been removed from the U.S. market at FDA's recommendation,[370] the first progestin implant (Norplant) was introduced to the U.S. market,[371] the modern IUD was introduced and the problematic Dalkon Shield removed from the market,[372] and DMPA had gained FDA approval,[373] with non-oral CHCs (CVR and patch) and levonorgestrel ECPs introduced by the early 2000s.[374] Thus, by the 1990s, the methods available in the U.S. began to reflect options available today.

We included articles quantitative data reporting on beliefs about: 1) contraceptive-related SAEs, 2) side effects, or 3) non-contraceptive health benefits of any of the following methods: DMPA, OCPs (both combined hormonal and progestin-only), CVR, the patch, LNG IUD, Cu IUD, and the implant. We chose to exclude barrier methods and behavioral methods like FAB and withdrawal, because these are less likely to be associated with SAEs or side effects than the selected methods. We excluded qualitative articles because we ended up with a very large sample of articles and to facilitate comparison across

articles. We did not include articles in which participants reported beliefs about contraceptives generally without specifying methods (e.g., whether participants believed birth control or hormonal methods to be safe or unsafe). We included articles that reported beliefs among people who could biologically become pregnant (with ovaries and a uterus). In most articles, participants were described as women or females. Search terms can be found in **Appendix 2.B**.

Since we were interested in knowledge and beliefs rather than experiences, we excluded articles that reported only on experiences of SAEs or side effects among contraceptive users (e.g., articles that reported discontinuation rates due to side effects). We searched reviews and reference lists of included articles for relevant articles reporting primary data. We excluded opinions, letters to the editor, dissertations and theses, and conference abstracts.

One authors (HR) sorted the initial articles and removed any that did not include U.S.-based participants, were topically unrelated to contraceptive use, focused on men or male contraceptives, and commentaries, opinion pieces, and articles that otherwise clearly did not meet inclusion criteria. Three authors (HR, PR, LG) then reviewed the remaining articles against inclusion criteria. Final inclusion decisions were made by the corresponding author (HR). A PRISMA flow chart is show in **Figure 2.1**. Data abstraction was conducted by three authors (HR, PR, LG). Final abstraction decisions were made by the corresponding author (HR). We abstracted data using a standard data abstraction form (adapted from KSH); available from the corresponding author) on the following domains: year, funding source, sample size, study purpose, sample description, study design, data collection procedures, analytic procedures, contraceptive methods, included beliefs about SAEs, beliefs about side effects, beliefs about non-contraceptive benefits, variables associated with beliefs, study strengths, and study limitations. We used U.S. Preventative Services Taskforce (USPSTF) guidelines to assess quality of scientific evidence of the included studies.[375]

We used contraceptive product package labels to guide which events were considered SAEs, and which were considered side effects. We categorized the following outcomes as SAEs: infertility, diminished fertility, or delayed return to fertility, abortion, miscarriage, teratogenic effects to existent or

future pregnancies, ectopic pregnancies, ovarian cysts, cancer, hypertension, blood clots, stroke, heart disease, or other adverse cardiovascular events, trouble bleeding, infection, bone mineral density loss, and method migration or displacement. We further grouped these outcomes as SRH-related, long-term health risks, or short-term/ immediate health risks. We categorized the following outcomes as side effects: increased menstrual flow, irregular, or more frequent menstrual periods, spotting between menstrual periods, amenorrhea, cramping, weight changes, negative skin changes, and other changes to physical appearance, mood changes (e.g., emotional lability, depression, or anxiety), acne, nausea, vomiting, fever, headaches, hair loss, and pain or discomfort at insertion (for IUDs and implants). Finally, we categorized the following outcomes as non-contraceptive benefits: lighter, less frequent, or more regular menstrual periods, reductions in cancer risk, skin improvements or reduced acne, and reduced risk for contracting sexually transmitted infections (STIs) or other infections, improved mood or increased mood stability. For side effects and benefits, we further grouped these outcomes as SRH-related, physical, or mental/psychological. This categorization scheme is described in **Table 2.1**. We noted whether studies were focused on special populations, like adolescents, veterans, or individuals with a shared medical diagnosis. We also report factors associated with beliefs. Meta-analysis was not possible due to heterogeneity in data collection methods, statistical analyses, and variable operationalization.

Results

Overview of included articles:

Forty-eight articles were identified.[22-42, 366, 367, 376-397] Inclusion and exclusion decisions are depicted in **Figure 2.1**, PRISMA flow-chart. Article characteristics are presented in **Table 2.2**. Most articles (n= 38, 79%) were cross-sectional surveys, four were prospective cohort studies, four were randomized controlled trials (RCTs), and two presented results of quasi-experimental evaluations of interventions. Two studies reported secondary analyses of a nationally representative survey of young, unmarried U.S. adults (only female data are presented here).[22, 385]

In total, 25,038 participants were included in this body of literature. Sample sizes ranged from 30 to 2, 358 (mean: 544, SD: 630.97). Participants ranged in age from 12 to > 50 years old. Samples were drawn from all four continental U.S. census regions: Northeast (n=18 articles), South (n=11 articles), West (n=14 articles), and Midwest (n=5 articles). Some studies recruited from more than one region. Seventeen U.S. states were represented (See Figure 3), with California represented most frequently (n=10 articles). Six studies recruited national samples, and one included cross-national comparisons from the U.S., France, and Japan (only U.S. data are presented here).[41]

In 78% of articles, participants were recruited in healthcare settings, including SRH settings,[23, 24, 27, 30, 32, 35-37, 376, 380, 381, 386, 390, 394-396, 398] urgent care or emergency departments (EDs),[34, 366] school-based health centers,[26, 393] and clinics offering treatment for drug use.[23, 24, 26-30, 32, 34-39, 42, 366, 376-378, 380, 381, 383, 384, 386, 387, 390-398] Participants were also recruited via telephone and text message,[22, 40, 385] social media or other online avenues,[41, 388, 389, 399] on college campuses,[38, 39, 367, 382] and in other community settings, including pharmacies and malls.[379, 398] Several sub-populations of people who can get pregnant were included, including homeless and uninsured youth,[387] people in rural areas,[24] veterans,[33] breast cancer survivors,[42] young pregnant and postpartum people,[37] people not born in the U.S.,[380] and those who use drugs.[391, 392, 397]

Articles included OCPs, ECPs, IUDs, Implants, DMPA, and Patches. The most frequently included methods were IUDs (n=20) and ECPs (n=19). The least commonly included method was the Patch (n=1). No articles were identified that reported beliefs about CVRs. Overall, quality of evidence was low (see Table 1). Most studies were classified as III, the lowest quality study design in the USPSTF evidence hierarchy. Most studies were categorized as "Poor," based on USPSTF quality criteria. Studies generally received poor ratings because they were cross-sectional, had low response rates, or reported only univariate or bivariate results.

Beliefs about SAEs

Thirty articles reported beliefs about SAEs. Included methods were: DMPA (n=2), ECPs (n=11 articles), implants (n=7 articles), IUDs (n=10 articles), OCPs (n=9 articles), and the patch (n=1). Results related to SAEs can be found in **Table 2.3**. Bar charts depicting proportions of samples reporting the most commonly identifies beliefs by method and article can be found in Figures 2.2-2.5.

Infertility or Fertility Problems

Fifteen articles reported beliefs related to adverse effects on fertility associated with method use.[22-27, 33-35, 38, 376, 385, 392, 396, 400] These included 13 cross-sectional surveys, one prospective cohort, and one RCT. Methods included: DMPA (n=2 articles), ECPs (n=3 articles), implants (n=7 articles), IUDs (n=9 articles), OCPs (n=3 articles), and the patch (n=1 article). Across these studies, 2% (for implants)[376] - 78% (for IUDs)[22] of samples reported these beliefs. In five articles, over 50% of samples reported concerns about fertility problems with use of: ECPs (n=2 articles), IUDs (n=2), or OCPs (n=1). In two cross-sectional surveys, one among college students in the Midwest and another among people receiving treatment for drug use in Vermont, between 3.5%[392] and 18.2%[25] of participants reported that fertility concerns served as barriers to LARC use.

In most studies, participants were asked about long-term concerns, but in two cross-sectional studies, participants reported beliefs about short-term fertility problems. In Rosenfeld et al.'s survey of users of the U.S. Veteran's Administration (VA) system, 22% of participants reported that DMPA caused fertility problems soon after stopping,[33] and in Craig et al.'s nationally representative survey of unmarried people, 76% of female participants thought OCPs use caused delayed returns to fertility. [22]

Six articles reported correlates of fertility beliefs. Neither analysis of the National Survey of Reproductive and Contraceptive Knowledge found race or ethnicity to be associated with fertility beliefs, and Craig et al. found no differences when comparing adolescents with young adults.[22, 385] On the other hand, Rosenfield et al. found that Black and non-Hispanic participants from other racial/ ethnic groups had 8-9 times lower odds than White participants of knowing it could be difficult to become pregnant soon after DMPA discontinuation ($p < 0.01$).[33] Edwards et al. also found significant differences in

concerns about fertility with IUD use across race/ethnicity groups in their sample of people seeking SRH care in Philadelphia, PA, with Black participants reporting this concern more frequently than participants from other racial or ethnic groups. Venkat assessed whether beliefs about fertility concern differed by method type, and found significant differences among their participants in their sample of Latina women accessing SRH care in NYC. Participants were more concerned about fertility problems with OCP and DMPA use compared with IUD or patch use (30-31% vs. 9-16%, p = 0.01).

Adverse Pregnancy Outcomes

In 13 articles, participants reported beliefs about risk of pregnancy termination or abortion associated with method use.[25, 28-32, 34, 36, 382, 383, 387, 396] These included three RCTs and eight cross-sectional surveys on ECPs, a cross-sectional survey on barriers to LARC use, and a cross-sectional survey on OCPs. Proportions of samples reporting these beliefs varied widely across articles, from 3% - 71%.[28, 31] In one RCT assessing the effect of advanced ECP provision, Weaver et al. asked participants to rate how strongly they agreed that ECPs could be used to end an unwanted pregnancy on a scale of 1 (agree) – 4 (disagree), and found a mean score of 1.3 (SD not reported).[383] In one cross-sectional survey,[366] 8.5% of participants sampled from an urban ED believed daily OCPs could cause abortion if used during pregnancy, and 19% of participants in the survey of LARC barriers among college students believed IUDs could.[25] Finally, in an early survey of women at family planning clinics in Texas, 10% of participants reported that implant use could cause ectopic pregnancy and 30% believed that use could adversely impact future pregnancies.[24]

In eight articles, authors assessed factors associated with these beliefs. In a recent survey of adolescents seeking SRH care in Alabama, participants who had used ECPs in the past had 5 times greater odds (95% CI: 1.04-22.4) of believing ECPs could be used to terminate pregnancy. No such differences were observed based on age or history of sexual activity.[396] A 2006 survey of people seeking care from a Northeastern emergency did not find an association based on past use of ECPs or OCPs.[366] In their survey of predominantly Black people seeking care at Title X clinics, Whittaker et al. found that participants

familiar with ECPs were less likely than those who were unfamiliar to believe that ECPs caused abortion (40% vs. 49%), though significance testing was not reported.[36] In three articles, authors found that individuals who believed that ECP could cause abortion were less likely or less willing to use them,[29, 30, 367] but in another two, authors did not identify a statistically significant relationship between these factors.[32, 366] In Frank et al.'s survey of women in Texas, believing that implants could cause ectopic pregnancy was not associated with use.[24]

Adverse Fetal Outcomes

In five articles, participants reported beliefs about teratogenic effects of ECPs (n= 4) or OCPs (n=1).[24, 28, 31, 34, 380, 381] These included two RCTs and three cross-sectional surveys. At the low end, approximately 1% of participants in two studies reported concerns about ECPs causing birth defects. One was a in a survey of predominantly White women from an urban internal medicine clinic,[28] and the other, an RCT assessing the effect of advance ECP provision on use.[381] In this study, three participants reported not using ECPs despite considering them during the study period due to concerns that they would "harm a baby." At the high end, in another RCT evaluating advanced ECP provision coupled with ECP education, 81% of the sample reported that ECP use could cause miscarriage or birth defects, but authors did not disaggregated by outcome.[34] In Sangi-Haghpeykar et al.'s study of women accessing SRH care in Houston, TX, 28% of participants reported that OCPs could cause birth defects. Foreign-born Hispanic (but not U.S.-born Hispanic) participants were more likely than White participants to believe this (39% vs. 17%, $p<0.001$).[380]

Device Migration, Expulsion, or other LARC problems

Eight cross-sectional surveys reported concerns about physical problems with LARC devices.[22-25, 27, 40, 397] Of these, four reported concerns about insertion or removal. Edwards et al. found that 30% of their sample thought IUD insertion required surgery in their sample of people seeking SRH care in Philadelphia, PA,[23] compared with 52% among Craig et al.'s nationally representative sample.[22] In both

articles, younger participants reported this belief significantly more frequently than older participants. Frank et al.'s found 33% of participants reported non-specific concerns about implant removal,[24] while Matusiewicz et al. found that 12% of their sample of people accessing drug use treatment reported insertion concerns.[397] In a survey of adolescent LARC users in Massachusetts, 24% of implant users reported selecting that method because of concerns about IUD expulsion.[40]

Four articles reported concerns about device migration. In Hall et al.'s survey of college women, 9% of the sample believed LARC migration was likely,[25] and 49% of Richards et al.'s survey reported the same.[27] Forty-two percent of this sample were concerned about a device breaking. In these two articles, authors did not report separately about IUD and implants. In the remaining two articles, 54-55% of samples reported concerns about IUD migration.[22, 23]

In two of these surveys, Black participants reported concerns about device migration at significantly higher rates than others. In Craig et al.'s analysis, Black participants had two times greater odds of believing that IUDs can move around in the body, compared with White participants ($p < 0.01$). This relationship was not observed when comparing Hispanic and White participants. In Edwards et al.'s analysis, 64% of Black participants expressed concerns about IUD migration, compared with 52% of White and Asian participants and 41% of participants from other racial/ethnic groups ($p=0.005$).

Cancer, Blood Clots, and Adverse Cardiovascular Events

Cancer-related concerns were reported in six articles: one prospective cohort study about implant use,[376] the two surveys about LARC barriers,[25, 392] and three surveys on OCP beliefs.[37-39, 378] In Frank et al.'s 1993 study, 4.2% of participants believed implants could cause cancer.[376] In two cross-sectional surveys of college campus populations from the 1990s, 41-47% of samples reported OCP-related breast cancer concerns and 29-33% reported cervical cancer concerns.[38, 39] In two small surveys of predominantly Black individuals presenting for SRH care, 7-8% reported cancer concerns related to OCPs.[37, 378]

In two surveys, authors asked whether concerns about SAEs like blood clots and cancer served as barriers to LARC use but did not disaggregate by outcome. For IUDs, 11.5%[392] and 22%[25] of participants reported these barriers, and for implants, 9.5%[392] and 15% did.[25] Three surveys included beliefs about OCP-related blood clot risk, with 4-9% of samples reporting that use could increase risk.[37, 38, 378] Gilliam et al. asked pregnant and post-partum young people if they believed blood clot risk was higher during OCP use or pregnancy, with 5% of the sample believing that risk is higher with OCP use.[37, 38, 378] Two articles reported beliefs about high blood pressure with OCP use, with 9.3% of participants in Peipart et al.'s survey of the Yale University campus community,[38] and 52% of Rosenfeld et al.'s survey of VA system users reporting this belief.[33] Peipart et al. also found that 9.7% of their sample believed OCPs could cause heart disease, and 3% reported that they could cause stroke.[38]

Two articles assessed correlates of these concerns. Gilliam et al. found that neither age nor prior OCP use were associated with OCP knowledge, including about cancer risk or blood clots.[37] Rosenfeld et al. found that, compared to White participants, Black participants, Hispanic participants, and those from other racial/ethnic groups were 10 – 12% less likely (when comparing percent point differences by knowledge item) of reporting that OCP use could increase blood pressure ($p < 0.01$ for all comparisons).[33]

Infection

In five cross-sectional surveys, participants reported concerns about infection with implant (n=1)[24] or IUDs (n=4) use.[22, 25, 42, 397] In the only article about infection concerns with implant use, 26% of Frank et al.'s sample reported this concern.[24] Across the IUD studies, between 6%[25] and 46%[397] of samples reported infection concerns. In both analyses of the National Survey of Reproductive and Contraceptive Knowledge, authors assessed correlates of infection concerns, although Rocca et al. did not report univariate results for this particular concern. Craig et al., found that teenagers were more likely than young adults to report IUD-related infection concerns (38% vs. 24%, $p <0.01$) but neither article reported differences by race and ethnicity when comparing Black, White, and Latina/Hispanic

participants.[22, 385] Additionally, Rocca et al. found no significant associations between infection concerns and effectiveness of methods used.[385]

Skeletal Problems

In two articles, both cross-sectional surveys, participants reported beliefs about skeletal changes associated with hormonal method use. In Rosenfeld at al.'s analysis of VA system users, 72% of the sample believed that DMPA use could cause permanent bone mineral density loss, while in Sangi-Haghpeykar et al.'s study 20% believed that OCP use during teenage years could limit growth. Differences across racial/ethnic groups were not identified in either study.[33, 380]

Hormonal Problems

Two articles, both published in 1993, reported on concerns about non-specific hormonal problems associated with implant use (n=1)[24] and OCP use (n=1).[38] In Frank et al.'s sample, 30% reported that implant use could cause a "hormonal reaction,"[24] and in Peipart et al.'s sample, 3.2% of participants reported that OCP use could lead to hormonal problems.[38] No correlates of these beliefs were noted.

Beliefs about side effects

We identified 25 articles reporting beliefs about side effects.[23-25, 27, 35, 37, 38, 40, 367, 376-379, 381, 384, 388-390, 392, 394, 396-400] Beliefs about the following methods were included: DMPA (n=1 article), ECPs (n=5), implants (n=9), IUDs (n=11), OCPs (n=8) and the patch (n=1). Data abstracted from these articles can be found in **Table 2.4**. Bar charts depicting proportions of samples reporting the most commonly identifies beliefs by method and article can be found in **Figures 2.6-2.8.**

Menstrual Changes

Fifteen articles reported on beliefs about method-associated menstrual changes. These included three prospective cohort studies[376, 377, 386] and 12 cross-sectional studies.[24, 25, 27, 35, 40, 378, 384, 388, 392, 396, 397, 400]

Six articles included beliefs about implants, six about IUDs, four about OCPs, and one each about DMPA, ECPs and the patch.

Across LARC articles, 5%[40, 392] -52%[384] of samples reported LARC use could cause menstrual changes. Proportions were similar for IUDs and implants. In four surveys, 5%[392] – 18%[384] of participants reported these concerns as barriers to LARC use, among college students,[25] people seeking treatment for drug use,[392] young people seeking SRH care in San Francisco, CA,[384] and young LARC users in Boston, MA.[40] In the survey of young LARC users in Massachusetts, 5% of the sample chose an implant because they were concerned about IUD-related menstrual changes. In the study at the San Francisco clinic, Fleming et al. found that 52% cited the possibility of heavier periods and cramping as barriers to IUD use, 18% of the sample cited amenorrhea and 32% cited light bleeding between periods.[384]

A similar range was found in articles about OCP-related menstrual changes. In a cross-sectional survey of people seeking SRH care in the U.S. Southeast, 2% of the sample named menstrual changes when asked about OCP side effects.[378] On the other hand, in an 1996 survey of adolescents accessing SRH care in San Francisco, CA, 63% reported that menstrual changes were likely with OCP use. In one cross-sectional survey of Latina women accessing SRH care in New York City, 34% of participants believed OCPs could cause menstrual changes, compared with 40% for DMPA, 18% for IUDs, and 14% for patch (p=0.005 for differences between methods).

In two cross-sectional surveys, authors asked about bleeding along with other side effects but did not disaggregate outcomes. In Gilliam et al.'s survey, 73% believed OCP use could cause menstrual spotting or headaches,[37] and in Williams et al.'s 2021 survey of ECP knowledge among young people seeking SRH care in Birmingham, AL, 66% reported that ECP use could cause bleeding changes or vomiting.[396]

Davis et al. assessed whether literacy was associated with knowledge of OCP side effects, including menstrual changes, and found no association.[378] In Williams et al.'s survey, neither age nor history of sexual activity were associated with knowledge of ECP side effects, but those who had used ECPs had almost three times greater odds of knowing that they could cause menstrual changes or

vomiting (aOR: 2.85, 95% CI: 1.18- 6.68).[396] Surprisingly, Frank et al. found that concerns about implant-related menstrual changes was associated greater rates of implant initiation ($p < 0.001$).[24] On the other hand, Moore et al. found that those who anticipated OCP-related menstrual changes had about 20% lower odds reporting baseline intention to use OCPs or actual use over one year ($p < 0.05$).[377]

Pain

Eleven articles included beliefs about pain with method insertion, removal, or long-term use.[24, 25, 27, 40, 376, 377, 384, 389, 390, 392, 399] These included one RCT, prospective cohort and nine cross-sectional surveys on LARC use, and one prospective cohort study on OCPs. Between 12%[24, 392] and 32%[376] of samples reported concerns about implant-associated pain and 5%[40] - 57%[399] of samples reported concerns about pain with IUD use. In three studies, between 5%[40] and 24%[25] of samples reported that these concerns served as barriers to method use.[25, 40, 392] In Callahan et al.'s survey of young LARC users in Boston, MA, 16% of the sample (31% of implant users) reported choosing implants because they were concerned about IUD insertion pain, and 5% of the sample (10% of implant users) chose implants because they were concerned about long-term pain with IUD use.[24, 27, 40]

In three articles, participants rated anticipated pain prior to LARC insertion.[40, 389, 390] In two, authors used a 100 mm visual analogue score (VAS). In an RCT assessing effectiveness of a paracervical block at IUD insertion, Hunter et al. found a median anticipated pain score of 63 mm (IQR: 38, 72 mm),[390] while Callahan et al. found a mean anticipate pain score of 55.6 mm for IUD insertion and 39.6 mm for implant insertion in their survey.[40] Additionally, in this study, anticipated pain IUD scores were significantly higher than implant ($p=.01$). DeMaria et al. asked participants to rate anticipated pain on a scale of 1 to 7, with 7 being the greatest pain. They found a mean of 3.68 (SD: 1.50). Authors did not ask separately about IUDs and implants, and this sample included both LARC users (12% of the sample) and non-users.[389] Finally, in Moore et al.'s prospective cohort study assessing whether baseline beliefs predicted OCP use, 65% of participants believed OCP use was likely to be uncomfortable or painful.

Four studies reported correlates of pain beliefs.[40, 390, 399] In their RCT of a pain management intervention for IUD insertion, Hunter et al. found higher median anticipated pain score among Black participants (68 mm) than White participants (51 mm) and participants from other racial/ethnic groups (64 mm) ($p = 0.012$) and among younger compared with older participants (69 mm vs. 59 mm, $p =0.016$). Additionally, when adjusting for age and race, authors found that participants with higher anticipated pain scores had higher actual pain scores throughout the insertion process ($p<0.003$).[390] In Callahan et al.'s sample, anticipated pain scores for IUDs were significantly higher than for implant ($p=.01$), and after insertion, IUD users were significantly more likely than implant users to report that insertion hurt more than expected (52% vs 4%, $p<0.0001$).[40] In their online survey, Gomez et al. found that participants who anticipated IUD insertion pain were 50% less likely to report interest in IUD use ($p < 0.05$).[399] In Moore et al.'s prospective cohort study, beliefs about OCP-related pain and discomfort were associated with significantly lower odds of reporting intentions to use OCPs at baseline ($p < 0.05$) among those who were sexually initiated at baseline, and actual use over one year among those who initiated sexual activity during the study period.[377]

Weight Changes

In seven articles, six cross-sectional surveys[23, 25, 35, 38, 378, 392] and one prospective cohort,[376] participants reported beliefs about weight change with LARCs (n=5), OCPs (n=3), DMPA (n=1) and the patch (n=1). In the two surveys on barriers to LARC use, authors asked participants whether concerns about side effects, like weight gain and mood changes served as barriers to LARC use, with between 10% and 22% of samples reporting these concerns.[25, 392] In two additional studies on LARC-related beliefs, 15% of participants in Crosby et al.'s prospective cohort believed implant use could cause weight changes, while 41% of participants in Edwards et al.'s survey believed that IUD use could.[23] In the surveys on beliefs about OCPs, 6%[38] - 53%[35] of samples reported that OCPs could cause weight gain. In the survey that solicited beliefs about OCPs, IUD, DMPA and the patch, significantly higher proportions of the sample reported that OCPs and DMPA could cause weight gain (53% and 66%, respectively)

compared with IUDs (7%) and the patch (21%) ($p < 0.0001$). Edwards et al. found that Black participants were significantly more likely to agree that IUDs could cause weight gain (80%) compared with White participants, Asian participants, and those from other racial and ethnic groups (59-64%, $p = 0.02$). They found no such differences by age.[23]

Nausea and Vomiting

Seven articles, four cross-sectional surveys,[37, 367, 378, 379, 396] an intervention with pre- and post-test,[30] and a prospective cohort,[376] reported beliefs about nausea and vomiting related to ECPs (n=3), OCPs (n=2), and implants (n=1). Across ECP articles, large proportions of samples believed that ECPs could cause these side effects, ranging from 41%[367] - 99%.[398] Davis et al. found that 11% of their sample believed OCPs could cause nausea.[378] As noted, in two surveys, authors asked about OCP-related nausea or vomiting and menstrual changes, without disaggregating outcomes.[37, 396] In the only article that included implants, only 3% of Crosby et al.'s sample expressed this belief.[376] Two articles assessed factors associated with these beliefs. Foster et al. found no differences when assessing whether beliefs differed between participants who accessed ECPs directly from pharmacies compared with those who received a prescription.[379] As noted, Williams et al. asked about vomiting and irregular bleeding together, and found that past ECPs use, but not age and sexual activity level, were not associated with reporting these as ECP side effects.[396]

Headaches

One prospective survey and four cross-sectional surveys reported on concerns about method-related headaches, related to OCPs (n=3), implants (n=2), DMPA, IUD, and the patch (n=1). [24, 35, 38, 376, 378] In Venkat et al.'s survey, 11- 12% thought IUDs or the patch could cause headaches, compared with 36-37% for DMPA and OCPs, respectively. These beliefs were significantly different across methods ($p=0.002$).[35] In the implant articles, 5%[376] and 22%[24] of samples believed that use could cause headaches, compared with 6% in the remaining two surveys on OCP use.[38, 378]

Sexual Side Effects

Five articles, including 3 surveys about LARC use, a survey about ECPs, and a prospective cohort study on OCP use reported concerns about sexual side effects.[25, 27, 377, 392, 394] Across the LARC articles, between 3%[392] and 28%[27] of samples reported these beliefs. In Berglas et al.'s survey on attitudes about ECPs among young people seeking SRH care in the San Francisco, CA area, 11% of the sample thought use might reduce sex drive. In multivariable analyses, no significant associations were found between these concerns and age, race/ethnicity, maternal education, pregnancy intentions, beliefs about ECP effectiveness, method use history, or satisfaction with SRH care.[394] In Moore et al.'s cohort study assessing predictors of OCP use, 92% of individuals who experienced sexual debut during the study period (9.6% of the total study sample) reported concerns about OCPs decreasing sexual pleasure at baseline. Among this sub-sample, this belief was associated with increased odds of using OCPs consistently after sexual initiation.[377]

Mood Changes

Three articles reported beliefs about mood changes regarding LARCs (n=2) and OCPs (n=1).[25, 377, 392] However, as noted, in two surveys, participants were asked about mood and weight changes together, without disaggregating by outcome.[25, 392] In Moore et al.'s prospective cohort study of OCP use, 65% of the sample reported that OCP use was likely to cause "guilt feelings." These beliefs were associated with intention to use OCPs at baseline, ever use, and consistent use over one year among participants who had initiated sexual activity by baseline[377]

Additional Side Effects

Additionally, studies reported about hair loss (n=1),[35] methods impacting physical appearance (n=2),[24, 377] trouble breathing and fever.[398] Details can be found in **Table 2.4**.

Beliefs about non-contraceptive benefits associated with method use

As shown in **Table 2.5**, 20 articles reported beliefs about non-contraceptive benefits of method use. Most of the articles identified were related to benefits of OCP use (n=10), followed by ECPs and IUDs (n=5 articles each), implants (n=3 articles), and DMPA use (n=1 article). Bar charts depicting proportions of samples reporting the most commonly identifies beliefs by method and article can be found in **Figures 2.9-**

Protection against Infection

In 17 articles, consisting of 11 cross-sectional surveys,[26, 30, 37-39, 367, 379, 380, 388, 391, 400] two RCTs,[34, 383] two prospective cohort studies,[386, 393] and an educational intervention,[395] participants were asked whether they believed methods could protect against infection, including sexually transmitted infections (STIs), HIV, and pelvic inflammatory disease (PID). Methods included OCPs (n=7), ECPs (n=5), IUDs (n=5), implants (n=3), and DMPA (n=1). Across methods, 3% - 28% of samples believed that methods other than condoms could provide protection. Across ECP articles, between 4% and 22% of samples believed ECPs could do protect against STI acquisition. This range was 7%- 28% in the articles about LARCs, and 3% - 5% in articles about OCPs. In one study on LARC knowledge, 0% reported this belief after a brief educational intervention.[395] Two surveys asked participants about protective effects of OCPs on PID risk, with 3-10% of samples reporting this belief. In one study, authors asked participants to rate how strongly they believed OCPs could protect against STIs and found a mean of 1.6 on a scale of 1-4, where 4 meant "strongly agree." Finally, in one study individuals seeking treatment for drug use were asked to select which methods could protect against STIs, in a list including DMPA, OCPs, IUDs and condoms, with 21% selecting a method other than condoms.[391]

In Foster et al.'s comparison of those seeking ECPs directly from pharmacies versus via physician prescription, no differences were observed in this belief across groups.[379] Similarly, Melbostad et al. found no differences across groups when comparing people seeking medication treatment for opioid use and those seeking primary care services. Schwarz et al. assessed the effect of a brief educational

intervention on ECP knowledge and found no differences in those believing ECPs could protect against STIs by study group. Sangi-Haghpeykar et al. assessed differences across racial/ethnic groups, and found no differences across groups regarding the belief that OCPs can protect against HIV.[380]

Improvement of menstrual-related symptoms

In seven articles, consisting of two prospective cohort studies, one intervention with pre- and post-test, and five cross-sectional surveys, participants reported beliefs about improvement of menstrual-related symptoms with use of implants (n=1),[395] IUDs (n=2), OCPs (n=5). In Ingersoll et al.'s intervention study, participants were asked whether they believed LARC methods could reduce heavy or painful periods. At baseline, 77% reported that they could, with 100% reporting this belief after viewing a brief educational video.[395] Authors did not disaggregate responses by method. In a prospective cohort study of young people using SBHCs in Bronx, NY, 42% of the sample reported that IUD use could lead to lighter periods or amenorrhea at baseline, and 19% that use could lead to more regular periods.[393] Across OCP studies, between 17%[38] and 82%[41] of samples reported that use could lead to more regular, lighter, shorter, or less painful periods, or could reduce cramping or dysmenorrhea. Rosenfeld et al. assessed differences across racial/ ethnic groups in those reporting this belief and found that Non-Hispanic White participants were more likely to report this belief, compared with participants from other racial/ ethnic groups (80% vs. 67-69%, $p < 0.001$).

Reduced Risk of Cancer, Breast Disease, and Ovarian Cysts

In 5 articles, participants reported beliefs about protective effects of OCPs on cancer risk. Additionally, four reported beliefs about a protective effect against benign breast disease and two about a protective effect of ovarian cysts. All were cross-sectional surveys.[22, 38, 39, 41, 380] Proportions reporting these beliefs ranged from 3-9% for breast cancer or benign breast disease, 3-22% for ovarian cancer or cysts, and 3-15% for endometrial or uterine cancers. In Craig et al.'s analysis, beliefs about protective effects of OCPs on cancer risk did not differ across racial/ ethnic groups.[22]

Other Non-Contraceptive Benefits

In four cross-sectional studies, authors reported beliefs about protective effects of OCPs on ectopic pregnancy risk, with 9%- 17% of samples reporting this belief. Additional beliefs included: protection against anemia (n=3 articles), hirsutism (n=1 article), and acne (n=1 article). Details can be found in **Table 2.5**.

Correlates of Beliefs:

Three articles assessed relationships between individuals' race or ethnicity and beliefs. Two of these reported results from different sub-sample analyses of the same nationally representative survey of young, unmarried U.S. adults. Odds ratios and 95% confidence intervals (CIs) from each of these studies are displayed in a forest plot, which can be found in **Figure 2.2**. Odds of reporting several beliefs about IUDs were higher among Black participants compared to White participants, including the belief that IUDs could move around in the body and the belief that IUDs were unsafe. Individuals from other racial and ethnic groups were also more likely to report that IUDs could move around in the body compared with White participants. However, overall, no clear pattern emerged to suggest consistent differences in the distribution of beliefs across racial and ethnic groups.

Similarly, we plotted the relationships observed between age and odds of certain beliefs. While younger people were generally more likely to report beliefs, these results were often non-significant. In one article, young people were more likely to know that IUD insertion did not require surgery. Results can be found in **Figure 2.3**.

Discussion

We identified 48 articles presenting three decades of data about contraceptive safety beliefs of over 25,000 people in the U.S., allowing us to paint a broad picture of knowledge and misconceptions. Our sample included participants from throughout the reproductive lifespan, throughout the continental U.S., and from several important population sub-groups.

We identified important misconceptions about contraceptive safety. Across the articles, small to moderate proportions of samples reported concerns about SAEs that are not clinically related to method use. The most frequently reported SAEs were concerns about adverse effects on fertility. Other than delays in return to fertility after DMPA use, which should resolve after a few months, method use, including long-term use, is not associated with infertility. Fertility concerns should be address in

counseling and education. For example, the impact of age on fertility should be addressed, as individuals using contraception for many years may attribute age-related drops in fertility to method use.

Throughout articles, participants exaggerated risks of ECPs, which have excellent safety profiles. Important misconceptions include concerns about infertility, miscarriage, birth defects, and the inability to differentiate ECPs from medical abortion. These non-evidence-based concerns may dissuade users from using ECP in situations in which it is indicated, for fear of harming an existent pregnancy. Alternatively, people who believe that ECPs can be used for medical abortion may use an ineffective product, resulting in delays in abortion care. Another concerning misconception was the belief that methods other than condoms provide protection against STIs. While most participants did not report this belief, approximately 400 individuals throughout this body of literature did. Counseling and education must stress that only condoms, abstinence, and mutually monogamous intercourse with an uninfected partner can prevent against STIs. Few articles asked about systemic benefits of contraceptive use, such as ovarian cancer protection, but the limited findings indicate that widespread knowledge of such benefits is lacking.

When we examined factors associated with beliefs, we found that Black participants were more likely than participants of other races to report concerns about fertility, IUD migration, and weight gain, and that White participants were more likely to know about delayed return to fertility after DMPA use and menstrual-related benefits of OCP use. These racial discrepancies are consistent with the literature. However, findings related to race and ethnicity were not uniform across articles for all beliefs. In the one study that assessed nativity status, being non-U.S. born was associated with beliefs about ECPs causing adverse reproductive outcomes, but not others. Younger people seem to report more concerns about LARC use than older participants, but many of the studies included restricted samples to only adolescents and young adults, making it difficult to draw conclusions about older people of reproductive age. We also found that individuals with awareness of and personal experience with methods tended to view those methods as safer, especially OCPs and ECPs. These findings may be able to help those developing counseling protocols and educational interventions tailor them based on the target populations.

Limitations and Strengths

Some limitations to this systematic review should be noted. Due to the large number of articles identified, we chose to only include articles reporting quantitative findings. By excluding qualitative articles, we were not able to understand the context under which beliefs are developed, reasonings behind beliefs and nuances of the beliefs. Importantly, we excluded several qualitative articles that reported the contraceptive needs and preferences among groups that do not always receive the best quality contraceptive services, including people who identify as sexual and gender minorities,[401-403] people with disabilities,[404, 405] individuals living in rural areas,[406, 407] and immigrants.[408-410] We are thus largely unable to generalize these findings for important sub-groups. We also excluded articles reporting aggregate knowledge scores and reporting on the perspectives of male-identifying participants, parents, or providers, three groups whose beliefs may influence contraceptive use. Future reviews should include qualitative literature and highlight beliefs among these groups.

Limitations within the body of literature itself impact the conclusions that can be drawn from it. Generally, the literature was of low quality, consisting predominantly of cross-sectional surveys with relatively small sample sizes (26% reported a sample size of <200). Less than half of the included articles reported results of multivariable analyses in which authors controlled for potential confounders. Finally, while we hoped to capture multi-level determinants of contraceptive beliefs, we found that the body of literature largely failed to capture such factors at levels higher than the individual or interpersonal level. Individual or interpersonal level.

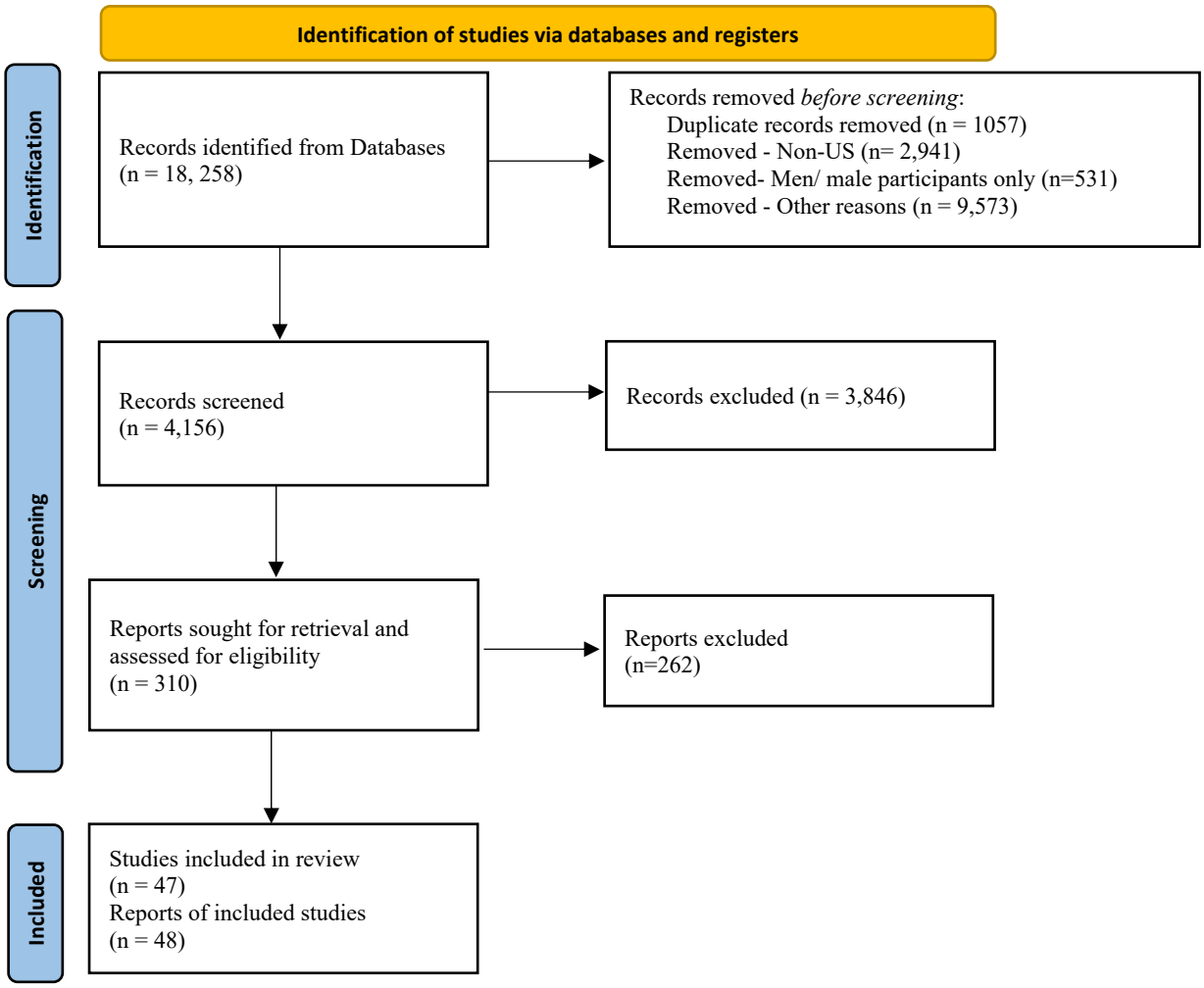
Despite these limitations, this review represents an important contribution. We describe a large number of articles and captured data spanning three decades, allowing us to assess changes over time. Unfortunately, common misconceptions, about ECPs, IUDs and fertility concerns with all methods appear persistent across time. Directly addressing these misconceptions in counseling and education may be necessary to improve knowledge. We were also able to document gaps in the published literature. Many

articles were cross-sectional, included convenience samples, or failed to report multivariable statistics. We found that more quantitative research is needed on beliefs among additional groups, including BIPOC, immigrant and gender and sexual minority communities, and individuals with disabilities or chronic medical conditions.

Conclusion

Through this systematic review of the literature, we were able to paint a picture of what people in the U.S. know about contraceptive safety and identify some glaring and persistent gaps in knowledge. Concerns about fertility, adverse reproductive outcomes, and LARC device problems are widespread and important. Discussions of SAEs, side effects, and benefits should be integrated into sexuality education and addressed by healthcare providers, including by those providing care to pediatric patients and in informal settings (e.g., social media). Providers themselves should be made aware of these common misconceptions. Investments in sexuality education and provider training are warranted to address the findings presented here. In order to truly empower all individuals to make the best contraceptive decisions for themselves, structural changes are needed to improve access, but, as this review demonstrates, misconceptions about safety continue to serve as unnecessary and modifiable barriers to use.

Figure 2.1. PRISMA 2020 flow diagram for new systematic reviews.



From: Page MJ, McKenzie JE, Bossuyt PM, Boutron I, Hoffmann TC, Mulrow CD, et al. The PRISMA 2020 statement: an updated guideline for reporting systematic reviews. BMJ 2021;372:n71.

Table 2.1. Outcome categorization.

Category	Sub-categories	Outcomes included
SAEs	SRH-related concerns	Infertility, diminished fertility, or delayed return to fertility Abortion or miscarriage Teratogenic effects to existent/future pregnancies Ectopic pregnancy Ovarian cysts
	Long-term health concerns	Cancer (including reproductive cancers) Hypertension Blood clots Stroke, heart disease, or other adverse cardiovascular events Problematic bleeding Bone mineral density loss
	Immediate or short-term health concerns	Infection Method migration or displacement
Side Effects	SRH-related concerns	Increased menstrual flow Irregular, more frequent menstrual periods, or spotting between menstrual periods Amenorrhea Cramping
	Physical concerns	Weight changes Negative changes to weight, skin, or physical appearance Nausea or vomiting Headaches Pain or discomfort at insertion (for IUDs and implants)
	Mental/ psychological concerns	Mood changes, “mood swings,” or emotional lability Depression Anxiety
Non-contraceptive benefits	SRH-related benefits	Lighter, less frequent, or more regular menstrual periods Reduced risk for contracting sexually transmitted infections (STIs) or other infections
	Physical benefits	Skin improvements or reduced acne Reduced cancer risk
	Mental/ psychological benefits	Improved mood Increased mood stability

Table 2.2. Characteristics of included studies (n= 47).

Author, Year, n, Study Quality	Sources of support	Study purpose	Sample description	Study Design	Data Collection Procedures	Analytic Procedures	Methods included	Strengths	Limitations
Crosby, 1993[376] n=2,358 II-3, Poor	None listed.	To determine reasons for early implant discontinuation.	Low-income women aged <17 – 34+ years receiving an implant at the University of Texas Southwestern Medical Center and Parkland Memorial Hospital in Dallas, TX between August 1991, and April 1993.	Prospective cohort.	During pre-insertion counseling sessions, patients were asked to report concerns about Norplant use to contraceptive counselors. Among those seeking early removal, patients were asked to report reasons for discontinuation to physicians or nurses.	Univariate statistics and between-group cross-tabulations without statistical testing.	Implants.	Prospective study design. Patient concerns recorded prior to insertion; possible to assess temporal relationship between concerns and duration of method use.	No statistical testing conducted. Single site study. Norplant no longer available in U.S.; results might not be generalizable to Nexplanon users. Surveys only offered in English.
Frank, 1993[24] n=1,322, III, Poor	None listed.	To identify patient characteristics and experiences associated with the choice of	English and Spanish-speaking U.S. women aged 13 – 50 years attending one of 11 sampled family planning clinics in the greater	Cross-sectional self-administered survey	All patients who presented for SRH services at one of the study clinics were invited to participate. Participants completed a self-	Bivariate analyses (Chi-squared, T tests, and ANOVA) and multivariabl	Implants.	Multi-site study, including both urban and rural sites.	Cross-sectional. Norplant no longer available in U.S; results might not

		Norplant by women in the U.S.	Houston area or in rural areas in Southeast Texas between March and April 1992.		administered written survey while at the family planning clinic. Methods received by participants during family planning visits were recorded.	e logistic regression.		High response rates (80-96% per clinic). Surveys offered in both English and Spanish. Use of multivariable analyses.	be generalizable to Nexplanon users. Surveys only offered in English.
Peipart, 1993[38] n=247 III, Poor	Robert Wood Johnson Foundation.	To assess beliefs about risks and benefits of OCPs among women receiving SRH care at Yale University.	Female students, faculty, and staff aged < 20 – 50+ years, who used Yale University Health Services in New Haven, CT for SRH care between April and June 1991.	Cross-sectional self-administered survey.	Participants completed self-administered written surveys while waiting to see provider at Yale Health Services.	Bivariate analyses (Chi squared, Fisher's exact, and T-tests).	OCPs.	Sample included older women of reproductive age (> 50 years).	Single site study. Highly educated sample; may not be generalizable to other populations.
Moore, 1996[377] n=345 II-3, Fair	NIH/NICHD & NIMH, Kaiser Family Foundation.	To examine the extent to which young women's intentions and use of the pill were influenced by intentions to have an abortion if	English-speaking, non-pregnant female adolescents, aged 14-19 years presenting for care from one of two general adolescent care clinics in San Francisco, CA.	Prospective cohort study.	Baseline visits occurred when participants presented for healthcare at study clinics. At baseline, interviewers asked participants background questions while they waited to see providers, then	Multivariable logistic regression.	OCPs.	Prospective study design. Multi-site study. Use of multivariable analyses.	Low follow-up rate (68%). Authors did not specify dates of data collection.

		they became pregnant.			participants completed self-administered written surveys, with interviewers available to answer questions. Participants were then invited to return for a follow-up visit one-year post-baseline. Follow-up surveys were administered in the same way as baseline surveys.				
Tessler, 1997[39] n=335 III, Poor	None listed.	To assess college students' beliefs about contraceptive effectiveness, perceptions of health risks and benefits of OCPs, and satisfaction with contraceptive methods.	Predominantly White Brown University undergraduate and graduate students aged 18-38 years presenting for care at Brown University in Providence, RI health services or on campus.	Cross-sectional self-administered survey.	Participants were approached while waiting for care at the Brown University health services center or on campus by female volunteers. Participants completed self-administered written surveys and returned them in opaque envelopes either to healthcare providers or to a sealed collection box.	Bivariate analyses (Chi squared, T-tests, and non-parametric tests).	OCPs.	High response rate (93%). Recruited participants from multiple sites on campus.	Single site study. Highly educated sample; may not be generalizable to other populations.

Jackson, 2000[30] n= 371 III, Poor	David and Lucile Packard Foundation.	To identify factors associated with lack of knowledge and willingness to use ECPs among women at high risk for unintended pregnancy.	Predominantly Latina English or Spanish-speaking women aged <19 - 30+ years who gave birth at SF General Hospital between September 1998 and March 1999.	Cross-sectional interviewer-administered survey	Bilingual interviewers administered surveys in-person at the hospital prior to discharge.	Bivariate analyses (Fisher's exact tests).	ECPs.	Surveys offered in both English and Spanish.	Cross-sectional. Single site. No multivariable testing reported.
Raymond, 2002[398] n=663 II-3, Poor	Family Health International, John Merck Fund, Women's Capital Corporation, an unnamed private foundation.	To evaluate comprehension of a prototype OTC package label for an ECP.	English-speaking women and girls aged 12 - 50 years at malls and family planning clinics, in the Denver, CO, Los Angeles, CA, Chicago, IL, San Antonio, TX, Philadelphia, PA, and Miami, FL metropolitan areas.	Quasi-experimental evaluation of education intervention with self-administered electronic pre- and post-test.	Interviewers administered survey in a private room at mall or clinic. Reading comprehension assessed for participants aged under 18 or those who had not completed college. Participants were given a prototype ECP package and answered to additional questions.	Bivariate analyses (Chi squared and Fisher's exact test).	ECPs.	Multi-site study, representing several geographic areas. Participants sampled from two different types of sites.	Convenience sample. Multivariable testing not reported. Only assessed reading comprehension for some participants. Only sampled participants from metropolitan areas.
Gilliam, 2003[37] n=43	ACOG, Parke-Davis.	To assess motivation, self-efficacy and	Pregnant or post-partum African American female adolescents and	Cross-sectional self-	Participants received counseling about OCPs from resident-physicians, then	Bivariate statistics (Chi square	OCPs, ECPs.	Surveys developed by focus groups with	Small sample. Size.

III, Poor		knowledge of OCPs in antepartum, African American adolescents and young adults following OCP counseling.	young adults aged 15-25 years presenting for care from 34 weeks of gestation to end of pregnancy at the Prentice Ambulatory Clinic at Northwestern Memorial Hospital in Chicago, IL between September 1998 and May1999.	administered survey.	completed self-administered written surveys.	and Fisher's exact test).		members of the target population.	Cross-sectional. Single site study. Multivariable testing not reported.
Romo, 2004[32] n=69 answered ECP-related questions III, Poor	NIH/ NICHD, John Sealy Memorial Endowment Fund for Biomedical Research.	To assess factors associated with ECP acceptability among low-income Latina women receiving care in two university reproductive health clinics.	Spanish and English-speaking Latina women aged 18-43 years presenting for care at one of two reproductive health clinics in Southeast Texas between January and May 2003.	Cross-sectional self-administered survey.	Participants completed self-administered written surveys while at the health clinic. Those who reported awareness of ECPs completed a second survey about ECPs. A research assistant was available to assist with survey completion as needed.	Bivariate analyses (Fishers exact and T-tests) and multivariable logistic regression.	ECPs.	Multi-site study. Use of multivariable analyses. Surveys offered in both English and Spanish. Participants were not informed about survey topic to reduce risk of selection bias.	Small sample size for questions about ECPs. Cross-sectional design.

Cunnane, 2006[28] n=149 III, Poor	None listed.	To determine the proportion of reproductive-age women at an internal medicine clinic who have received counseling about ECPs and to assess knowledge, attitudes, and experiences with ECPs.	Predominantly White U.S. women aged 18-45 years randomly sampled from the patient records of a metropolitan, University-based general internal medicine clinic between July 2001 and June 2002.	Cross-sectional phone survey.	Participants were sent an initial mailing describing the study. Those who did not opt out were contacted by telephone by the study team, and the survey was administered via telephone. Participants who did not respond were contacted > 5 times.	Bivariate analyses (Chi squared and Fisher's exact test).	ECPs.	Use of random sampling. Use measures adapted from the NSFG.	Low response rate (57%). Single site study. Multivariable testing not reported.
Davis, 2006[378] n=400 III, Poor	Louisiana State University Health Sciences Center-Shreveport.	To assess understanding and use of OCPs and determine whether these factors were associated with literacy.	Predominantly African American female patients aged 11-51 years presenting for care at the Caddo Parish Health Unit in Louisiana who were using or planning to initiate OCPs following their visit, between June and August 1998.	Cross-sectional interviewer-administered survey.	Research assistants administered survey and Rapid Estimate of Adult Literacy in Medicine test to participants in a private room at the study clinic after their visits.	Bivariate analyses (Chi squared tests).	OCPs.	Use of validated tool to assess literacy. Wide age range (spanned reproductive years).	Cross-sectional. Convenience sample. Single site study. No multivariable testing reported.
Fagan, 2006[29] n=401 III, Poor	U.S. HRSA, University of North Carolina, Chapel Hill.	To determine knowledge, attitudes and self-reported use of ECPs among women in rural western	Predominantly White, English-speaking women aged 18-44 years, presenting for care at one of two county health departments, three community-based	Cross-sectional self-administered survey.	Surveys were administered by study staff at check-in. Participants completed the self-administered written surveys in waiting rooms or examination rooms	Logistic regression (authors do not state whether bivariate or multivariable logistic	ECPs (LNG ECPs and Yuzpe method).	Multi-site study.	Convenience sample. Cross-sectional. Only included English-

		North Carolina.	residency clinics or three private family physician offices in western North Carolina.		and returned them to office staff or providers in sealed envelopes.	regression was used).			speaking participants.
Foster, 2006[379] n=426 III, Poor	The Compton Foundation.	To examine women's experiences in obtaining ECPs via direct pharmacy access.	English-speaking women aged 13 - 30+ years, seeking ECPs from one of 25 California pharmacies during the Summer 2004.	Cross-sectional self-administered survey.	Pharmacists distributed self-administered written surveys to women seeking ECPs from sampled pharmacies after ECP prescriptions were filled.	Bivariate analyses (ANOVA).	ECPs.	Multi-site study, including pharmacies from urban and rural settings across state. Use of random sampling at pharmacy level.	Cross-sectional study. Sample included primarily independent pharmacies (23/25). Randomly sampled chain pharmacies were largely unable to participate, which may have biased sample.
Merchant, 2006[366] n=539 III, Poor	NIH/NIDA, Society of Academic Emergency Medicine, CVS	To assess contraceptive use, knowledge, and factors associated with OCP and ECP use.	Predominantly White, English-speaking women aged 18- 55 years presenting for care at a northeastern United States urban ED between July 2002 and May 2003	Cross-sectional interviewer-administered survey	Research assistants and volunteers administered the survey to patients while at clinic over three seasons during two time slots each day (11 AM - 7 PM and 7 PM - 11 AM).	Bivariate and multivariable logistic regression.	OCPs, ECPs.	Sampling techniques allowed authors to capture representative sample of clinic patients.	Cross-sectional. Single site study.

	pharmacy.							Multivariable analyses used. Wide age range (included older women of reproductive age). Pilot testing with participant interviewing used to develop survey.	
Sangi-Haghpeykar, 2006[380] n=422 III, Poor	None listed.	To compare psychosocial factors related to contraceptive use among U.S.-born Hispanic women, U.S.-born non-Hispanic Whites, and foreign-born Hispanic women.	English or Spanish-speaking Hispanic women aged 18 - 50 years, presenting for SRH care at one of two publicly funded OB/GYN clinics in Houston, TX between October 2004 and March 2005.	Cross-sectional self-administered survey.	Participants were invited by bilingual staff members to participate while at clinic, completed self-administered written surveys while at the clinic.	Bivariate analyses (Chi squared or T -Tests).	OCPs.	Surveys offered in both English and Spanish. Multi-site study.	Cross-sectional. Significance-level set at 0.10 rather than 0.05; may be more likely to commit Type I error in analyses.
Rocca, 2007[381] n=1,950 I, Good	The William and Flora Hewlett Foundat	To evaluate acceptability of ECPs among young women at risk of UIP, ECP	English or Spanish-speaking female patients aged 15-24 year, who have had sex in past 6 months,	RCT.	At baseline, participants reporting for care were invited to complete a self-administered written	Bivariate analyses (Chi squared and t tests) and multivariabl	ECPs.	Randomized trial with prospective design.	Side effects not specified.

	ion, Compton Foundation, Open Society Foundations, Wallace Alexander Gerbode Foundation, Women's Capital Corporation.	non-use in situations in which they want to use it, and whether increased ECP access leads to more favorable attitudes, or prompter or more convenient use.	did not want to become pregnant, and were not using a highly effective contraceptive method, presenting for SRH care at one of 4 clinics offering family planning services in the SF Bay Area between July 2001 and October 2003.		survey during family planning visits. Research assistants then administered a brief ECP educational session. Participants were then randomly allocated to 1 of 3 groups (pharmacy access, advance provision, or comparison group). Six months after enrollment, follow-up data were collected via interview-administered survey at the clinic or participant's home.	e logistic regression.		Surveys offered in both English and Spanish. Multi-site study. Multivariable analyses used. Moderation assessed. 92% follow up rate.	
Schwarz, 2008[34] n=466 I, Poor	University of California S, Mt. Zion Health Fund, U.S. VA, NIH/ NICHD, Duramed Pharmaceuticals, Inc.	To evaluate whether computerized ECP counseling with provision of a free ECP sample can increase knowledge and the use among women seen in an urgent care clinic.	Women aged 18-45 years old, seeking care from one of 2 urgent care clinics in SF, CA between March and July 2005.	Single-blind RCT.	Participants completed self-administered electronic survey while waiting to see a provider, then were randomized to intervention (computerized counseling about ECPs and ECP sample) or control group (counseling about preconception folate and a folate sample). Six months post- baseline, research assistants blinded to study	Bivariate analyses (Chi squared or T-Tests) and multivariable logistic regression.	ECPs.	Randomized trial with prospective design. Multi-site study. Research assistants blinded to study group at follow-up.	Low response rate (59%) Greater loss to follow-up among those considered at higher risk for pregnancy group.

					group membership administered follow-up phone surveys.				
Venkat, 2008[35] n=102 III, Poor	None listed.	To identify perceptions of Latina women about four contraceptive methods and to investigate whether religiosity and acculturation play a role in contraceptive choice.	Latina-identifying women aged 16-70 years presenting for SRH care at the Bellevue Hospital Center in New York City between July and August 2004.	Cross-sectional self-administered survey.	Bilingual research assistants invited patients to complete a self-administered written survey while waiting to see a provider in the OB/GYN clinic waiting room.	Bivariate analyses (Chi squared tests and ANOVA)	OCPs, IUDs, Patch, and DMPA.	Wide age range (included older women of reproductive age). Bilingual study staff (not specified whether the survey was available in multiple languages).	Cross-sectional design. Low response rate (49%). Single site study. No multivariable testing reported.
Whittaker, 2008[36] n=211 patient participants III, Poor	NIH/ NICHD, Pennsylvania Department of Public Health.	To collect information from patients and staff at 4 Title X clinics concerning advanced provision of ECP.	Predominantly Black, female sexually active patients aged 15-39 years who did not desire pregnancy and were not using highly effective contraception, presenting for care at one of four Title X-funded clinics in Pennsylvania.	Cross-sectional survey.	Eligible participants completed interviewer-administered intake surveys. Participants with birthdays on odd numbered days were invited to complete a longer in-depth survey. Surveys were completed prior to seeing providers or counselors.	Bivariate analyses (Chi-squared or non-parametric tests).	ECPs.	Part of mixed methods study of patients and providers. Authors adjusted statically for multiple comparisons.	Cross-sectional. No multivariable testing reported.
Hickey, 2009[382] n=699	None listed.	To examine female college students' knowledge,	Predominantly White female college students aged 18-24 years, attending a private	Cross-sectional web-based survey.	An email announcement introducing the study and explaining eligibility criteria	Univariate statistics only.	ECPs.		Cross-sectional. Single site study.

III, Poor		perceptions, and use of ECPs.	suburban university in the Mid-Atlantic region of the U.S. in Fall 2007.		was sent to all enrolled students with a link to the web-based survey. Participants completed the survey electronically.				Descriptive statistics only. Highly educated sample; may not be generalizable to other populations.
Weaver, 2009[383] n=1,490 I, Fair	Family Health International, NIH/ NICHD, Willian and Flora Hewlett Foundation, Barr Pharmaceuticals.	To explore effects of unrestricted access to ECPs on attitudes and practices regarding SRH, use of ECPs, and use of other methods.	Sexually active women aged 14-24 years who did not desire pregnancy and were not using or planning to use long-acting contraceptive methods presenting for care at clinics in Nevada and North Carolina.	Unblinded RCT.	At baseline, participants completed computer-assisted self-interviews then were randomly assigned to receive increased ECP access (2 samples at enrollment with access to unlimited free ECPs throughout study period) or control (standard access). At 6- and 12-months post-baseline, participants completed in-person computer-assisted follow-up surveys.	Exploratory and Confirmatory Factor analysis, General linear mixed models and generalized estimating equations, Cox proportional hazard models.	ECPs, OCPs.	Prospective RCT. Multi-site study. Authors used e of advanced multivariable statistical techniques. High response rates at 12 months (78% for intervention and 80% for control).	Authors did not to adjust statistically for multiple tests. Only included 2 disparate geographical regions.
Fleming, 2010[384] n=252	None listed.	To study perceptions of and attitudes about the	Female teenagers and young women aged 14- 27 years presenting for SRH care at the	Cross-sectional self-administered survey.	All patients were given study information sheets when presenting for their appointment.	Bivariate analyses (Fisher's exact and t-test) and	IUDs.	Multivariable analyses used.	Cross-sectional. Single site study.

III, Poor		IUD among teenagers and young women.	University of California SF's New Generation Health Center between January 9 and February 27, 2007.		Interested participants completed self-administered written surveys while at the clinic. Surveys included a picture and lay description of the LNG IUD.	multivariable logistic regression.		Pilot tested survey with sub-sample from target population.	
Matsumoto, 2011[41] n= 200 U.S. women III, Poor	None listed.	To assess differences between OCP knowledge, perceptions among women in three countries.	U.S., Japanese, and French women aged 20-24 years, who registered with the web-based market research company Marcomille in May 2009.	Cross-sectional web-based survey.	Women from each country were randomly selected from more than 850, 000 who had registered as monitors with the market research company Marcomille and completed web-based surveys.	Descriptive statistics only (including cross-tabulations by country).	OCPs.	Multi-national comparison.	Authors do not describe how open responses were coded/ categorized. Descriptive statistics only.
Miller, 2011[367] n=354 female students III, Poor	Edinboro University of Pennsylvania Senate Grant Committee.	To explore college students' knowledge of and attitudes toward ECPs.	Male and female undergraduate college students aged 18-53 years, enrolled in health and physical education classes at a mid-sized university in Northwest Pennsylvania during Spring 2008.	Cross-sectional self-administered survey.	Participants were approached by researchers in-person and physical education classes who introduced the study and distributed surveys. Participants completed self-administered written surveys during class time.	Bivariate analyses (Chi squared or T-Tests).	ECPs.		Cross-sectional. Convenience sample. Single site study. No multivariable testing reported. Highly educated sample; may not be

									generalizable to other populations.
Rocca, 2012[385] n=602 III, Poor	National Campaign to Prevent Teen and Unplanned Pregnancy.	To examine whether women's contraceptive knowledge, attitudes and use differ across racial and ethnic groups.	English and Spanish speaking unmarried, sexually active female participants, aged 18-29 from the 2009 U.S. nationally representative Survey of Reproductive and Contraceptive Knowledge.	Cross-sectional telephone survey.	Participants were recruited via random and targeted sample of landline numbers, and a random sample of cell phone numbers. Surveys were administered by interviewers over the phone in English or Spanish between October 2008 and April 2009.	Bivariate analyses (Chi squared tests) and multivariable logistic and linear regression. Authors assessed mediation by attitudes.	OCPs, IUDs.	Nationally representative sample. Use of multivariable analyses. Authors conducted mediation assessment. Surveys offered in both English and Spanish.	Cross-sectional. Low response rate (~20% for each sampling frame). Not clear if authors adjusted for complex survey design.
Craig, 2014[22] n=897 III, Poor	NIH/ NIMHD and NICHD, National Campaign to Prevent Teen and Unplanned Pregnancy.	To assess differences in knowledge and attitudes about contraceptives by race/ethnicity, age group, and among Hispanic participants, by nativity, using data from the Survey of	English and Spanish speaking unmarried, female participants aged 18-29 years from the 2009 U.S. nationally representative Survey of Reproductive and Contraceptive Knowledge.	Cross-sectional telephone survey	Participants were recruited via random and targeted sample of landline numbers, and a random sample of cell phone numbers. Surveys were administered by interviewers over the phone in English or Spanish between October 2008 and April 2009.	Bivariate and multivariable logistic regression. Survey weights were used to account for the complex sampling approach.	OCPs, IUDs.	Nationally representative sample. Use of multivariable analyses. Authors accounted for complex survey design in analysis. Surveys offered in	Cross sectional survey. Low response rate (~20% for each sampling frame).

		Reproductive and Contraceptive Knowledge.						both English and Spanish.	
Bachorik, 2015[400] n=129 III, Poor	NIH/ NCATS	To assess awareness of and attitudes toward etonogestrel implants among adolescent and young adult women.	English-speaking adolescent and young adult women aged 14-24 attending a birth control education group at an adolescent health center in NYC between June and August 2012.	Cross-sectional self-administered written survey,	Participants completed surveys prior to contraceptive education programs.	Bivariate analyses (Chi squared and Fisher's Exact Tests).	Implants.		Cross-sectional study. Convenience sample. Relatively small sample size (n=53 participants answered questions about implants) Did not assess knowledge after educational intervention.
Friedman, 2015[386] n=79 II-2, Fair	None listed.	To estimate rates of adolescent IUD satisfaction at 3- and 6 - months post insertion.	English-speaking women aged 15-24 years, presenting for a follow-up appointment within 1 month of receiving an IUD Mt. Sinai Adolescent Health Clinic in NYC.	Prospective cohort study.	Participants completed a self-administered written survey while at the clinic for follow-up IUD visits, then were contacted for follow-up surveys 3- and 6-months later at subsequent clinic visits or by phone.	Bivariate analyses (Chi squared and Fisher's Exact Tests) and multivariable logistic regression.	IUDs.	Prospective design. Use of multivariable analyses. Patient concerns recorded prior to insertion;	Small sample size. Single site study. Relatively short follow-up period 6 months).

								possible to assess temporal relationship between concerns and duration of method use.	
Gomez, 2015[399] n=382 III, Poor	SF State University	To examine correlates of young women's interest in using an IUD, including sources of information about, knowledge of, and attitudes toward IUDs.	Predominantly White young adults in the U.S. aged 18-29 years using Facebook, Twitter, and Craigslist or on other email listservs between May and August 2012.	Cross-sectional web-based survey.	Participants were recruited via Facebook, Twitter, e-mail listservs; and Craigslist and invited to participate a web-based survey.	Multivariable logistic regression.	IUDs.	National sample. Use of multivariable analyses.	Cross-sectional.
Lehan Mackin, 2015[31] n=2007 III, Fair	NIH/ NINR.	To describe knowledge and use of ECP in college women aged 18 -35 years and determine whether select demographic characteristics, sexual behaviors, or pregnancy	Predominantly White undergraduate, graduate, and non-degree seeking students aged 18-35 years, attending a large Midwestern university.	Cross-sectional web-based survey.	An email introducing the study with a link to the web-based survey was sent to all female students at the target university. Interested participants could click the study link and complete the survey.	Bivariate and multivariable logistic regression.	ECPs.	Three-phase survey development process. Survey administered as part of larger mixed methods study.	Cross-sectional. Low response rate (14%). Single site.

		history was associated with knowledge of ECP access and ECP use.						Use of multivariable analyses.	
Yen, 2015[387] n=290 female participants III, Poor	Lucile Packard Foundation for Children's Health, The Children's Health Fund.	To assess knowledge of and misconceptions about ECPs among uninsured adolescents.	Uninsured and homeless adolescents and young adults aged 13 – 25 years, presenting for care from the "Teen Health Van" mobile primary care clinic in the SF Bay Area between June 2010 and July 2012.	Cross-sectional self-administered survey, administered as part of a ECP distribution program.	Participants completed self-administered written surveys in a private setting during their mobile health clinic visits.	Bivariate analyses (Chi squared tests).	ECPs.	All patients invited to participate in the original survey consented.	Cross-sectional. Retrospective design. No multivariable testing reported. Did not disaggregate all items by sex.
Hall, 2016[25] n=1,982 III, Fair	NIH/ NICHD, Society of Family Planning, Robert Wood Johnson Foundation, University of Michigan.	To describe knowledge, perceptions and experiences regarding IUDs and implants among a sample of college women and identify perceived individual-, health systems- and community-level barriers	Predominantly White, English-speaking, full-time enrolled female undergraduates aged 18 – 22 + years at a large mid-western university in Fall 2013.	Cross-sectional web-based survey, administered as part of a multiphase mixed-methods project.	All full-time enrolled undergraduate students meeting study eligibility criteria were sent a series of email invitations from the Office of the Registrar. Interested students could click the link to the web-based survey included in the emails.	Bivariate analyses (Chi squared, T-tests, and ANOVA) and multivariable linear regression.	IUDs, Implants.	Measured multiple levels of influences on contraceptive use.	Cross-sectional. Single site study. Low response rate (14.5%). Highly educated sample; may not be generalizable to other populations.

		to LARC use on campus.							
Hoopes, 2016[26] n=102 III, Poor	NIH/ NIMH, HRSA/ MCHB, a Seattle-based private donor group.	To evaluate correlates of knowledge and acceptability of LARC methods among adolescent women at a school-based health center (SBHC).	Young women aged 13-19 years, who received care from one of two SBHCs in Seattle, WA between December 2013 and January 2014.	Cross-sectional, multi-site web-based survey.	Participants completed the web-based survey on tablets at SBHCs or on their personal devices between December 2013 through January 2014.	Bivariate analyses (Chi squared tests and bivariate logistic and linear regression) and multivariable logistic and linear regression.	IUDs, Implants.	Multi-site study. Samples represent 1/3 of school populations.	Cross-sectional. Relatively small sample size. Excluded minors without parental permission. Authors did not explain how study SBHCs were selected.
[395], 2016[388] n=348 III, Poor	Society of Family Planning Research Fund.	To assess teenagers' attitudes toward OTC and direct pharmacy access for OCPs and understanding of a prototype OTC product label.	Predominantly White, English-speaking female Facebook users aged 14-17 years from across the U.S.	Cross-sectional web-based survey.	Participants were recruited via targeted Facebook advertisement. Interested users were prompted to click on the advertisement, which brought them to the web-based survey.	Bivariate analyses (Chi squared, Fisher's exact, T-tests, and ANOVA).	OCPs.	National sample. Sample divers in terms of insurance status, and SRH factors.	Cross sectional. Convenience sample. Did not assess beliefs prior to viewing prototype OTC OCP label; could not measure baseline knowledge

									prior to exposure. No multivariable testing reported.
Rosenfeld, 2017[33] n=2,302 III, Poor	U.S. VA.	To assess racial and ethnic differences in contraceptive knowledge among U.S. women veterans.	Randomly sampled female U.S. veterans from all U.S. regions, aged 18-44 years who received care from the VA healthcare system between 2013 and 2016.	Cross-sectional interviewer-administered survey	Surveys were administered to randomly sampled participants who opted to participate via computer-assisted telephone interview.	Bivariate tests (Chi squared and ANOVA) and multivariable logistic regression.	DMPA, OCPs, IUDs.	Large national sample. Random sampling employed. Multivariable analyses used.	Cross-sectional. Low response rate (28%). Only included veterans who accessed care from the VA system. No multivariable testing reported.
Matusiewicz, 2017[397] n=83 III, Poor	NIH/ NIDA and NIGMS	To assess interest in, concerns about and knowledge of LARC among women in medication-assisted treatment medication treatment for	Predominantly White women aged 18-49 years, receiving mOUD at one of two outpatient clinic in Burlington, VT.	Cross-sectional self-administered survey, part of an RCT evaluating behavioral economic interventions to	Participants presenting for mOUD care were recruited by study staff at a Burlington, VT mOUD clinic. Participants complete a self-administered survey.	Univariate statistics only.	IUDs, Implants.	Included reproductive age people receiving care for opioid use disorder, an understudied population.	Cross-sectional. Small sample size. Convenience sample. No bivariate or

		opioid use for opioid use disorder (mOUD) who were at risk of unintended pregnancy.		increase contraceptive use among women who use drugs at risk UIP					multivariable testing reported.
Mody, 2019[42] n=150 III, Poor	NIH/ NICHD, Safeway Foundation, University of California.	To identify reproductive-aged breast cancer survivors' contraceptive-related practices, counseling needs, counseling preference, concerns, and barriers to use.	Predominantly White women aged 18-50, with history of breast cancer within past 5 years receiving care from the University of California Athena Breath Health Network or involved with the national Young Survival Coalition.	Cross-sectional web-based survey.	Participants recruited from University of California Athena Breast Health Network registry and from posting on the Young Survival Coalition's social media sites. Link to web-based survey sent via email to all interested eligible individuals.	Bivariate analyses (Chi squared tests).	Cu IUDs.	Included reproductive age breast cancer survivors, an understudied population. Wide age range (included older women of reproductive age).	Cross-sectional study. Low response rate (33%). Convenience sample.
Callahan, 2019[40] n=95 III, Poor	Boston Children's Hospital, Pediatrics Associates.	To examine how the IUD insertion experience affects long-term IUD acceptability among adolescents.	English-speaking nulliparous adolescents aged 13-21 years who received an IUD or implant from Boston Children's Hospital and Cambridge Health Alliance in Boston, MA between January 2012 and May 2018.	Cross-sectional text-to-web survey	Eligible participants who had provided an active mobile phone number were texted an invitation to participate in the web-based study. Participants could click a link in the text message and complete the survey. Individuals who did not complete survey were sent 3 reminder texts.	Bivariate analyses (Fishers exact and T-Tests).	IUDs, Implants.	Sample included 6 years of IUD and implant users. Multi-site study. Included users of 3 types of IUDs (Mirena,	Cross-sectional study. Small sample size. Low response rate (9% for IUD users and 8% for Implant users).

								Sykla, and Paragard) and 2 types of implants (Implanon and Nexplanon). Use of text messaging to distribute survey.	No multivariable testing reported. Anticipated pain scores recorded after IUD and implant insertion, leading to risk of recall bias.
DeMaria, 2019[389] n=547 III, Poor	College of Charleston.	To examine reproductive-aged women's menstrual regulation and suppression attitudes and how this influence contraceptive choice.	Predominantly White English-speaking women aged 18 - 44 years living in or near an urban southeast coastal region of the US between June and July 2014.	Cross-sectional web-based study.	Participants were recruited through Facebook advertisements, advertisements on a local newspaper website, individual emails, and printed flyers. Interested participants completed a web-based survey.	Univariate analyses only.	IUDs, Implants.	Part of a larger mixed methods study. Participants recruited through multiple avenues. Use of health behavior theory (Theory of Planned Behavior)	Cross-sectional. No bivariate or multivariable testing reported.
Hunter, 2020[390] n=93 I, Good	Bayer Healthcare, Inc., HRSA,	To identify predictors of anticipated pain with intrauterine device (IUD)	Nulliparous young women aged 14- 22 years, presenting for 13.5 mg LNG IUD insertion at	Single-blind RCT.	Participants presenting for IUD insertion at one of the study clinics were invited to participate by	Bivariate analyses (T-tests, ANOVA, and Wilcoxon	IUDs.	Randomized trial. Prospective study, with data	Small sample size. All data collection

	NIH/ NICHD.	insertion in adolescents and young women.	one of three academic family planning clinics in Philadelphia, PA or who responded to a study recruitment poster at non-enrolling sites.		healthcare providers. Participants who responded to study posters at non-enrolling sites called the study coordinator to enroll. Participants completed a self-administered written survey in person prior to IUD insertion. Participants were then randomized into intervention group (paracervical block of 10 mL 1% lidocaine at IUD insertion) or control (placebo block). Perceived pain was measured using a visual analog scale on an iPad at 7 time points throughout insertion procedure. A post-procedure survey assessed IUD insertion experiences was administered by a research assistant.	rank sum tests), multivariable linear regression, and general estimating equations used for repeated measures.		collection at 7 time points. Multi-site study. Used of advanced statistical techniques for repeated measures data.	points during single family planning appointment.
Melbostad, 2020[391] n= 169 female	NIH/ NIDA and NIGMS	To compare contraceptive knowledge among women and men	Predominantly White men and women aged 18-45 years, receiving mOUD or seeking	Cross-sectional self-administered survey.	Participants presenting for mOUD care were recruited by study staff at a Burlington, VT mOUD clinic at	Bivariate analyses (Chi squared test, ANOVA) and	OCPs, DMPA, IUDs.	Used a validated scale to assess contracepti	Cross-sectional. Single site study.

participants III, Fair		receiving mOUD relative to a comparison group seeking primary care.	primary care at a large outpatient treatment clinic in Burlington, VT.		various times throughout the week in waiting rooms. Participants complete a self-administered written survey while at the clinic. Participants presenting for primary care were recruited by study staff by study staff at one of two University of Vermont-affiliated primary care practices in Burlington, VT various times throughout the week in waiting rooms. Participants complete a self-administered written survey while at the clinic.	multivariable logistic regression.		ve knowledge. Included people receiving care for opioid use disorder, an understudied population. Compared participants with opioid use disorder to a comparison group of people who do not use drugs. Used multivariable analyses.	No multivariable testing reported.
Rey, 2020[392] n=200 III, Poor	NIH/ NIDA and NIGMS	To evaluate perceptions of LARC among women receiving mOUD.	Predominantly White women aged 18-44 years, receiving mOUD at an outpatient clinic in Burlington, VT between November 2017 and January 2018.	Cross-sectional self-administered electronic survey.	Individuals presenting for mOUD care at an outpatient Burlington, VT clinic were invited to participate by study staff. Interested participants completed a self-	Bivariate analyses (Z tests for partially overlapping groups).	IUDs, Implants.	Included people receiving care for opioid use disorder, an understudi[27, 394]ed population.	Cross-sectional. Single site study. No multivariable testing reported.

					administered survey on an electronic tablet while at the clinic.			Low refusal rate among participants. Used appropriate statistical techniques for overlapping data.	
Richards, 2020[27] n=332 III, Fair	None reported.	To examine the attitudes of adolescent and young adults toward long- LARC, and to assess how attitudes are associated with acceptability.	Young people aged 14-24 years presenting for care at the Children's Hospital Colorado Adolescent Family Planning Clinic in Aurora, CO between March and August 2018.	Cross-sectional self-administered survey.	Patients were approached by the principal investigator or a research assistant when presenting for care at the sampled clinic and invited to participate. Participants completed the self-administered written survey before seeing a provider.	Exploratory factor analysis, bivariate analyses (Chi squared tests and ANOVA), and multivariable logistic regression.	IUDs, Implants.	A waiver of parental consent was used to allow individuals aged 14-17 years to participate. Use of multivariable analyses.	Cross-sectional. Single site study.
Stein, 2020[393] n=104 II-2, Fair	Montefiore Medical Center.	To determine the acceptability to and satisfaction of high school students receiving an IUD at a SBHC.	Predominantly Hispanic adolescents aged 14-19 years who had an IUD inserted at a Bronx, NY SBHC between November 2010 and June 2013	Prospective cohort study.	Patients reporting for IUD insertion at the sampled were invited to participate after their IUD insertion was complete. Participants completed a self-administered written survey in a private room on the same day as their insertion	Bivariate and multivariable logistic regression.	IUDs.	Prospective design. Use of multivariable analyses. Relatively high response rate (75% of eligible patients at	Relatively small sample size. Single site study.

					visit. Participants completed a follow-up survey at the SBHC standard 6-week IUD follow-up visit. Those who did not return the appointment were asked to complete the survey when they presented to the clinic for any other reason within 6 months post-baseline.			baseline and 72% at follow-up).	
Berglas, 2021[394] n=212 III, Fair	William and Flora Hewlett Foundation University of California SF/ ANSIRH.	To examine young women's attitudes about and willingness to use ECPs, with particular attention to their experiences with health care providers.	English-speaking, sexually active young people assigned female at birth, aged 15–25 years, presenting at one of 10 family planning clinics in the SF Bay Area between May 2017 and February 2018.	Cross-sectional self-administered written or electronic survey.	Sexually active young women presenting for care at 10 freestanding and school-based family planning clinics in the San Francisco Bay area were invited to participate by an onsite research coordinator. Additional participants reached out to the study team after seeing study flyers posted in sampled clinics. Participants completed self-administered written survey at the clinic or opted to complete an electronic survey	Bivariate and multivariable logistic regression, using clustered standard errors to account for non-independence within clinics.	ECPs.	High response rate (81%). Multi-site study. Participants had the choice to complete the survey in-person or electronically in their free time. Use of appropriate statistical analyses for	Cross-sectional. Study team offered survey administration in written and electronic form.

					after their appointment, which was sent via text or email.			clustered data.	
Edwards, 2021[23] n=521 III, Poor	None listed.	To investigate how attitudes and knowledge about IUDs vary by age and race.	English-speaking women aged 14-50+ years presenting for routine care or accompanying patients at an outpatient OB/GYN office at a large urban academic center in Philadelphia, PA between June 2016 and July 2016.	Cross-sectional self-administered written survey.	All women presenting for care at the sampled clinics and eligible women accompanying them were invited by study authors and invited to participate. Participants completed the self-administered written survey while in the clinic waiting room.	Bivariate analyses (Chi squared and Ttests) and multivariable logistic regression.	IUDs.		Cross-sectional. Single site study. Low response rate (38.1%).
Ingersoll, 2021[395] n=30 III, Poor	None listed.	To improve adolescent and young adult clients' knowledge of LARC methods by standardizing the education they received at an outpatient clinic.	English or Spanish-speaking, non-pregnant female adolescent and young adult patients aged 14-25 years presenting for contraceptive-related care at an academic medical center in the Northeastern U.S.	Brief education intervention with self-administered electronic pre- and post-test completed as part of a clinic quality improvement study.	Eligible patients were given a flyer introducing the study when presenting for care at the sampled clinic. Interested participants scanned a QR code on the study flyer using their mobile phones. Participants completed an electronic baseline self-administered survey then watched a 6-minute LARC educational video and completed a post-intervention survey, all using	Univariate analyses only.	IUDs, Implants	Use Health Belief Model for project development. Pre- and post-test design. Surveys and intervention offered in both English and Spanish. Part of mixed	Very small sample size. Single-site study. No bivariate or multivariable testing reported. No comparison group.

					their mobile phones. The data collection and educational intervention all occurred prior to seeing a healthcare provider. Those who needed more time had one week to complete the survey in their free time.			methods study of patients and providers.	
Williams, 2021[396] n=253 III, Fair	None listed.	To describe the current usage patterns, knowledge regarding, and perception of emergency contraception in adolescent patients.	Female patients aged 14-21 seen at the University of Alabama in Birmingham, AL Pediatric and Adolescent Gynecology clinic between June 2017 and April 2018.	Cross-sectional web-based survey.	All eligible patients presenting for care at the University of Alabama in Birmingham Pediatric and Adolescent Gynecology clinic were invited by the study team to complete a web-based survey on a university-owned computer while in the exam room at the end of their clinic visits.	Bivariate analyses (Chi squared and Fisher's Exact tests) and multivariable logistic regression.	ECPs.	Very high response rate (97%). Pilot tested instrument with members of the study population. Use of multivariable analyses.	Cross-sectional. Single site study.

Abbreviations: OCPs: Oral contraceptive pills; SRH: sexual and reproductive health; NIH: National Institutes of Health; NICHD: Eunice Kennedy Shriver National Institute of Child Health and Human Development; NIMH: National Institute of Mental Health; DMPA: Depot Medroxyprogesterone Acetate; ECPs: Emergency contraception pills; SF: San Francisco, CA; OTC: Over the counter; ACOG: the American College of Obstetrics and Gynecology; NSFG: National Survey of Family Growth; HRSA: U.S. Health Resources and Services Administration; ANOVA: Analysis of Variance; NIDA: National Institute on Drug Abuse; ED: Emergency department; OB/GYN: Obstetrics and Gynecology; UIP: Unintended pregnancy; RCT: Randomized controlled trial; VA: U.S. Department of Veterans Affairs; IUDs: Intrauterine Devices; LNG: Levonorgestrel; CVR: Contraceptive vaginal ring; NYC: New York City; NINR: National Institute of Nursing Research; LARC: long-acting reversible contraceptives; MCHB: HRSA Maternal and Child Health Bureau; SBHC: School-based health center; Cu: Copper; mOUD: Medication treatment for opioid use; NIGMS: National Institute of General Medical Sciences; ANSIRH: Advancing New Standards in Reproductive Health.

Table 2.3. Studies reporting SAEs (n=30).

Author, year	Method-related SAE Belief
DMPA	
Venkat, 2008[35]	*SRH-related risks* Increase risk of future infertility/fertility problems (n=30, 16%)
Rosenfeld, 2017[33]	*SRH-related risks:* Cause fertility problems soon after stopping (n=507, 22%) *Long-term health risks:* Could cause permanent bone loss (n=1657, 72%)
ECPs	
Jackson, 2000[30]	*SRH-related risks:* Cause abortion or work similarly to medical abortion (n=118, 31.8%)
Romo, 2004[32]	*SRH-related risks:* Use during pregnancy will terminate pregnancy (n=17, 24.6%)
Cunnane, 2006[28]	*SRH-related risks* Cause abortion (n=27, 20%) The same as medical abortion (n=4, 3%) Cause serious birth defects (n=1, 0.73%)
Fagan, 2006[29]	*SRH-related risks* The same as medical abortion (n=107, 27%)
Rocca, 2007[381]	*SRH-related risks* Could "harm a baby" if taken while pregnant (n=3, 1%)
Schwarz, 2008[34]	*SRH-related risks* Increase risk of future infertility/fertility problems (n=224 50.2%) Cause birth defects or miscarriage (n=362, 81.2%)
Whittaker, 2008[36]	*SRH-related risks* Cause abortion (n=97, 46%)
Hickey, 2009[382]	*SRH-related risks* The same as medical abortion (n=56, 8%)
Weaver, 2009	*SRH-related risks* Cause abortion / can be used to terminate pregnancy (mean agreement score: 1.3 on scale of 1-4 where 1 = strongly disagree and 4 = strongly agree)
Lehan Mackin, 2015[31]	*SRH-related risks* The same as medical abortion (n=1,414, 70.8%) Cause birth defects if taken during pregnancy (n=555, 27.8%)
Yen, 2015[387]	*SRH-related risks* The same as medical abortion (n=33, 11.5%)

Williams, 2021[396]	*SRH-related risks* Cause miscarriage or abortion (n=126, 49.8%) Increase risk of future infertility/fertility problems (n=129, 51.0%)
Implants	
Crosby, 1993[376]	*SRH-related risks:* Increase risk of future infertility (n=50, 2.1%) *Long-term health risks:* Increase risk of cancer (n=101, 4.2%)
Frank, 1993[24]	*SRH-related risks:* Negative impact on future pregnancies (n=162, 30.3%) Increase risk of future infertility/fertility problems (n=149, 27.8%) Increase risk of ectopic pregnancy (n=55, 10.3%) *Short-term / Immediate health risks:* Increase risk of infection (n=140, 26.2%) Hormone reaction (n=162, 30.3%) Problems removing (n=179, 33.4%)
Bachorik, 2015[400]	*SRH-related risks:* Increase risk of future infertility/fertility problems (n=26, 20.16%)
Hall, 2016[25]	*SRH-related risks:* Increase risk of future infertility (n=300, 15.14%) *Short-term / Immediate health risks:* Likely to move around in body* (n=184, 9.2%) *Long-term health risks:* Increase risk of serious health problems (i.e., blood clots, cancer) (n=383, 19.32%)
Hoopes, 2016[26]	*SRH-related risks:* Increase risk of future infertility/fertility problems* (n=45, 44.12%)
Rey, 2020[392]	*SRH-related risks:* Increase risk of future infertility/fertility problems (n=10, 5%) *Long-term health risks:* Increase risk of serious health problems (i.e., blood clots, cancer) (n=19, 9.5%)
Richards, 2020[392]	*SRH-related risks:* Increase risk of future infertility* (n=162, 39.8%) Method-related amenorrhea would be bad for health* (n=73, 22.2%) *Short-term / Immediate health risks:*

	Might move around in body and get lost/ need surgery to remove* (n=184, 48.8%) Might break and cause health problems* (n=139, 41.9%)
IUDS	
Venkat, 2008[35]	*SRH-related risks* Increase risk of future infertility/fertility problems (n=16, 16%)
Rocca, 2012[385]	*SRH-related risks* Increase risk of future infertility/fertility problems (n=145, 24%)
Craig, 2014[22]	*SRH-related risks* Increase risk of future infertility (n=700, 78%) *Short-term / Immediate health risks:* Increase risk of infection (n=242, 27%) Might move around in body (n=485, 54%)
Hall, 2016[25]	*SRH-related risks:* Increase risk of future infertility (n=369, 18.6%) Likely to cause harmful bleeding patterns* (n=147, 7.4%) Can cause abortion if become pregnant during use (n=371, 19%) *Short-term / Immediate health risks:* Likely to move around in body* (n=184, 9.3%) Likely to cause infection (n=111, 5.6%) *Long-term health risks:* Increase risk of serious health problems (i.e., blood clots, cancer) (n=430, 21.7%)
Hoopes, 2016[26]	*SRH-related risks* Increase risk of future infertility* (n=45, 44.12%)
Matusiewicz, 2017[397]	*Short-term / Immediate health risks:* Increase risk of infection (n=16, 19.3%) Concerns about insertion (n=9, 10.8%) Concerns about removal (n=10, 12.0%)
Mody, 2019[42]	*Short-term / Immediate health risks:* Increase risk of infection (n=33, 22%)
Callahan, 2019	*Short-term / Immediate health risks:* Might fall out (n=12, 24%)
Rey, 2020[392]	*SRH-related risks:* Increased risk of future infertility (n=7, 3.5[25]%) *Long-term health risks:* Increase risk of serious health problems (i.e., blood clots, cancer) (n=23, 11.5%)
Richards, 2020[27]	*SRH-related risks:*

	Increase risk of future infertility* (n=162, 39.8%) *Short-term / Immediate health risks:* Might move around in body and get lost/ need surgery to remove* (n=184, 48.8%) Might break and cause health problems* (n=139, 41.9%)
Edwards, 2021[23]	*SRH-related risks:* Increase risk of future infertility/fertility (n~ 228, 43.8%) *Short-term / Immediate health risks:* Might move around in body (n~ 291, 55%) Insertion requires surgery (n=154, 29.6%)
OCPs	
Peipart, 1993[38]	*SRH-related risks:* Increase risk of future fertility problems (n=10, 4.1%) *Long-term health risks:* Increase risk of breast cancer (n=116, 47%) Increase risk of cervical cancer (n=72, 29%) Increase risk of high blood pressure (n=24, 9.7%) Increase risk of heart disease/problems (n=24, 9.7%) Increase risk of blood clots (n=23, 9.3%) Increase risk of stroke (n=8, 3.2%) Increase risk of hormonal problems (n=8, 3.2%)
Tessler, 1997[39]	*Long-term health risks:* Increase risk of breast cancer (n=137, 41%) Increase risk of cervical cancer (n=111, 33%)
Gilliam, 2003[37]	*Long-term health risks:* Increase risk of uterine or ovarian cancer (n=3, 8%) Increase risk of blood clots (greater than risk of during pregnancy) (n=2, 5.4%)
Davis, 2006[378]	*Long-term health risks:* Increase risk of cancer (n=27, 6.75%) Increase risk of blood clots (n=15, 3.75%)
Merchant, 2006[366]	*SRH-related risks:* Cause abortion (n=46 8.5%)
Sangi-Haghpeykar, 2006[380]	*SRH-related risks:* Increase risk of birth defects if taken while pregnant (n=123, 28%) *Long-term health risks:* Limit growth if taken during teenage years (n=88 participants, 20%)
Venkat, 2008[35]	*SRH-related risks:*

	Increase risk of future infertility/fertility problems (n=31, 31%)
Craig, 2014[22]	*SRH-related risks:* Delays return to fertility after use (n=682, 76%)
Rosenfeld, 2017[33]	*Long-term health risks:* Increase risk of high blood pressure (n=1266, 52%)
Patch	
Venkat, 2008[35]	*SRH-related risks* Increase risk of future infertility/fertility problems (n=9, 9%)

*Item asked about beliefs about both IUDs and implants.

SAE: Serious adverse event; SRH: Sexual and Reproductive Health.

Table 2.4. Studies reporting side effects (n=27).

Author, year	Side Effects Reported
DMPA	
Venkat, 2008[35]	*SRH-related:* Bleed irregularly or more heavily (n=40, 40%) *Physical:* Weight changes (n=66, 66%) Headaches (n=36, 36%) Hair loss (n=9, 9%)
ECPS	
Foster, 2006[379]	*Physical:* Nausea (n=307, 75%)
Miller, 2011[367]	*Physical:* Nausea (n=146, 41.2%)
Raymond, 2002[398]	*Physical:* Nausea (n=650, 99%) Trouble breathing (n= 109, 6.7%) Vomiting (n=626, 95.4%) Fever (n=132, 20.2%)
Berglas, 2021[394]	*SRH-related:* Reduce sex drive (n=22, 11%)
Williams, 2021[396]	*SRH-related/ Physical:* Vomiting or irregular bleeding (n=134, 66%)
Implant	
Crosby, 1993[376]	*SRH-related:* Menstrual changes (n=287, 39.8%) *Physical:* Pain at insertion (n=757, 32.1%) Weight changes (n=349, 14.8%) Headaches (n=112, 4.7%) Nausea (n=65, 2.8%)

Frank, 1993[24]	*SRH-related:* Menstrual changes (n=213, 12.2%) *Physical:* Pain (n=212, 39.6%) Concerns about appearance in the arm (n=165, 30.8%) Headaches (n=118, 22.0%)
Bachorik, 2015[400]	*SRH-related:* Irregular bleeding (n=22, 42%)
Hall, 2016	*SRH-related:* Interference with sexual life or enjoyment (n=141, 7.1%) Irregular bleeding or spotting (n=226, 11.4%) Likely to cause harmful bleeding patterns* (n=147, 7.4%) *Physical:* Side effects (i.e., weight gain, mood changes) (n=399, 10.1%) Anticipated pain at insertion (n=379, 19.1%)
Matusiewicz, 2017	*SRH-related:* Menstrual changes (n=7, 8.4%)
Callahan, 2019	*Physical*: Anticipated pain at insertion (mean score = 39.6 mm on 100 mm visual analogue scale)
DeMaria, 2019	*Physical*: Anticipated pain at insertion* (mean score =3.68 ± 1.50 on scale of 1 to 7 (where higher numbers indicate more pain)
Rey, 2020	*SRH-related:* Interference with sexual life or enjoyment (n=6, 3.0%) Irregular bleeding or spotting (n=9, 4.5%) *Physical*: Anticipated pain at insertion (n=23, 11.5%) Side effects (i.e., weight gain, mood changes) (n=24, 12.0%)
Richards, 2020	*SRH-related:* Method-related amenorrhea would be bad for health* (n=73, 22.2%) *Physical:* Would hurt too much to have in* (n=77, 23.1%)
IUD	
Venkat, 2008[35]	*SRH-Related:* Bleed irregularly or more heavily (n=18, 18%)

	Physical: Weight gain (n=7, 7%) Headaches (n=12, 12%) Hair loss (n=4, 4%)
Fleming, 2010[384]	*SRH-Related:* Amenorrhea would be bothersome enough to not use IUD (n=65, 18.1%) Light bleeding between periods for 3 to 6 months would be bothersome enough to not use IUD (n=73, 31.6%) Heavier periods and cramping would be bothersome enough to not use IUD (n=119, 52.0%) *Physical:* Anticipated pain at insertion (n=62, 25%)
Gomez, 2015	*Physical:* Anticipated pain at insertion (n=217, 56.8%)
Hall, 2016	*SRH-related:* Interference with sexual life or enjoyment (n=176, 8.9%) Irregular bleeding or spotting* (n=290, 14.6%) *Physical:* Side effects (i.e., weight gain, mood changes) (n=443, 22.3%) Anticipated pain at insertion (n=483, 24.3%)
Callahan, 2019	*SRH-related:* Menstrual changes (n=5, 5.3%) *Physical*: Anticipated pain at insertion (mean score = 55.6 mm on 100 mm visual analogue scale) Anticipated pain at removal (n=8, 8.4%) Possible pain for a long time (n=5, 5.3%)
DeMaria, 2019	*Physical*: Anticipated pain at insertion* (mean score =3.68 ± 1.50 on scale of 1 (negative association) to 7 (positive association)
Hunter, 2020	*Physical*: Anticipated pain at insertion (median score = 63 mm [IQR: 38, 72] on 100 mm visual analogue scale)
Rey, 2020	*SRH-related:* Interference with sexual life or enjoyment (n=12, 6.0%) *Physical*: Anticipated pain at insertion (n=26, 13.0%) Side effects (i.e., weight gain, mood changes) (n=30, 15.0%) Irregular bleeding or spotting (n=16, 8.0%)

Richards, 2020	*SRH-related:* Interference with sexual life (be felt during sex, hurt during sex) (n=94, 28.3%) *Physical:* Would hurt too much to have in* (n=77, 23.1%)
Edwards, 2021	*Physical*: Weight gain (n= 211, 40.5%)
OCPs	
Peipart, 1993	*Physical*: Weight gain (n=7, 6%) Headaches or migraines (n=7, 6%)
Moore, 1996	*SRH-related:* Menstrual changes (n=219, 63.4%) Likely to decrease sexual pleasure (n=33, 9.6%) *Physical:* Likely to be uncomfortable or painful (n=221, 65%) Likely to affect my physical appearance (n=222, 64%) *Psychological:* Likely to give me guilt feelings (n=224, 65%)
Gilliam, 2003[37]	*Physical*: Nausea and spotting (responses not disaggregated) (n=31, 73.0%)
Davis, 2006[378]	*SRH-related:* Irregular bleeding (n=9, 2.3%) *Physical*: Weight gain (n=61, 15.1%) Nausea (n=45, 11.2%) Headaches (n=22, 5.6%)
Rocca, 2007[381]	*Physical:* Weight gain (n=153, 42%)
Venkat, 2008[35]	*SRH-related:* Bleed irregularly or more heavily (n=34, 34%) *Physical:* Weight gain (n=53, 53%) Headaches (n=37, 37%) Hair loss (n=21, 21%)
Manski, 2016[388]	*SRH-related:*

	Irregular bleeding (n=16, 4%)
Patch	
Venkat, 2008[35]	*SRH-related:* Bleed irregularly or more heavily (n=14, 14%) *Physical:* Weight gain (n=66, 66%) Headaches (n=11, 11%) Hair loss (n=23, 23%)

Table 2.5. Studies reporting beliefs about non-contraceptive benefits (n=20).

Author, year	Benefits Reported
DMPA	
Melbostad, 2020	*SRH-Related:* Protects against STIs** (n=35, 21%)
ECPS	
Jackson, 2000[30]	*SRH-Related:* Protects against STIs (n=70, 18.8%)
Raymond, 2002[398]	*SRH-Related:* Protects against STIs (n=28, 4.2%)
Foster, 2006[379]	*SRH-Related:* Protects against STIs (n=61, 15%)
Schwarz, 2008.	*SRH-related:* Protects against STIs (n=71, 15.9%)
Miller, 2011	*SRH-related:* Protects against STIs (n=77, 21.8%)
Implants	
Bachorik, 2015	*SRH-related:* Protects against STIs (n=5, 9%)
Hoopes, 2016	*SRH-related:* Protects against STIs* (n=28, 28%)
Ingersoll, 2021	*SRH-related:* Protects against STIs* (n=2, 6.7% pre-intervention, n=0, 0% post-intervention) Reduces heavy or painful periods* (n=23, 76.7% pre-intervention, n=30, 100% post-intervention)
IUDs	
Friedman, 2015	*SRH-related:* Decreases menstrual flow (n=31, 39%)
Hoopes, 2016	*SRH-related:* Protects against STIs* (n=28, 28%)
Melbostad, 2020	*SRH-Related:* Protects against STIs** (n=35, 21%)
Stein, 2020	*SRH-Related:* Causes lighter menses or amenorrhea (n=43, 42%) Causes regular menses (n= 19, 19%)
Ingersoll, 2021	*SRH-related:* Protects against STIs* (n=2, 6.7% pre-intervention, n=0, 0% post-intervention) Reduces heavy or painful periods* (n=23, 76.7% pre-intervention, n=30, 100% post-intervention)
OCPs	

Peipart, 1993	*SRH-related:* Causes regular menses (n=42, 17%) Decreases dysmenorrhea (n=18, 7.3%) Causes easier or lighter menses (n=12, 4.9%) Decreases risk of ectopic pregnancy (n=15, 12.5%) Decreases risk of PID (n=14, 11%) *Physical:* Decreases risk of breast cancer (n=7, 2.8%) Decreases risk of ovarian cancer (n=7, 2.8%) Decreases risk of endometrial cancer (n=25, 10.1%) Decreases risk of anemia (n=19, 7.7%) Decreases risk of ovarian cysts (n=19, 2.8%) Decreases risk of benign breast disease (n=6, 5%)
Tessler, 1997	*SRH-related:* Decreases dysmenorrhea (n=222, 66%) Causes lighter menses (n=168, 50%) Decreases risk of ectopic pregnancy (n=30, 9%) Decreases risk of PID (n=33, 10%) *Physical:* Decreases risk of benign breast disease (n=20, 5%) Decreases risk of anemia (n= 37, 11%) Decreases risk of uterine cancer (n=64, 19%) Decreases risk of ovarian cancer (n=77, 23%)
Gilliam, 2003	*SRH-related:* Protects against STIs (n=1, 2.7%)
Sangi-Haghpeykar, 2006.	*SRH-related:* Protects against HIV (n= 22, 5%) Decreases risk of PID (n=13, 3%) Causes regular menses (n=221, 50%) Decreases risk of ectopic pregnancy (n=75, 17%) *Physical:* Decreases risk of ovarian cancer (n=71, 16%) Decreases risk of endometrial cancer (n=13, 3%) Decreases risk of benign breast disease (n=31, 7%)
Weaver, 2009[383]	*SRH-related:* Protects against STIs (mean agreement score: 1.6 on scale of 1-4 where 1 = strongly disagree and 4 = strongly agree)

Matsumoto, 2011	*SRH-related:* Causes regular menses (n=102, 51.9%) Reduces menstrual cramps (n=88, 82.2%) Shortens duration of menstrual periods (n=82, 76.6%) Decreases risk of ectopic pregnancy (n=15, 14.0%) *Physical:* Improves acne or causes beautiful skin (n=84, 78.5%) Improves hirsutism (n=8, 7.5%) Improves anemia (n= 18, *16.8*%) Decreases risk of ovarian cancer (n=19, 17.8%) Decreases risk of endometrial cancer (n=16, 15.0%) Decreases risk of benign breast disease (n=10, 9.3%) Decreases risk of ovarian cysts (n=14, 13.1%)
Craig, 2014	*Physical:* Reduces risk of certain cancers (n = 215, 24%)
Manski, 2016.	*SRH-Related:* Protects against STIs (n=18, 5.2%)
Rosenfeld, 2017[33]	*SRH-Related:* Causes lighter or less crampy menstrual periods (n=1704, 74%)
Melbostad, 2020	*SRH-Related:* Protects against STIs** (n=35, 21%)

Figure 2.2. Bar Chart of proportions reporting concerns about infertility.

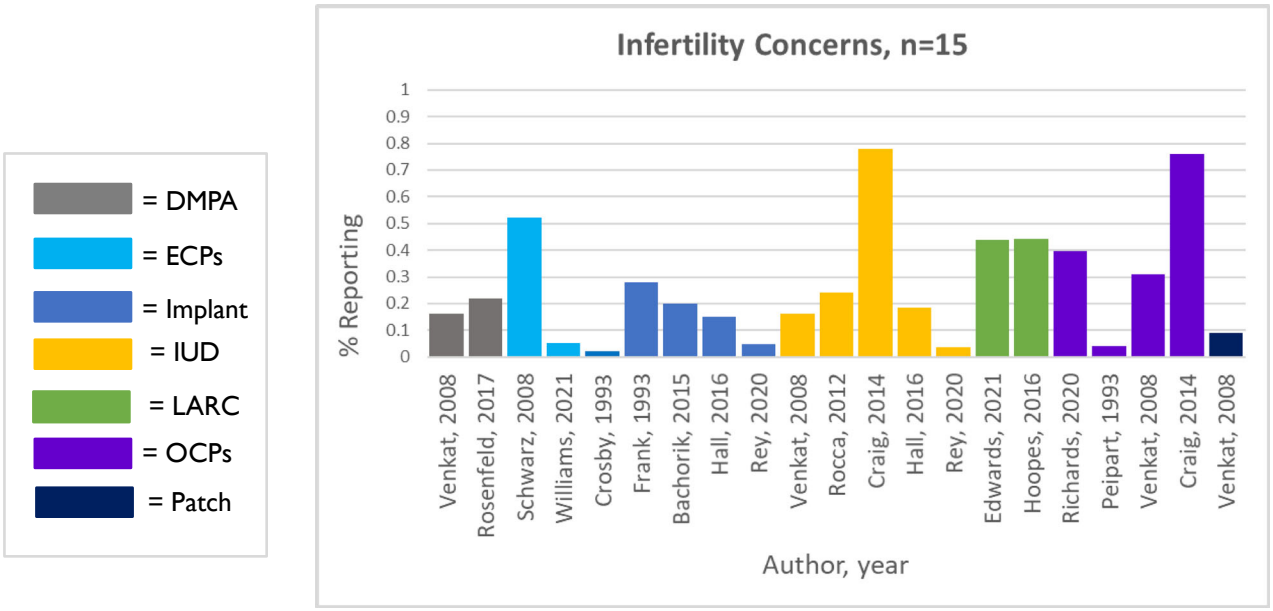


Figure 2.3. Bar Chart of proportions reporting concerns about adverse pregnancy and fetal outcomes.

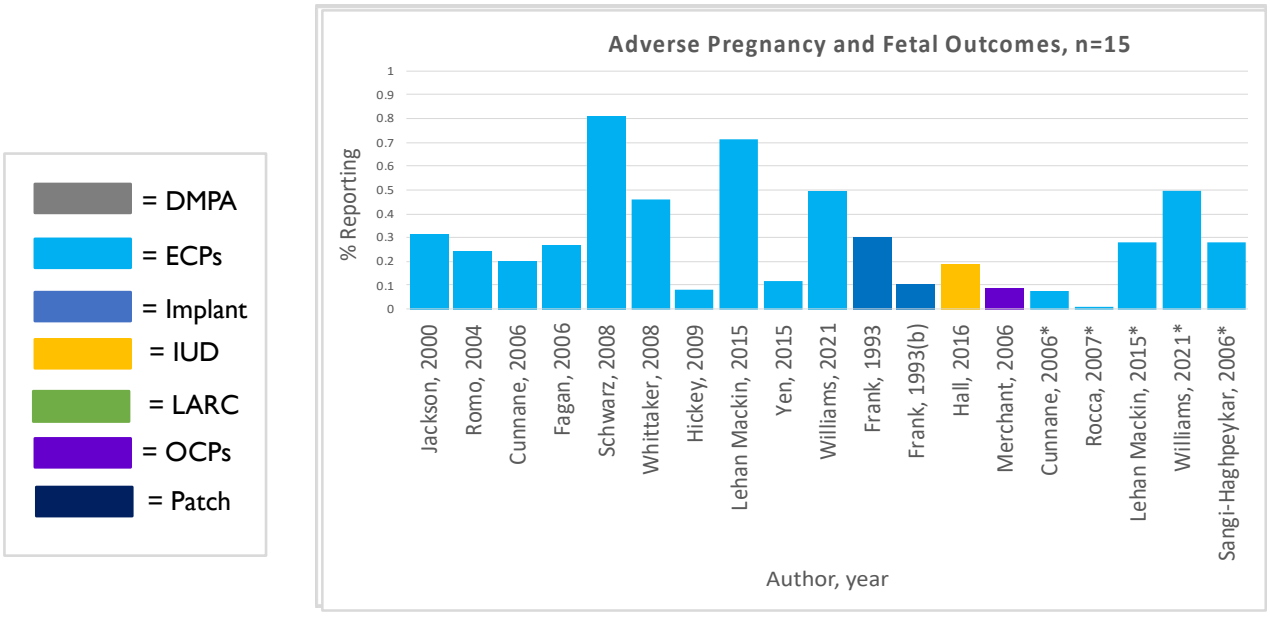


Figure 2.4. Bar Chart of proportions reporting concerns about adverse pregnancy and fetal outcomes.

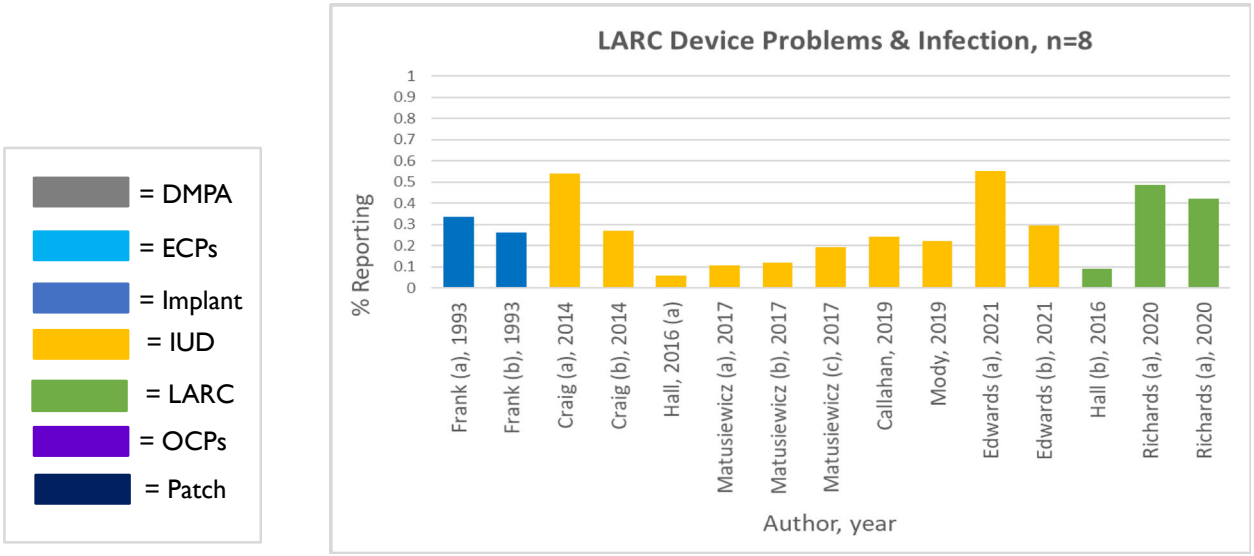


Figure 2.5. Bar Chart of proportions reporting concerns about cancer and blood clots.

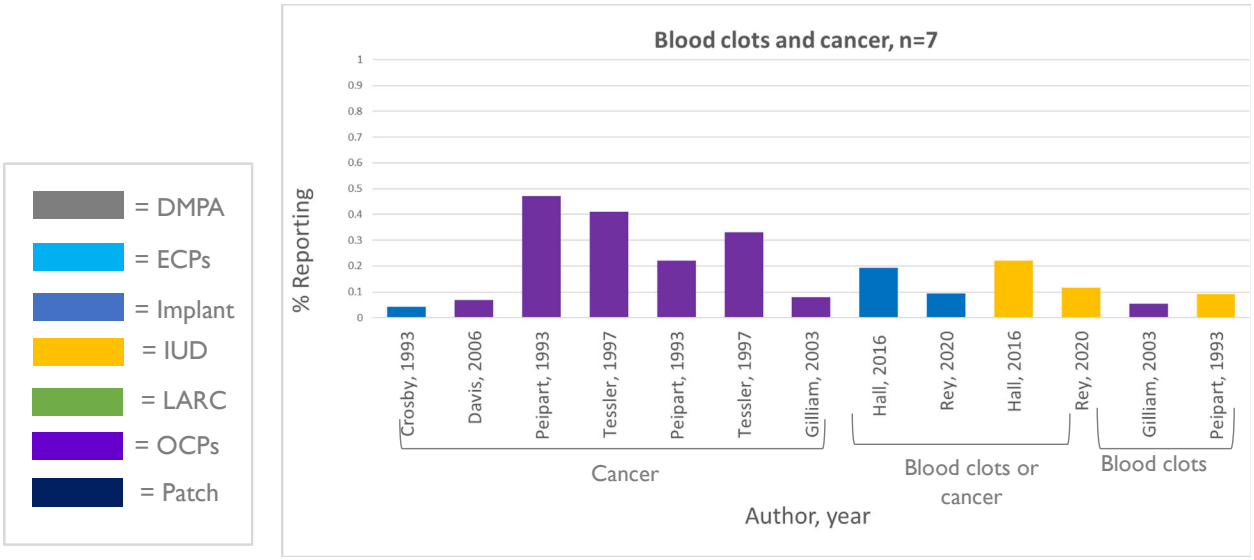


Figure 2.6. Bar Chart of proportions reporting beliefs about menstrual changes

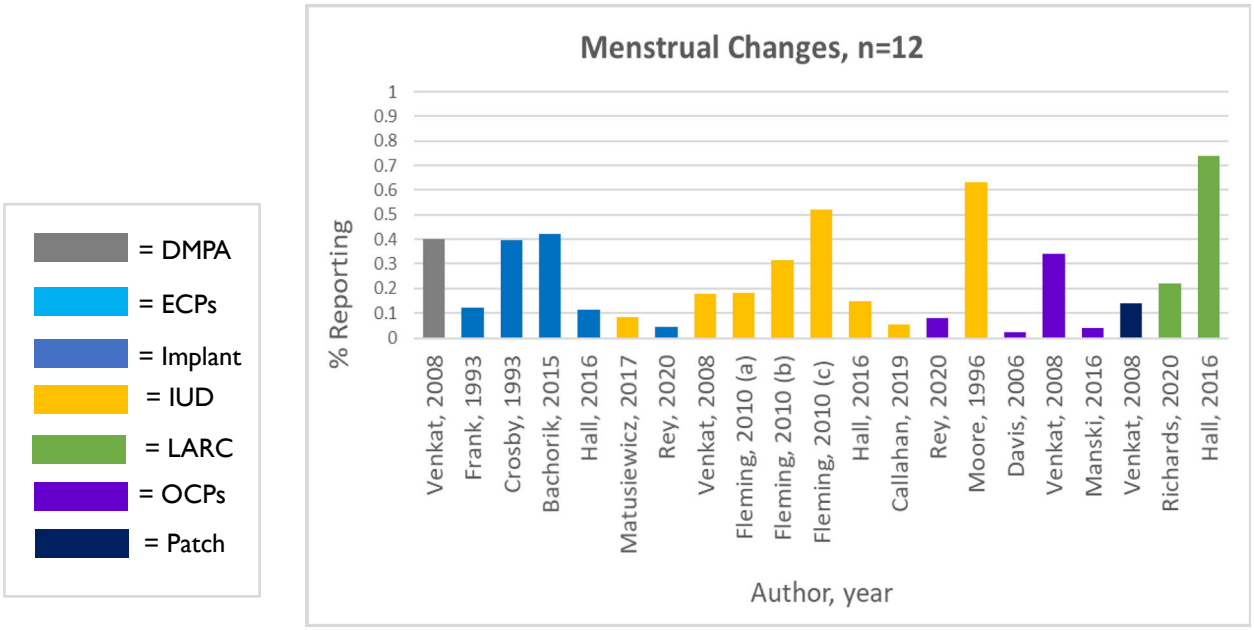


Figure 2.7. Bar Chart of proportions reporting beliefs about pain

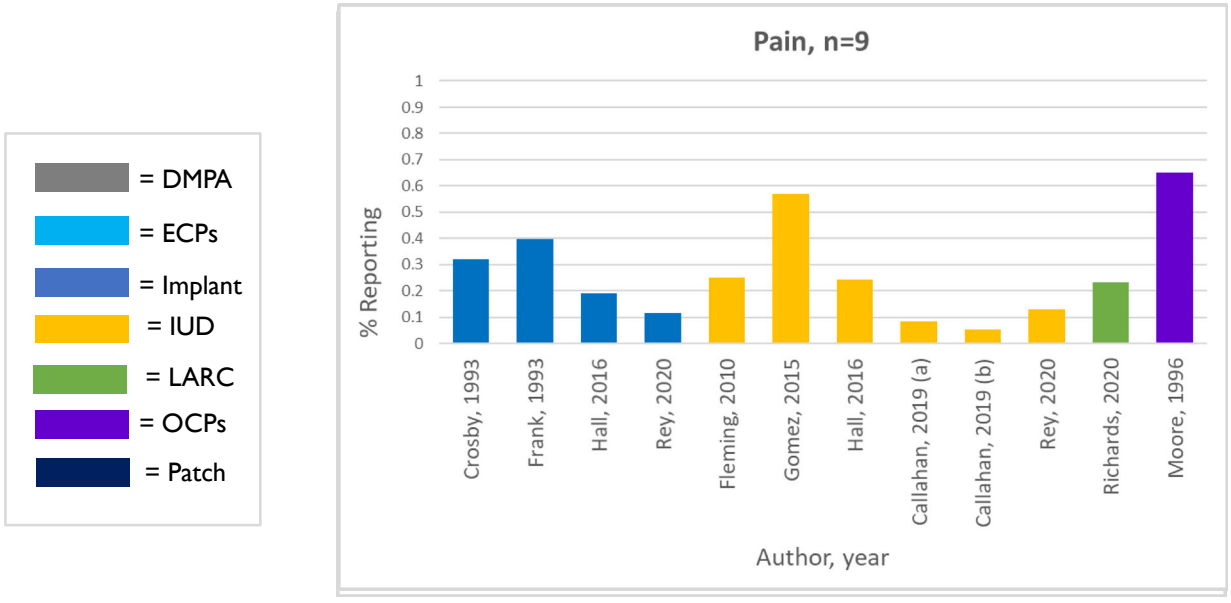


Figure 2.8. Bar Chart of proportions reporting beliefs about sexual side effects

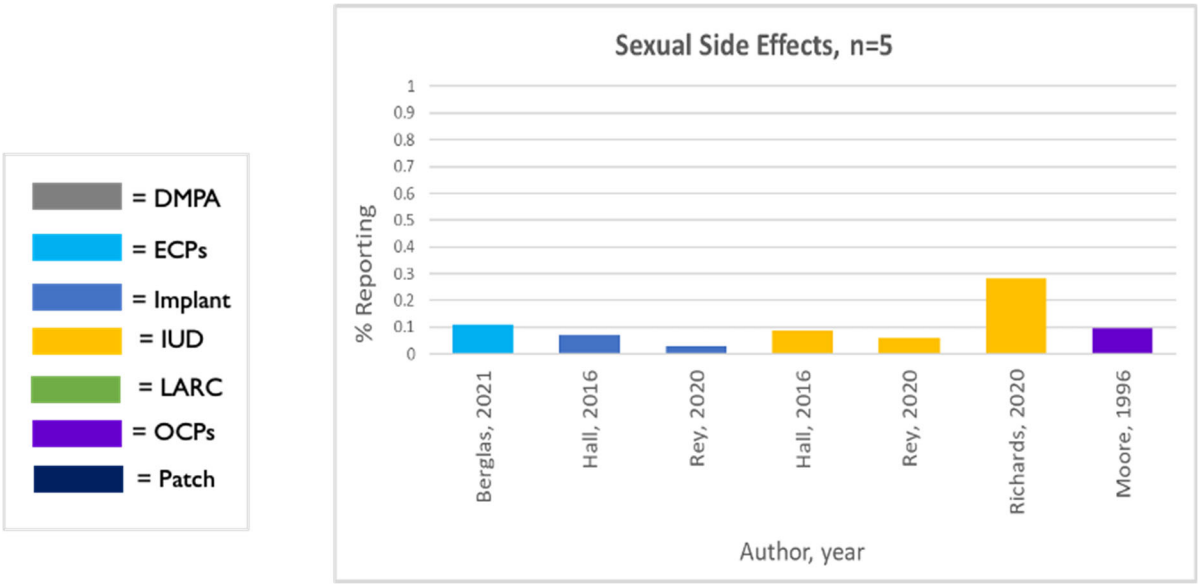


Figure 2.9. Bar Chart of proportions reporting beliefs about protective effects of methods other than condoms or abstinence on STIs.

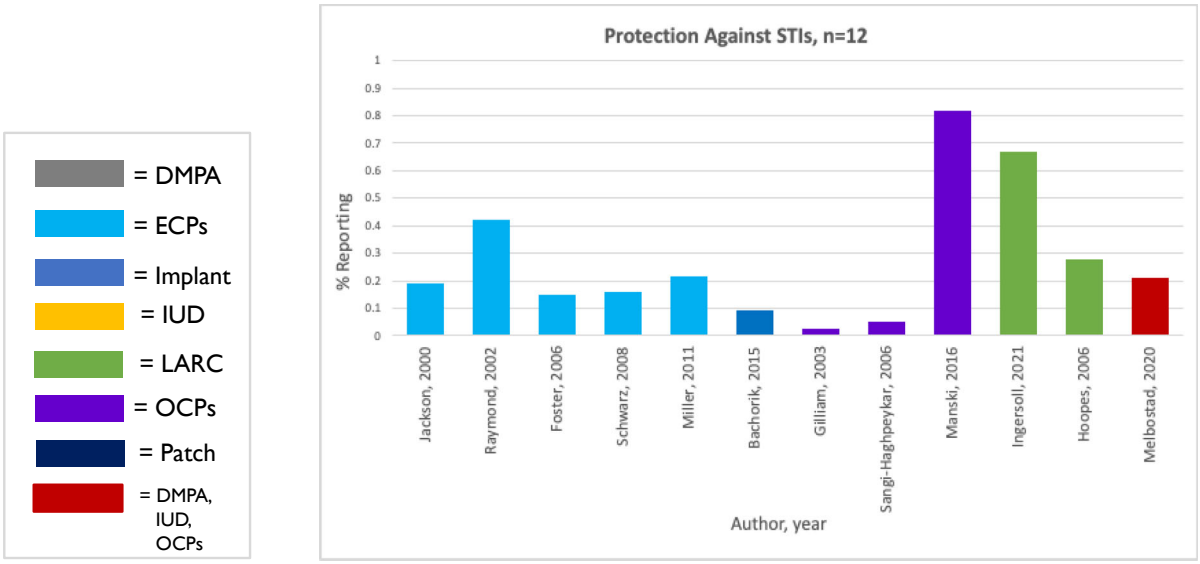


Figure 2.9. Bar Chart of proportions reporting beliefs about protective effects of OCPs on cancer and benign disease.

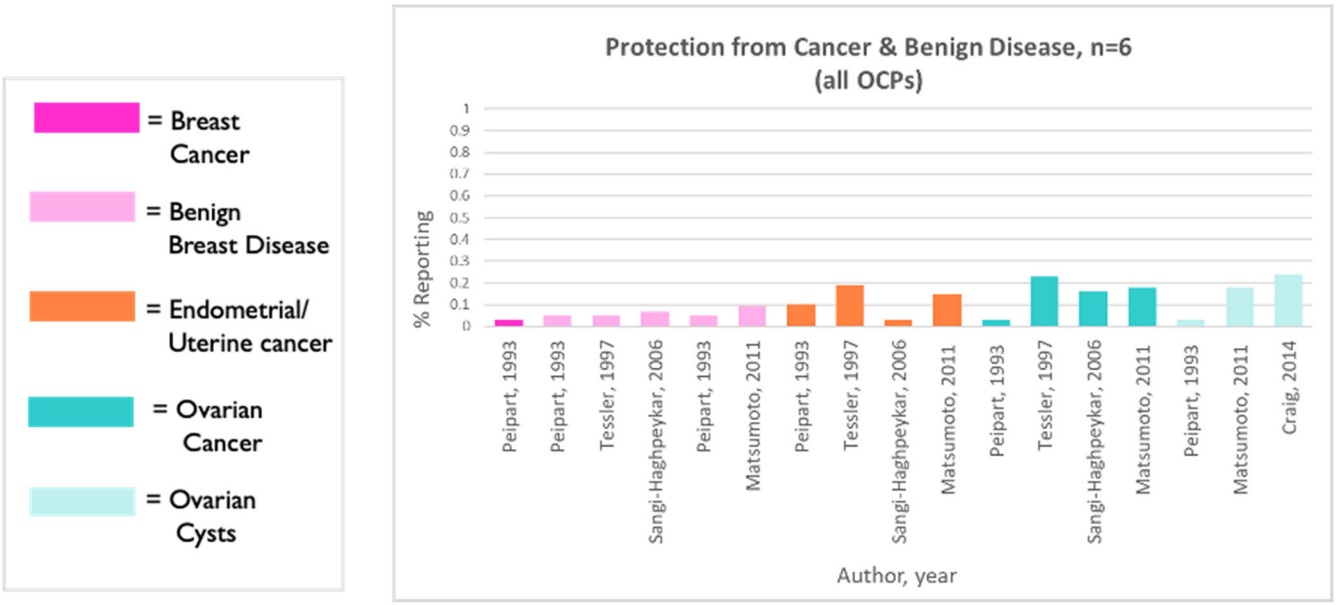


Figure 2.10. Forest Plot Depicting Relationship Between Race/Ethnicity and Odds of Beliefs

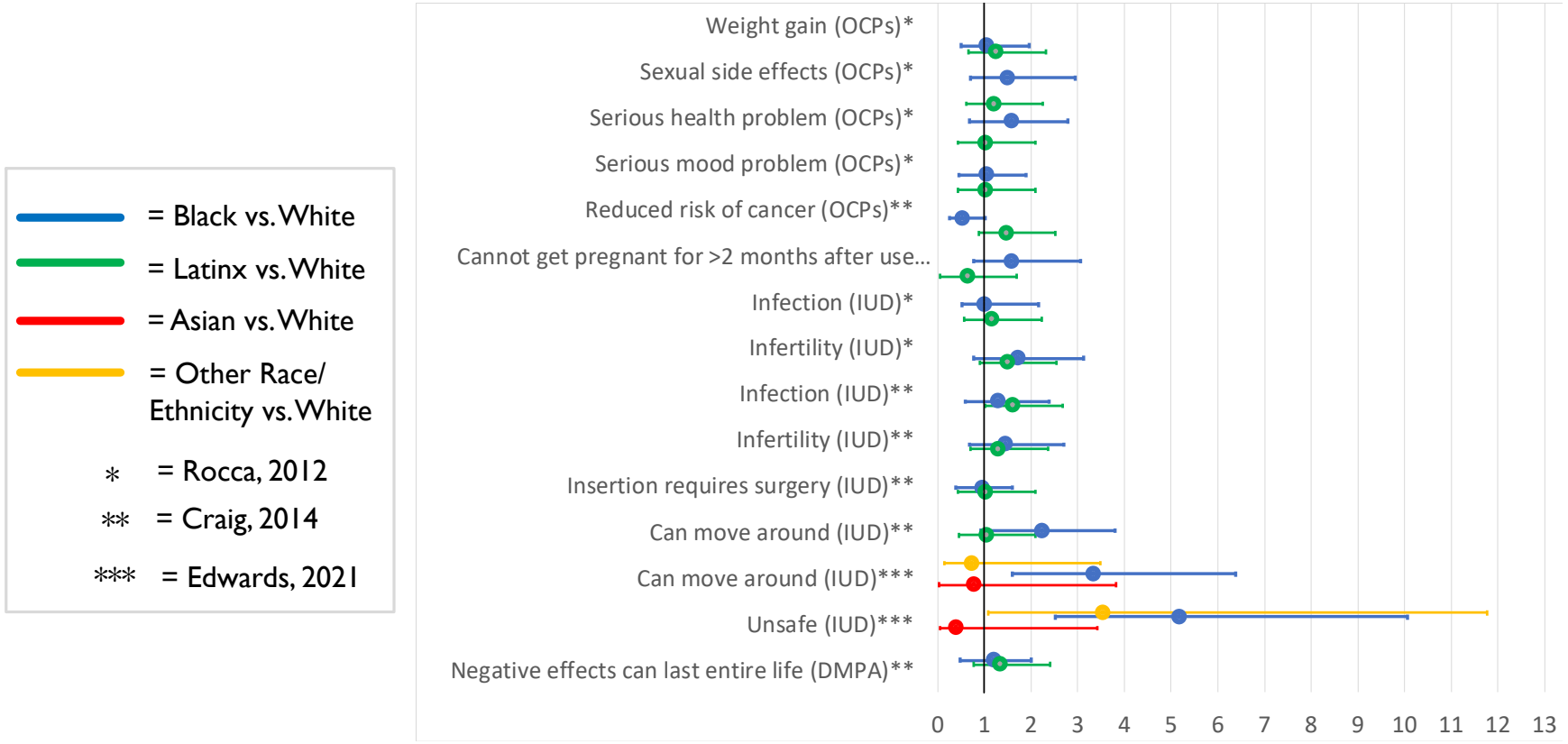
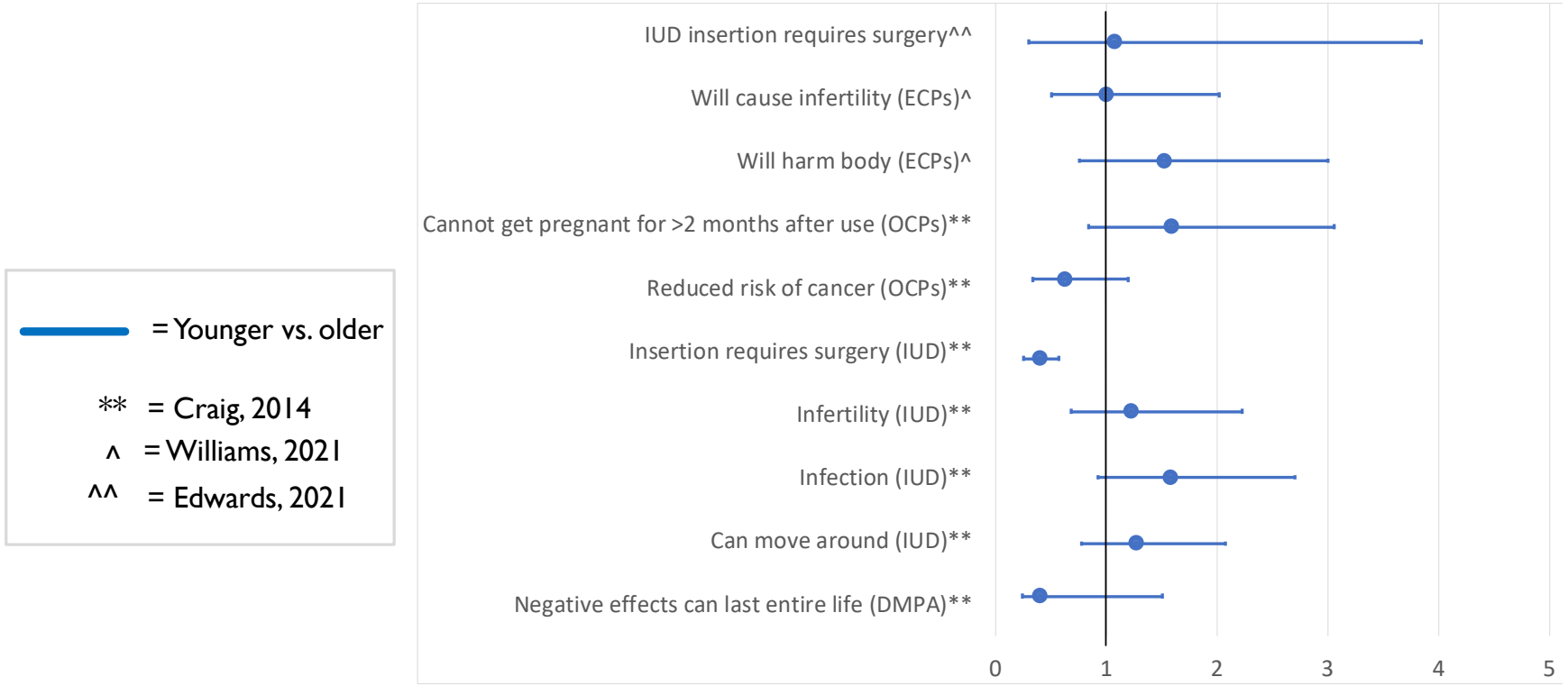


Figure 2.11. Forest Plot Depicting Relationship Between Age and Odds of Beliefs



Appendix 2.A. PRISMA 2020 Checklist.

Section and Topic	Item #	Checklist item	Location where item is reported
TITLE			
Title	1	Identify the report as a systematic review.	Page 1
ABSTRACT			
Abstract	2	See the PRISMA 2020 for Abstracts checklist.	
INTRODUCTION			
Rationale	3	Describe the rationale for the review in the context of existing knowledge.	Pages 1-4
Objectives	4	Provide an explicit statement of the objective(s) or question(s) the review addresses.	Page 4
METHODS			
Eligibility criteria	5	Specify the inclusion and exclusion criteria for the review and how studies were grouped for the syntheses.	Pages 4-6
Information sources	6	Specify all databases, registers, websites, organisations, reference lists and other sources searched or consulted to identify studies. Specify the date when each source was last searched or consulted.	Pages 4-5
Search strategy	7	Present the full search strategies for all databases, registers and websites, including any filters and limits used.	Appendix B
Selection process	8	Specify the methods used to decide whether a study met the inclusion criteria of the review, including how many reviewers screened each record and each report retrieved, whether they worked independently, and if applicable, details of automation tools used in the process.	Page 5
Data collection process	9	Specify the methods used to collect data from reports, including how many reviewers collected data from each report, whether they worked independently, any processes for obtaining or confirming data from study investigators, and if applicable, details of automation tools used in the process.	Page 5
Data items	10a	List and define all outcomes for which data were sought. Specify whether all results that were compatible with each outcome domain in each study were sought (e.g. for all measures, time points, analyses), and if	Pages 5-6

Section and Topic	Item #	Checklist item	Location where item is reported
		not, the methods used to decide which results to collect.	
	10b	List and define all other variables for which data were sought (e.g. participant and intervention characteristics, funding sources). Describe any assumptions made about any missing or unclear information.	Page 5.
Study risk of bias assessment	11	Specify the methods used to assess risk of bias in the included studies, including details of the tool(s) used, how many reviewers assessed each study and whether they worked independently, and if applicable, details of automation tools used in the process.	N/A
Effect measures	12	Specify for each outcome the effect measure(s) (e.g. risk ratio, mean difference) used in the synthesis or presentation of results.	Page 6.
Synthesis methods	13a	Describe the processes used to decide which studies were eligible for each synthesis (e.g. tabulating the study intervention characteristics and comparing against the planned groups for each synthesis (item #5)).	Pages 4-6
	13b	Describe any methods required to prepare the data for presentation or synthesis, such as handling of missing summary statistics, or data conversions.	N/A
	13c	Describe any methods used to tabulate or visually display results of individual studies and syntheses.	Pages 5-6
	13d	Describe any methods used to synthesize results and provide a rationale for the choice(s). If meta-analysis was performed, describe the model(s), method(s) to identify the presence and extent of statistical heterogeneity, and software package(s) used.	N/A
	13e	Describe any methods used to explore possible causes of heterogeneity among study results (e.g. subgroup analysis, meta-regression).	N/A
	13f	Describe any sensitivity analyses conducted to assess robustness of the synthesized results.	N/A
Reporting bias assessment	14	Describe any methods used to assess risk of bias due to missing results in a synthesis (arising from reporting biases).	N/A
Certainty assessment	15	Describe any methods used to assess certainty (or confidence) in the body of evidence for an outcome.	Page 5
RESULTS			
Study selection	16a	Describe the results of the search and selection process, from the number of records identified in the search to the number of studies included in the review, ideally using a flow diagram.	Figure 1

Section and Topic	Item #	Checklist item	Location where item is reported
	16b	Cite studies that might appear to meet the inclusion criteria, but which were excluded, and explain why they were excluded.	Pages 5, 19-20
Study characteristics	17	Cite each included study and present its characteristics.	Table 1.
Risk of bias in studies	18	Present assessments of risk of bias for each included study.	N/A
Results of individual studies	19	For all outcomes, present, for each study: (a) summary statistics for each group (where appropriate) and (b) an effect estimate and its precision (e.g. confidence/credible interval), ideally using structured tables or plots.	Table 1
Results of syntheses	20a	For each synthesis, briefly summarise the characteristics and risk of bias among contributing studies.	N/A
	20b	Present results of all statistical syntheses conducted. If meta-analysis was done, present for each the summary estimate and its precision (e.g. confidence/credible interval) and measures of statistical heterogeneity. If comparing groups, describe the direction of the effect.	N/A
	20c	Present results of all investigations of possible causes of heterogeneity among study results.	N/A
	20d	Present results of all sensitivity analyses conducted to assess the robustness of the synthesized results.	N/A
Reporting biases	21	Present assessments of risk of bias due to missing results (arising from reporting biases) for each synthesis assessed.	
Certainty of evidence	22	Present assessments of certainty (or confidence) in the body of evidence for each outcome assessed.	Table 1
DISCUSSION			
Discussion	23a	Provide a general interpretation of the results in the context of other evidence.	Page 18-21
	23b	Discuss any limitations of the evidence included in the review.	Page 18
	23c	Discuss any limitations of the review processes used.	Pages 19-20
	23d	Discuss implications of the results for practice, policy, and future research.	Pages 18-21

Section and Topic	Item #	Checklist item	Location where item is reported
OTHER INFORMATION			
Registration and protocol	24a	Provide registration information for the review, including register name and registration number, or state that the review was not registered.	Page 1
	24b	Indicate where the review protocol can be accessed, or state that a protocol was not prepared.	Page 1
	24c	Describe and explain any amendments to information provided at registration or in the protocol.	Page 19.
Support	25	Describe sources of financial or non-financial support for the review, and the role of the funders or sponsors in the review.	N/A
Competing interests	26	Declare any competing interests of review authors.	N/A
Availability of data, code and other materials	27	Report which of the following are publicly available and where they can be found: template data collection forms; data extracted from included studies; data used for all analyses; analytic code; any other materials used in the review.	Page 5

From: Page MJ, McKenzie JE, Bossuyt PM, Boutron I, Hoffmann TC, Mulrow CD, et al. The PRISMA 2020 statement: an updated guideline for reporting systematic reviews. BMJ 2021;372:n71.

Appendix 2.B. Search Terms.

PubMed: (contracept* OR “birth control” OR “family planning” OR "Contraceptive Agents, Female"[Mesh] OR "Long-Acting Reversible Contraception"[Mesh] OR "Contraception Behavior"[Mesh] OR "Contraception"[Mesh] OR "Contraceptive Devices"[Mesh] OR "Contraceptives, Oral"[Mesh] OR "Progestins"[Mesh] OR "Intrauterine Devices"[Mesh]) AND (Concern OR belief OR fear OR misconception OR misperception OR reluctance OR non-use OR misinformation OR myth OR "Perception"[Mesh] OR "Health Knowledge, Attitudes, Practice"[MeSH Terms] OR "Choice Behavior"[Mesh] OR "Decision Making"[Mesh] OR "Treatment Adherence and Compliance"[Mesh] OR "Medication Adherence"[Mesh]) AND (health OR risk OR safety OR "side effects" OR “Adverse event” OR "Drug-Related Side Effects and Adverse Reactions"[Mesh]) Filters: Publication date from 1980/01/01; Humans; English

CINAHL: (contraception OR “birth control” OR “family planning”) AND (concern OR belief OR fear OR fearful OR afraid OR misconception OR perception OR misperception OR reluctance OR determinants OR non-use OR misinformation OR myth OR side effect)) AND (safety OR "side effects" OR “Adverse event”)
Limiters - Publication Year: 1980-2019; Peer Reviewed; Geographic Subset: USA; Language: English
Expanders - Apply equivalent subjects; Also search for related words (synonyms and plurals)
Search modes - Boolean/Phrase

PsycINFO: (contraception OR "birth control" OR "family planning") AND ((concern OR belief OR fear OR fearful OR afraid OR misconception OR pereption OR misperception OR reluctance OR determinants OR non-use OR misinformation OR myth OR side effect) AND (health OR safety OR "side effects" OR “Adverse event”)
Limiters - Publication Year: 1980-2019
Peer Reviewed: Publication Type: Peer Reviewed Journal
Language: English

Expanders - Apply equivalent subjects; Also search for related words (synonyms and plurals)
Search modes - Boolean/Phrase

Cochrane: ((contracept* OR "birth control" OR "family planning") AND (concern OR belief OR fear OR fearful OR afraid OR misconception OR perception OR misperception OR reluctance OR determinants OR non-use OR misinformation OR myth OR side effect) AND (health OR safety OR "side effects" OR “Adverse event”)):ti,ab,kw (Word variations have been searched)

Limitations: Cochrane Library publication date from Jan 1980 to Oct 2019, in Cochrane Reviews
Expanders: Word variations have been searched.

Chapter 3: Safety concerns and contraceptive method use among young people who can get pregnant in Atlanta, GA

Abstract

Objective(s): To assess whether concerns about contraceptive-related adverse events (AEs) were associated with use of less effectiveness contraceptive methods among a cohort of young people who can get pregnant in Atlanta, GA

Study Design: We analyzed baseline and monthly psychosocial survey data from a community-based cohort study of 148 biologically female people aged 15-24. At baseline, participants reported whether concern about four contraceptive-related adverse events had ever prevented them from using a contraceptive method: serious health problems, side effects, bleeding, and pain. We categorized contraceptive use, by effectiveness tiers: no method (tier 0), low effectiveness (tier 1), moderately effective (tier 2), and highly effective (tier 3). Tier 3 was used as the reference group. We used multinomial logistic regression to assess whether participants' concerns were associated with use of less effective methods, controlling for sociodemographics and sexual and reproductive history. Random intercepts in the growth curve models allowed for heterogeneity in baseline odds of method tier.

Results: At baseline, 67.12% of participants reported at least one contraceptive concern, with a mean of 1.81 (SD: 1.65) concerns. Participants most frequently reported concerns about side effects (60.81%). In multivariable models using baseline data, concerns about side effects (aOR 4.33, 95% CI: [1.10, 17.04]), pain (aOR 4.76, 95% CI: [1.18, 19.22]), and any contraceptive-related AE (aOR 6.08, 95% CI: [1.35, 27.36]) were associated with increased odds of reporting a tier 1 rather than tier 3 method as the most effective method ever used. For current method use, concern about serious health problems, side effects, pain, bleeding, and having at least one contraceptive-safety concern were associated with greater odds of using a tier 1 method rather than a tier 3 method (range aOR 4.77, 95% CI: [1.19, 19.18] for concerns about bleeding – aOR 34.55, 95% CI: [3.36, 355.42] for any concern). Concern about serious health

problems (aOR 3.27, 95% CI: [1.13, 9.43]) and having any contraceptive safety concern (aOR 2.72, 95% CI: [1.02, 7.24]) were associated with increased odds of currently using no method rather than a tier 3 method; concern about pain was associated with current use of a tier 2 method (aOR: 2.25, 95% CI: [1.54, 21.62]) rather than a tier 3 method. In longitudinal models, all contraceptive concern indicators except bleeding were associated with use of less effective methods rather than tier 3 methods over 11 months of follow-up data.

Conclusion(s): Participants who were concerned about contraceptive-related side effects used less effective contraception methods. Findings suggest that more patient-centered approaches to contraceptive counseling and education approaches can better address contraceptive safety to support informed decision-making.

Introduction

Unintended pregnancies (UIPs), i.e., pregnancies that are either unwanted or mistimed, are associated with increased risk for adverse maternal and child health outcomes in the United States of America (U.S.) and worldwide.[1-3] According to the most recently available estimates, approximately 45% of U.S. pregnancies are unintended.[2, 4] Rates vary by age, race, socioeconomic status, and geography. Younger people who can get pregnant, people of color, those with low socioeconomic status, and people in certain regions of the country (e.g. Southern states, rural residing), shoulder a higher burden of UIP as compared to people who are older, White, have high SES, or live in other parts of the country.[2, 4-9] Among people who can get pregnant aged 15-19 years old, approximately 75% of pregnancies are unintended.[2, 4, 5]

Pregnancy and childbearing during adolescence is associated with a host of social and health sequelae. Pregnant adolescents and adolescent mothers are more likely to use tobacco, alcohol, and other drugs compared with nulligravid adolescents.[52, 53, 56, 411] Pregnant adolescents have higher rates of adverse perinatal outcomes, including preeclampsia, preterm birth, low birth weight babies, stillbirth and miscarriage compared with older pregnant people.[53] Thirty five percent of adolescents who have been pregnant experience a rapid repeat pregnancy, a pregnancy within two years of a prior pregnancy, putting them at further risk for adverse pregnancy outcomes compared to mothers not experiencing a rapid repeat pregnancy.[54] For adolescents, UIP and unintended birth are associated with adverse social and economic outcomes, such as higher rates of high school dropout.[56]

Since young people who can get pregnant are generally highly fecund,[54] correct, consistent, voluntary, and medically appropriate contraceptive use is key for UIP prevention for those who have sex with male partners. Recent declines in the UIP rate in the U.S. are likely attributable to increases in contraceptive use and use of more effective contraceptive methods across the population.[4] Contraceptive methods vary widely in terms of ease-of-use and subsequent effectiveness.[71] Contraceptive methods can be grouped into three tiers based on method effectiveness under typical-use conditions.[71] The highest effectiveness tier includes: permanent sterilization and long-acting reversible contraceptive (LARC)

methods, which include the levonorgestrel-containing (LNG) intrauterine device (IUD), the copper (Cu) IUD, and the subdermal etonorgestrel-containing (ENG) implant. Typical use failure rates for these methods range from 0.05 to 0.08 pregnancies per 100 women per year.[71] The second effectiveness tier includes: the combined oral contraceptive pill (COC), the hormonal vaginal ring, and the transdermal patch, each of which contain both estrogen and progestin; the progestin-containing injectable contraceptive, depot medroxyprogesterone acetate (DMPA) and progestin-only oral contraceptive pills (OCPs). While these methods are comparable to LARC methods or sterilization when used perfectly, typical use of these methods results in 6-9 pregnancies per 100 women per year.[71] Methods in the lowest effectiveness tier include: barrier methods (the diaphragm, the male and female condom, the contraceptive sponge), withdrawal, spermicide, and fertility awareness based methods. Use of these methods typically results in 12-28 pregnancies per 100 women per year.[71]

Highly effective methods are used less frequently than less effective methods across age groups. In the 2017-2019 National Survey of Family Growth, 96% of young women aged 15-24 years old who had ever had vaginal sex with a male reported ever using condoms, 70% reported ever using withdrawal, and 63% reported ever using an oral contraceptive pill. Conversely, only 12% of individuals in this age group report ever using an IUD and only 11% report ever using an implant.[412]

Drivers of contraceptive method non-use are multi-faceted and complex. Structural barriers, such as method cost and poor availability of family planning providers in certain settings prevent individuals from accessing prescription methods and those that require a healthcare provider to insert or remove.[158, 316, 336, 337] Among young people, lack of adolescent-friendly reproductive healthcare, discomfort, concerns about parental approval, beliefs and attitudes, and peer norms may inhibit contraceptive use or lead people to choose more familiar methods, like OCPs and condoms, instead of methods with lower typical use failure rates.[158, 316, 337, 338]

Further, method effectiveness is not the only factor that individuals consider when selecting a method. In an analysis of contraceptive CHOICE project participants, effectiveness was the most important contraceptive method attribute for only 44% of the sample, followed closely by safety, ranked

as the most important attribute by 38% of participants.[355] As with any pharmaceutical intervention, adverse events (AEs) and side effects are possible with use of any contraceptive methods, particularly hormonal methods and IUDs.

Serious adverse events (SAEs) associated with contraceptive use, though rare, do occur. SAEs observed during clinical trials or reported during post-marketing surveillance are listed in product prescribing information and occasionally reported in the news media, which may trigger concern among potential users. Such findings have attracted the attention of national and international media outlets, often without appropriate nuance or context (e.g., by specifying sub-populations at heightened risk or contextualizing risks in relation to risk of such events during pregnancy).[413, 414] Two well-known examples include media coverage of a link between drospirenone-containing oral contraceptive pills (such as those sold under the brand name "Yaz") and increased risk of venous thromboembolic events (VTE),[413, 415, 416] and the association between the Dalkon Shield IUD and increased risk of pelvic inflammatory disease (PID) and other SAEs, including mortality.[417] Importantly, absolute risk of VTE remains very low for healthy people of reproductive age, and today's IUDs bear virtually no resemblance to the Dalkon Shield, messages that may be lost when these findings are reported in non-scientific avenues.[78-83]

The U.S. Centers for Disease Control and Prevention (CDC), issues the U.S. Medical Eligibility Criteria for Contraceptive Use (U.S. MEC), evidence-based guidelines that provide over 1800 recommendations for contraceptive method use by individuals with medical conditions or personal characteristics that might cause providers to question their eligibility to use certain methods.[17] Two stated goals of the U.S. MEC are to "address misconceptions regarding who can safely use contraception" and "remove unnecessary medical barriers to accessing and using contraception."[17, 72] From this perspective, misconceptions about contraceptive safety may be a greater barrier than actual medical contraindications. According to the U.S. MEC most people who can get pregnant, including adolescents, can safely use most contraceptive methods,17 with very low risk of experiencing an SAE. However, some evidence

indicates that concern about contraceptive-related AEs serves as a barrier to method use for some people.[21]

In a nationally representative survey of U.S. young adults ("The Fog Zone"), 50% of participants reported believing that hormonal method use would lead to cancer or another SAE, 30% believed IUD use caused infection, 36% believed that OCPs caused weight gain, and 40% believed OCP use could lead to severe mood swings.[21] Importantly, none of these relationships are well-supported by the literature, but participants reported that these concerns reduced their likelihood of using these methods. Evidence of the relationship between concerns about AEs and contraceptive non-use is supported elsewhere in the quantitative and qualitative literature.[25, 109-111, 123, 134, 158, 316, 418] These findings are troubling given clinical evidence of rarity of SAEs among healthy young contraceptive users.[17, 81] The apparent disconnect between concern about documented rates of AEs suggests that people may overestimate risk and make decisions about contraceptive use based on this inflated perceived risk. Yet, research to date has failed to provide an adequate understanding of perceptions and experiences with contraceptive related side effects and AE's shape use of different methods and thus risk of UIP among young people who can get pregnant.

This phenomenon deserves further exploration, as misconceptions about contraceptive safety may be easily correctible through evidence-based contraceptive counseling and comprehensive sexuality education. Improving access to and providing accurate information about contraceptives can only help adolescents make informed, healthy decisions about their reproductive lives. The objective of this study is to assess the relationship between self-reported concerns about contraceptive-related AEs and method use among a cohort of biologically female young people in Atlanta, GA.

Methods

Study Overview

The Young Women's Stress Study (YWSS) was a prospective cohort study of 200 young people who can get pregnant in the Atlanta, GA metropolitan area. The primary aim of the YWSS was to explore the relationship between risk of unintended pregnancy and stressful life experiences, clinical markers of

stress and fecundity, and other social and biological predictors. Participants were recruited through social media, from community centers, public events, local family planning clinics, and via word-of-mouth. Individuals were eligible if they were aged 15-24 years at screening, were biologically female (sex assigned as female at birth), were fluent in English, were not pregnant at enrollment, had no known history of primary amenorrhea (never having had a menstrual period), ovarian disease, or reproductive cancers, and had access to a smartphone or computer for completion of monthly follow-up surveys. At baseline, participants completed a comprehensive interviewer-administered survey which gathered information on multiple dimensions of their sexual and reproductive health, mental and physical health and social wellbeing. Participants then enrolled in the longitudinal portion of the study, completing monthly internet-based follow-up surveys for one year, which collected abbreviated information from the baseline assessment and dynamic measures of their health experiences and social context. At 12 months, participants completed a final in-person interviewer-administered comprehensive survey assessment. All participants were compensated for participation (a $50 electronic gift card for completing in-person baseline and follow-up interviews and $10 for every two monthly surveys completed). For the present analysis, we restricted the sample to 148 participants who reported ever having vaginal sex with a male partner by baseline.

Measures

Independent variables

The YWSS includes a 24-item scale that measures multi-level barriers to contraceptive use, adapted from prior research by Hall et al's study on barriers to LARC use among college women.[25] The stem for the question is: "Have any of the following reasons ever prevented you from using a prescription or medical contraceptive method—that is one that you have to obtain from a healthcare provider or facility, for example pills, patch, ring, shot, IUD, implant (either now or in the past)…?". Response options are binary (yes/ no). Items cover individual, interpersonal, and institutional/ health systems-level

barriers to contraceptive use.[25] Participants could report multiple reasons for non-use or indicate that no such barriers had ever prevented them from using a method. For this study, we assessed the relationship between method use and each of five reasons for contraceptive non-use related specifically to contraceptive side effects and safety concerns, including: "You are worried about serious health problems (for example blood clots, cancer)," "You are worried about side effects (for example weight gain, mood changes)," "You are worried about irregular bleeding or spotting," "You are worried about pain," and "You are worried about such method interfering with your sexual life or sexual enjoyment." We analyzed each of these independent variables separately. We then created a composite binary measure indicating whether or not participants had one or more contraceptive safety concerns (any concerns) and a count variable indicating the number of contraceptive safety concerns endorsed by a participant. We hypothesized that participants who endorsed any of these items would have greater odds of using a less effective contraceptive method, with the magnitude of effects strongest among those reporting multiple concerns and with magnitudes of effects varying across the different types or levels of concerns (e.g. effects stronger for serious health problem concerns vs bleeding or spotting).

Dependent variables

Contraceptive method use was conceptualized in terms of method effectiveness, as has been widely done in prior related research and by CDC and WHO guidance.17, 18 At baseline, participants responded to a series of questions about whether they were currently using or had ever used a series of 13 contraceptive methods. Method use was coded as: no method (tier 0), a lower effectiveness method (condom, withdrawal, emergency contraception, barrier method other than condom, spermicide, or natural family planning) (tier 1), a moderately effective method (OCPs, patch, ring or injection) (tier 2), or a highly effective LARC method (tier 3). The YWSS questionnaire did not ask participants about sterilization. For participants reporting use of multiple methods, responses were top coded to the most effective method type. For example, participants who reported using both condoms and an IUD were coded as tier 3. In monthly surveys, participants reported each method they had used in the previous

month. We used LARC use as a reference group in order to model the odds of using a less effective method among participants reporting contraceptive-related safety concerns. We conducted two sets of cross-sectional analyses using baseline data, first using lifetime (ever) method use as a dependent variable and second using current method use. We conducted longitudinal analyses using -varying monthly measures of contraceptive method use as a dependent variable. All analyses used baseline data on contraceptive safety concern as a predictor of method use.

Moderators

We assessed moderation between each of the contraceptive safety concern variables and 1) exposure to negative information about contraception in the media, and 2) negative vicarious contraceptive experiences (events experienced by family members of friends that have influenced participants' perceptions of contraceptive methods). We used two additional items from 24-item barriers to contraceptive use scale: "You have heard bad things about such methods on TV or in the newspaper." The second read: "Your friends or relatives have had bad experiences with such methods."

Covariates

We controlled for the following sociodemographic and SRH history factors that have been found to be associated with contraceptive method use in the literature and our team's prior work: age,[419] race,[419, 420] age at sexual debut,[421] frequency of sexual intercourse,[422, 423] lifetime number of sexual partners,[424] lifetime history of pregnancy, use of alcohol or drugs at last sex,[425-427] health insurance status,[428-430] and use of healthcare in the past year (a proxy for healthcare access). Age was measured continuously; all other covariates were categorical variables. Race was a five-category variable. Participants were asked to select the race or ethnicity category with which they usually identify. Response options were: Black or African American, White, Hispanic or Latino, Asian or Pacific Islander, American Indian, Alaskan

Native, Native Hawaiian, Biracial, Multiracial, or another race or ethnicity. Age at sexual debut, lifetime number of sexual partners, insurance status, and relationship status were all three-level variables. Response options for frequency of sexual intercourse were: once a week or more frequently, a few times a month to every two months, or a few times a year or less often. Response options for lifetime number of sexual partners were: 1-2 partners, 3-5 partners, or more than 5 partners. Participants were also asked to indicate their primary source of insurance. Response options were: no insurance or participant did not know whether or not they had insurance, own plan, or a parent's insurance plan. For relationship status, participants indicated whether they were in a serious relationship, a casual dating or sexual relationship, or no relationship. Lifetime history of pregnancy, use of alcohol or drugs at past sex, and healthcare access in the past year were all binary (yes/no) variables. Not all multivariable models were able to control for all covariates simultaneously. Given our relatively small sample and modeling a multinomial outcome, issues with model convergence and model over-parameterization occurred. For example, we were unable to control for race in multivariable models, as no White participants reported that they had never used any method. We conducted sensitivity analyses to test different combinations of covariates and their influence on our main effects of interest. We present reduced models as final versions.

Analysis

We used univariate statistics (frequencies and proportions for categorical variables, means and standard deviations for continuous variables) to describe the sample. We conducted bivariate statistics, including student's t-tests, analysis of variance (ANOVA), chi squared tests, and Fisher's exact tests, to examine associations between our contraceptive-related concerns independent variables, our contraceptive method use outcome variables, moderators and covariates.

In multivariable analyses, we first used cross-sectional baseline data to assess relationships between the independent variables and two different contraceptive effectiveness use outcomes: the most effective method a participant had ever used at baseline, the most effective method a participant was

currently using at baseline, using multivariable multinomial logistic regression. To assess moderation, we added interaction terms (moderators*concern IVs). We added in covariates iteratively until models failed to converge or we observed quasi-complete separation of data points, which results in confidence limits approaching -∞ and/or ∞. For this reason, we were unable to control for race or present stratified models for each racial/ethnic group. However, we assessed relationships among Black participants specifically to examine whether relationships differed within this group compared to the full sample. We chose to examine Black participants because this was the largest racial group and because some literature suggests that Black participants might report contraceptive safety concerns at higher rates than individuals from other groups.[22, 23, 33] We were unable to model the odds of most effective method ever used given concerns about sexual life or enjoyment, since no participants who endorsed this item reported never using a method. We retained covariates that reflected demographics, healthcare access-related characteristics, sexual history and pregnancy risk. Fully adjusted reduced models included: age, frequency of sex, age at sexual debut, history of pregnancy, number of sexual partners, and insurance status. To assess model fit, we examined Deviance and Pearson's chi squared goodness of fit statistics, as well as Hosmer and Lemeshow's Test. Results from model fit assessment can be found in **Appendix 3.A**.

In our analyses of longitudinal outcomes data, we used generalized linear mixed models to assess the relationship between monthly contraceptive method use over 12 months and baseline contraceptive-safety concerns. We first assessed bivariate relationships and then added covariates iteratively. Due to model convergence failure when more than three parameters were included in longitudinal models, we were only able to control for frequency of sex and history of pregnancy in longitudinal models. These covariates were selected due to their relationship with pregnancy risk and successful model convergence when they were included. We incorporated random intercepts into all models, allowing for heterogeneity in baseline odds of an individual using a method in a particular effectiveness tier. Restricted maximum likelihood estimation was used to estimate longitudinal models, with unstructured covariance matrices. We included only baseline independent variables and covariates to ensure temporality. Multiple imputation was used for missing data for independent variables and covariates in all multivariable

models. In multiple imputation models, fully conditional specification (FCS) methods were used for model estimation and 50 imputations were requested.[431] All analyses were conducted using SAS 9.4.[432]

Results

Baseline Univariate Results:

Sociodemographic and SRH history characteristics

Characteristics of the analytic sample are described in **Table 3.1**. The mean age of the sample was 21.11 years (SD: 2.44 years). Sixty participants (40.54%) identified as Black or African American, 42 participants (28.38%) identified as White, 17 participants (11.49%) identified as Hispanic or Latinx, 10 participants (6.76%) identified as Asian or Pacific Islander, and 19 participants (12.84%) identified as American Indian, Alaskan Native, Native Hawaiian, Biracial, Multiracial, or another race/ ethnicity. Most participants (n=97, 65.54%) were on a parent's insurance plan, and 27.03% (n=40) were on their own insurance plan. The remaining 11 participants (7.43%) either did not have health insurance or did not know whether or not they did. One hundred and thirty-three participants (93.66 %) had accessed healthcare in the past year.

Twenty-seven participants (18.49%) reported first initiating vaginal sex at age 14 or younger. Fifty-eight participants (39.73%) initiated between ages 15-17 years, and 61 participants (41.78%) initiated at age 18 or older. Sixty-three participants (42.86%) reported having sexual intercourse with a male partner weekly or more frequently, while 55 (37.41%) reported having sex a few times a month to every two months, and 29 (19.73%) reported having sex a few times a year or less often. Forty-five participants (30.82%) reported having 1-2 sexual partners over their lifetime, 47 (32.19%) reported 3-5 partners, and 54 (36.99%%) reported 6 or more partners. Thirty-one participants (20.95%) reported use of alcohol or other drugs before their last sexual experience. Thirty-four participants (22.97%) had ever been pregnant. Nearly half of the sample reported being in a serious relationship (n=71, 47.97%), 35 (23.65%)

reported casually dating or having sex with someone, and 42 (28.38%) were not in any relationship. Seven participants (4.76%) reported that they would want to get pregnant at all within the next month.

In terms of moderators, 52 participants reporting having heard bad things about certain contraceptive methods on TV or in the newspaper and not used a method for this reason (35.37%) while 49 reported not using one because a friend or relative had a bad experience with one (33.33%).

Contraceptive-related Concerns and Method Use

Ten participants (6.76%) reported never using any contraceptive method by baseline, 22 (14.86%) reported a tier 1 method as the most effective method they had ever used, 70 participants (47.30%) reported a tier 2 method as the most effective method used, and 45 (30.41%) reported having ever used a tier 3 method. At baseline, 51 participants (34.46%) reported not currently using any method, 20 (13.51%) reported currently using a tier 1 method, 39 (26.35%) reported currently using a tier 2 method, and 36 (24.32%) reported currently using a tier 3 method.

At baseline, nearly two-thirds of the participants (67.12%) responded "yes" to at least one of the contraceptive safety concern items. Of these, 90 participants (60.81%) reported not using a method due to concerns about side effects, and 61 participants (41.22%) reported not using a contraceptive method due to concerns about a serious health problem. Forty-three participants (29.25%) reported not using a method due to concerns about irregular bleeding or spotting, while 39 (26.71%) reported not using a method due to concerns about method-associated pain, and 31 (20.95%) reported not using a method due to concerns about the method interfering with sexual life or sexual enjoyment. The mean number of concerns was 1.81 (SD: 1.65) concerns.

Baseline Bivariate Results

Bivariate associations between contraceptive concerns, covariates, moderators, and method use are presented in **Table 3.2**. Participants who reported concerns about side effects or about any

contraceptive-related AE were significantly more likely to report a tier 1 rather than tier 3 method as the most effective method ever used (OR: 3.93, 95% CI: [1.15, 13.49] for side effects; OR: 5.07, 95% CI: [1.31, 19.58] for any AE). None of the other independent variables, moderators or covariates were significantly associated with ever use. Participants reporting concerns about side effects were significantly more likely to report current use of a tier 1 versus tier 3 method (OR: 10.07, 95% CI: [2.03, 49.86]), as were those reporting concerns about any contraceptive-related AE (OR: 18.80, 95% CI: [2.29, 157.08]). Participants reporting concerns about pain were significantly more likely to report current use of a tier 1 (OR: 5.53, 95% CI: [1.35, 21.02]) or tier 2 (OR: 5.57, 95% CI: [1.64, 18.84]) method rather than a tier 3 method. Compared with participants in a serious relationship, participants who were not in a relationship were significantly more likely to currently use no method (OR: 3.29, 95% CI: [1.21, 8.94]) than a tier 3 method. Those who reported dating or having sex casually were also more likely to report current non-use (OR: 6.12, 95% CI: [1.51, 24.83]) or tier 2 use (OR: 7.47, 95% CI: [1.83, 30.40]). None of the other independent variables, moderators, or covariates were significantly associated with current method tier.

We also assessed bivariate relationships between each of the contraceptive safety concern variables and each moderator and covariate. Participants who reported not using a method due to hearing bad things about such a method on television or the radio had greater odds of reporting concerns about a serious health problem (OR: 6.20, 95% CI: [2.99, 13.27]), side effects (OR: 4.11, 95% CI: 1.85, 9.14), bleeding (OR: 3.91, 95% CI: [1.85, 8.26]), interference with one's sexual life or enjoyment (OR: 2.81, 95% CI: [1.25, 6.32]), pain (OR: 2.55, 95% CI: [1.20, 5.42]), or about any contraceptive-related AE (OR: 3.81, 95% CI: [1.62, 9.00]). The mean number of contraceptive safety concerns was significantly higher for participants who reported hearing bad things about a method on television or the radio compared with those who did not (2.75 concerns versus 1.32 concerns, $p < .0001$).

Similarly, participants who reported not using a method due to a family or friend having a bad experience with such a method had increased odds of reporting concerns about a side effects (OR: 6.25, 95% CI: [2.56, 15.26]), interference with one's sexual life or enjoyment (OR: 4.54, 95% CI: [1.97,

10.45]), pain (OR: 3.83, 95% CI: [1.78, 8.27]), serious health problem (OR: 3.41, 95% CI: [1.67. 6.98]), bleeding (OR: 3.41, 95% CI: [1.62, 7.18]), or about any contraceptive-related AE (OR: 5.47, 95% CI: [2.13, 14.06]). The mean number of safety concerns for participants who reported a friend or family member had a bad experience with a method was 2.78 compared with 1.32 concerns among those who did not ($p < .0001$).

For covariates, only relationship status and frequency of sexual intercourse were significantly associated with any of the contraceptive safety concern items. Odds of reporting a concern about bleeding were greater for participants in a serious relationship (OR: 2.75, 95% CI: [1.01, 7.48]) or those dating or having sex casually (OR: 4.50, 95% CI: [1.51, 13.43]) compared with those not in any relationship. Frequency of sexual intercourse was associated with some of the contraceptive-safety concern items. Participants who had sex weekly or more often were significantly more likely to report concerns about bleeding compared with those who had sex a few times a year or less (OR: 4.22, 95% CI: [1.31, 13.62]). Participants who had sex a few times a year or less were more likely to report concerns about a method interfering with their sexual lives or enjoyment compared with those who had sex a few times a month to every two months (OR: 3.19, 95% CI: [1.23, 8.28]). None of the contraceptive safety concern items were significantly associated with race, age, healthcare utilization in the past year, insurance status, lifetime number of sexual partners, age at sexual debut, use of alcohol or drugs before last sex, or desire to get pregnant in the next month. Full results can be found in **Table 3.3**.

Moderation Assessment

We created a series of 28 models, each of which included only an independent variable (IV), hypothesized moderator (M), and an interaction term (IV*M) regressed on each dependent variable (ever and current use effectiveness tier). We did not find evidence of statistically significant moderation in any of these models. Thus, we concluded that the relationship between contraceptive safety concerns and method use did not differ based on whether participants had heard bad things about a method in the media

or had a family member or friend who had a bad experience with a method. We did not include these variables in multivariable models. We report p-values from Wald Chi Squared test, which indicate that parameters for interaction terms are not significantly different from 0. Results from these analyses can be found in **Appendix 3.B**.

Baseline Multivariable Results

Full multivariable cross-sectional results can be found in Table 3. For each model fitted, at least two measures of model fit provided evidence for adequate fit. Full results from model fit assessment can be found in **Appendix 3.A**. In multivariable analyses using baseline data, the odds of using a tier 1 rather than a tier 3 method as the most effective method ever used were 4.33 times higher (95% CI: 1.10, 17.04) for participants reporting concerns about side effects versus no concerns, controlling for demographic and SRH factors. The odds of using a tier 1 rather than tier 3 method as the most effective method were 4.76 times higher (95% CI: 1.18, 19.22) for those reporting concerns about method-related pain versus no pain concerns. For participants reporting at least one concern (versus no concerns), odds of a tier 1 rather than tier 3 method being a participant's most effective method were 6.08 times higher (95% CI: 1.35, 27.36). None of the contraceptive concerns were significantly associated with never having used a method or a tier 2 method as one's most effective method ever used. Concern about irregular bleeding or spotting was not significantly associated with most effective method ever used. Models containing concerns about sexual life or enjoyment and the continuous contraceptive concern variable could not be reported due to model convergence issues caused by our small sample size. A forest plot depicting odds ratios and 95% confidence intervals for each of these models can be found in **Figure 3.1**

For current method use, participants reporting concerns about a serious health problem had greater odds of using no method (aOR: 3.27, 95% CI: [1.12, 9.43]) or a tier 1 method (aOR: 9.56, 95% CI: [2.36, 38.51]) compared with a tier 3 method. Participants reporting concerns about side effects had 16.59 times greater odds of currently using a tier 1 versus tier 3 method (95% CI: [2.75, 99.98]), and

those reporting concerns about bleeding had 4.77 times greater odds of currently using a current tier 1 versus tier 3 method (95% CI: [1.19, 19.18]). Participant reporting concerns about pain had greater odds of using a tier 1 method (aOR 8.63, 95% CI: [1.80, 41.40]) or a tier 2 method (aOR: 2.25, 95% CI: [1.54, 21.62]) rather than a tier 3 method. Participants reporting concerns about any contraceptive-related AE had greater odds of current using no method (aOR: 34.55, 95% CI: [3.36, 355.42]) or currently using a tier 1 method (aOR: 34.55, 95% CI: [3.36, 355.42]), rather than a tier 3 method. Concern about a method interfering with sex life or enjoyment was not associated with current method use.

As noted, we also fit multivariable models while restricting to only Black participants, since we were not able to control for race in multivariable models. Fewer statistically significant relationships were observed, though point estimates tended to be larger. In these models, the only independent variable associated with method use was reporting any contraceptive safety concern (aOR: 7.83, 95% CI: [1.06, 57.98]). For current use, concerns about serious health problems were associated with increased risk of tier 1 method use rather than tier 3 use (aOR: 28.82; 95% CI: [1.26, 658.40]). Concerns about pain or having any contraceptive safety-related concern were associated with increased odds of no method use compared with tier 3 use (aOR: 2.19; 95% CI: [1.44, 3.32] for pain and aOR: 25.73; 95% CI: [1.43, 462.83 for any concern]) and pain concerns were also associated with increased odds of tier 2 method use (aOR: 11.34; 95% CI: [7.27, 17.69]). Full results for this sub-sample analysis can be found in **Appendix 3.C**.

Longitudinal Results of Baseline Contraceptive Concerns and Time-varying Method Use

Monthly response rates for our primary outcome of interest of our analytic sample ranged from 93.91% (month 1) to 71.62% (months 10 and 11). Over 11 months, 112 participants (79.43%) reported switching between contraceptive method tiers at least once. Of these, 24 (17.02%) increased method tier, while 112 (79.43%) decreased tier. Eight participants (5.67%) reported both an increase and decrease in tier, meaning they switched at least twice over the follow-up period. A “spaghetti” plot, or line plot with

lines depicting contraceptive use patterns for all participants who contributed complete follow-up data over 11-months (n=78), is depicted in **Figure 3.1**. The red line indicates the regression line of best fit for these data.

Over the follow-up period, 37 participants (26.24%) used a tier 3 method for at least one month, 50 (35.46%) used a tier 2 method for at least one month, and 26 (18.44%) used a low effectiveness method for at least one month, and 91 (64.54%) reported using no method for at least one month.

We ran a series of unadjusted longitudinal multinomial regression models to assess bivariate relationships between baseline contraceptive safety concern variables and our time varying measure of method use. In unadjusted longitudinal models, participants reporting concerns about serious health problems had significantly greater odds of reporting no method use (OR: 2.17, 95% CI: [1.00, 4.70]) or tier 1 method use (OR: 3.57, 95% CI: [1.06, 12.02]) rather than tier 3 method use. Participants with concerns about side effects and those with concerns about any contraceptive-related AE had lower odds of using a tier 1 rather than a tier 3 method (OR: 0.07, 95% CI: [0.02, 0.29] for side effects, OR: 0.06, 95% CI: [0.01, 0.27] for any AE). Participants with concerns about pain had lower odds of using a tier 2 rather than a tier 3 method (OR: 0.34, 95% CI: [0.13, 0.92]). Concerns about bleeding were not associated with monthly method use.

Full multivariable longitudinal regression results are presented in **Table 3.4**. In generalized linear mixed effects models, concern about a serious health problem was associated with 3.61 times greater odds of using a tier 1 method (95% CI: [1.07, 12.16]) and 2.84 times greater odds of using a tier 2 method (95% CI: [1.08, 7.43]), as compared to tier 3 method. Concern about side effects was associated with 1.28 times greater odds of using a tier 1 versus tier 3 method (95% CI: [2.05, 24.11]), and concern about any contraceptive-related AE was associated with 9.21 times greater odds of using a tier 1 method (95% CI: [2.03, 41.80]). Concern about pain was associated with 3.00 times greater odds of using a tier 2 method rather than a tier 3 method (95% CI: [1.04, 8.53]).

Discussion

We assessed the relationship between concerns about contraceptive safety and side effects and method use among a diverse sample of young people in a Southeastern U.S. city. We operationalized contraceptive method use in three ways and used seven distinct safety concern variables to assess various dimensions of these constructs. We found evidence that concerns about serious health events, side effects, and pain were associated with use of less effective methods as compared to LARC methods in our sample. Our results suggested that concerns about bleeding and concerns about a method interfering with sexual activity? or enjoyment may not be associated with contraceptive method effectiveness, when controlling for potential confounders. These findings identify the specific concerns that might be most important to prioritize during contraceptive counseling and education of young people who can get pregnant.

Use of a four-level measure of contraceptive method use allowed us to observe nuanced relationships between our various contraceptive safety concern variables and method use. For example, in all multivariable models, we observed a significant relationship between concerns about side effects and use of a tier 1 method rather than a tier 3 method but did not observe similar relationships between such concerns and method non-use or tier 2 use. Similarly, by operationalizing method use in three ways (ever use, current use, and time varying use), we were able to observe patterns that may have been missed had we used a single measure of method use. Concerns about serious health problems, for example, were not associated with lifetime method use but were associated with method use cross-sectionally at baseline and prospectively. This may indicate that individuals with such concerns may uptake a more effective method but ultimately discontinue it or switch to a less effective one. Both behaviors that may be associated with increased risk of UIP.[433, 434] Thus, these findings add to the literature on predictors of contraceptive-method discontinuation and switching.[435-437] Better characterizing and addressing concerns about method-related safety and side effects through education and counseling may help individuals pick appropriate methods for them and sustain use of such methods.

For most of the statistically significant relationships observed, individuals endorsing a contraceptive safety concern item were more likely to report a tier 1 method rather than a tier 3 method.

This was true for serious health problems (current use and monthly use), side effects (ever use, current use, and monthly use), pain (ever use and current use), bleeding (current use), any contraceptive-related AE (ever use, current use, and monthly use). This is an especially notable finding because tier 3 methods (LARC methods) can be up to 560 times more effective than tier 1 methods in typical use in terms of expected pregnancies per 100 users per year (comparing typical use failure rates of spermicide, a tier 1 method, to the implant, a tier 3 method).[71]

Since tier 1 methods do not require pharmaceutical intervention, hormonal exposure, or a prescription, they may be viewed as safer or less "risky" alternatives for those with contraceptive safety concerns. However, increased risk of pregnancy may be associated with greater absolute risk of serious AEs associated with pregnancy.[438] Users may overestimate absolute risk of safety concerns associated with tier 3 methods, which are generally very safe for most users,[17] while underestimating risks associated with pregnancy, a finding consistent with the literature.[439] We found that only participants with concerns about serious health problems were more likely to use no method at all, meaning that such concerns may outweigh the anticipated risks of pregnancy among those who hold them. Each family planning client must have the freedom to make decisions about method use based on a personal risk-benefit assessment. However, young people must also be provided with evidence-based information on contraceptive safety to use in this decision-making process.

We did not find statistically significant evidence of moderation by exposure to negative media messages about contraception or vicarious experiences among friends or family, nor was either factor independently associated with contraceptive method tier at the bivariate level. This may suggest that exposure to these social and interpersonal influences influence use in a manner not explored in this study, or the study may not have been adequately powered to assess such effects. For example, exposure to such influences may precede contraceptive safety concerns, which in turn may mediate the relationship between exposure and use. Future analyses should further explore whether such social and interpersonal influences mediate the relationship between contraceptive safety concerns and method use.

When we examined a sub-sample of participants who identified as Black, our findings were largely inconclusive. While we noticed fewer statistically significant relationships, odds ratios were generally larger. This indicates that relationships between concerns and method use could exist among this sub-group but that our study was underpowered to detect them. Future research should include larger sample sizes in order to examine sub-group differences, including by race/ethnicity.

Limitations and Strengths

There are some limitations to this work. The sample used for this analysis included only 148 young women at baseline, which decreased over time due to loss to follow-up. We were not able to look at relationships between beliefs and specific method use, which would have provided a more nuanced understanding of the relationships examined. This small sample size also prevented us from including all proposed covariates in longitudinal models. Additionally, our analyses may have been under-powered to detect some of the relationships examined, including moderation. Since we had to be careful about overparameterizing our models, we were unable to include variables related to past medical conditions or chronic disease while also controlling for sociodemographic and SRH factors. The small sample size likely contributed to the large confidence intervals surrounding some of our estimates. While these very large confidence intervals suggest lack of precision in our estimates, the consistency of our findings lead us to believe that observed relationships can be trusted.

While we contribute to the literature on contraceptive use among young people in the Southeastern U.S., our results cannot be generalized beyond the region or to other age groups. While non-cisgender individuals who could get pregnant were eligible for participation, our sample included only participants who identified as female. Thus, our results also cannot be generalized to all people who can get pregnant in the Southeastern U.S. We also were unable to account for multilevel structural and health-systems barriers of or facilitators to contraceptive use, since these data were not collected in the YWSS.

This study has several strengths. It incorporates a comprehensive approach to data collection and measurement with a longitudinal design, in which data were collected monthly for a year. This study design allowed us to measure experiences and perspective of contraception across a highly dynamic

period in young people's lives, rather than relying on retrospective or static measures of contraceptive use. We measured both our dependent and independent variables in different ways, which gives us confidence that our findings are not artifacts of measurement alone. This study extends the previous literature by using a robust conceptualization and measure of a range of contraceptive side effects and concerns, allowing us to explore nuanced relationships between specific concerns and particular use patterns.

The study is restricted to generally healthy young people, allowing us to discern that the observed concerns about contraceptive-related AEs are likely unrelated to true medical contraindications. Finally, the study focuses on a diverse group of young people who can get pregnant situated in the Southeastern U.S., an important and understudied population. Georgia, and the Southeastern U.S. region, have high rates of maternal morbidity, mortality, and UIP, and increasingly restrictive abortion policies compared with other regions. [59, 61, 62, 64, 440, 441] Thus, UIP may represent a greater health risk for young people in this part of the U.S. compared with others. Access to high-quality, evidence-based information about contraception, coupled with access to chosen methods, is vital for the health of young people seeking to prevent pregnancy in the region.

Conclusion

This study adds to the literature on psychosocial factors related to contraceptive use. It helps advance that literature by incorporating a longitudinal design to determine whether concerns about contraceptive use impact the methods that individuals use. We found consistent evidence that individuals with concerns about various contraceptive-related AEs tend to use less effective methods rather than LARCs. We believe that this suggests an opportunity for improving knowledge through contraceptive counseling and sexuality education. High-quality sexuality education is lacking in the U.S. Southeast, which may be one contributor to the high rates of adverse maternal health outcomes in this region, compared with other parts of the country. Young people should be given accurate information about contraceptive safety, contraindications to methods, absolute risk of contraceptive related SAEs, and risks

of AEs during pregnancy. Above all, voluntary choice, coupled with access to evidence-based information and high-quality healthcare, must be at the core of any effort to promote contraceptive use.

Table 3.1. Demographics and reproductive history of YWSS participants who reported ever having sex with a male partner by baseline, n=148.

		n (%)
Dependent Variables		
Most effective contraceptive method ever used		
	No method	10 (6.76)
	Tier 1 Method	22 (14.86)
	Tier 2 Method	70 (47.30)
	Tier 3 Method	45 (30.41)
Most effective contraceptive method currently used		
	No method	51 (34.46)
	Tier 1 Method	20 (13.51)
	Tier 2 Method	39 (26.35)
	Tier 3 Method	36 (24.32)
Independent Variables		
Concern about a serious health problem associated with contraceptive use		61 (41.22)
Concern about side effects associated with contraceptive use		90 (60.81)
Concern about pain associated with contraceptive use		39 (26.71)
Concern about irregular bleeding or spotting associated with contraceptive use		43 (29.25)
Concern about a contraceptive method interfering with sexual life or sexual enjoyment		31 (20.95)
Concern about any adverse event associated with contraceptive use		98 (67.12)
		Mean (SD)
Number of contraceptive safety concerns		1.81 (1.65)
Moderators		**n (%)**
Heard bad things about contraceptive methods on TV or in the newspaper		52 (35.37)
Friends or relatives have had bad experiences with contraceptive methods		49 (33.33)
Covariates		
		Mean (SD)
Age		21.11 (2.44)
Race		**n (%)**
	Black or African American	60 (40.54)
	White	42 (28.38)
	Hispanic or Latina	17 (11.49)
	Asian or Pacific Islander	10 (6.76)

American Indian, Alaskan Native, Native Hawaiian, Biracial, Multiracial, or Other race/ ethnicity	19 (12.84)
Accessed healthcare within past year	133 (93.66)
Insurance status	
Own insurance plan, college/university-sponsored plan, or another plan	40 (27.03)
Parent's insurance plan	97 65.54)
No health insurance/ not sure	11 (7.43)
Age at sexual debut	
14 years old or younger	27 (18.49)
15-17 years old	58 (39.73)
18 years or older	61 (41.78)
Frequency of sexual intercourse	
Weekly or more often	63 (42.86)
A few times a month to every two months	55 (37.41)
A few times a year or less often	29 (19.73)
Lifetime total number of sexual partners	
1-2 partners	45 (30.82)
3-5 partners	47 (32.19)
6 or more partners	54 (36.99)
Used alcohol or drugs before last sex	31 (20.95)
Ever been pregnant	34 (22.97)
Wants to get pregnant at all during the next month	7 (4.76)
Relationship status	
In a serious relationship	71 (47.97)
Dating or having sex casually	35 (23.65)
Not in any relationship	42 (28.38)

Table 3.2. Bivariate Relationships between Contraceptive Method Use (Dependent Variables) and independent variables, moderators, and covariates, n=148.

	Most effective method ever used, n (row %) / mean (SD)					Most effective method currently used, n (row %) / mean (SD)				
	No method	Tier 1	Tier 2	Tier 3	p*	No method	Tier 1	Tier 2	Tier 3	p*
Independent Variables										
Concern about a serious health problem	3 (5.00)	10 (16.67)	33 (55.00)	14 (23.33)	0.31	23 (38.33)	11 (18.33)	18 (30.00)	8 (13.33)	0.054
Concern about side effects	3 (3.37)	18 (20.22)	44 (49.44)	24 (26.97)	**0.03**	30 (33.71)	18 (20.22)	24 (26.97)	17 (19.10)	**0.02**
Concern about pain	1 (2.63)	8 (21.05)	22 (57.89)	7 (18.42)	0.11	10 (26.32)	8 (21.05)	16 (42.11)	4 (10.53)	**0.01**
Concern about irregular bleeding or spotting	2 (4.76)	5 (11.90)	23 (54.76)	12 (28.57)	0.71	11 (26.19)	9 (21.43)	15 (35.71)	7 (16.67)	0.07
Concern about a method interfering with sexual life or sexual enjoyment	0 (0.00)	4 (13.33)	14 (46.67)	12 (40.00)	0.33[F]	7 (23.33)	6 (20.00)	11 (36.67)	6 (20.00)	0.23
Concern about any adverse event	4 (4.12)	19 (19.59)	49 (50.52)	25 (25.77)	**0.03**	34 (35.05)	19 (19.59)	26 (26.80)	18 (18.56)	**0.007**
Number of concerns	1.00 (1.32)	2.05 (1.43)	1.97 (1.68)	1.55 (1.69)	0.89	1.65 (1.42)	2.60 (1.54)	2.15 (1.89)	1.17 (1.45)	0.32
Moderators										
Heard bad things about contraceptive methods on TV or in the newspaper	4 (7.84)	7 (13.73)	27 (52.94)	13 (25.49)	0.69	18 (35.29)	8 (15.69)	18 (35.29)	7 (13.73)	0.09
Friends or relatives have had bad experiences with contraceptive methods	0 (0.00)	9 (18.75)	26 (54.17)	13 (27.08)	0.09	16 (33.33)	9 (18.75)	16 (33.33)	7 (14.58)	0.14
Covariates										
Race					0.17[F]					0.24
Black or African American	8 (13.33)	8 (13.33)	27 (45.00)	17 (27.33)		28 (46.67)	10 (16.67)	11 (18.33)	11 (18.33)	
White	0 (0.00)	6 (14.63)	19 (46.34)	16 (39.02)		7 (17.07)	6 (14.63)	15 (36.59)	13 (31.71)	

	1	1	12	3		6	2	5	3	
Hispanic or Latino	(5.88)	(5.88)	(70.59)	(17.65)		(37.50)	(12.50)	(31.25)	(18.75)	
	1	2	5	2		4	1	3	2	
Asian or Pacific Islander	(10.00)	(20.00)	(50.00)	(20.00)		(40.00)	(10.00)	(30.00)	(20.00)	
	0	5	7	7		6	1	5	7	
Other race/ ethnicity	(0.00)	(26.32)	(36.84)	(36.84)		(31.58)	(5.26)	(26.32)	(36.84)	
	20.10	20.27	21.11	21.67		20.67	21.25	21.08	21.53	
Age	(3.38)	(2.47)	(2.47)	(193)	0.64[A]	(2.56)	(2.51)	(2.46)	(1.98)	0.12[A]
	7	19	65	41		44	18	38	32	
Accessed healthcare within past year	(5.30)	(14.39)	(49.24)	(31.06)	0.17[F]	(33.33)	(12.64)	(28.79)	(24.24)	0.60
Insurance status					0.59[F]					0.46[F]
Own insurance plan, college/university-sponsored plan, or another plan	5 (12.82)	4 (10.26)	18 (46.15)	12 (30.77)		16 (41.03)	7 (17.95)	7 (17.95)	9 (23.08)	
Parent's insurance plan	4 (4.12)	16 (14.49)	47 (48.45)	30 (30.93)		31 (31.96)	11 (11.34)	31 (31.96)	24 (24.74)	
No health insurance/ not sure	1 (9.09)	2 (18.18)	5 (45.45)	3 (27.27)		4 (40.00)	2 (20.00)	1 (10.00)	3 (30.00)	
Frequency of sexual intercourse					0.27[F]					0.14
	4	6	28	25		18	6	20	18	
Weekly or more often	(6.35)	(9.52)	(44.44)	(39.68)		(29.03)	(9.68)	(32.26))	(29.03)	
	4	8	29	13		17	12	13	12	
A few times a month to every two months	(7.41)	(14.81)	(53.70)	(24.07)		(31.48)	(22.22)	(24.07)	(22.22)	
	2	8	12	7		15	2	6	6	
A few times a year or less often	(6.90)	(27.59)	(41.38)	(24.14)		(51.72)	(6.90)	(20.69)	(20.69)	
	3	1	18	11		14	1	10	7	
Ever been pregnant	(9.09)	(3.03)	(54.55)	(33.33)	0.13[F]	(43.75)	(3.13)	(31.25)	(21.88)	0.20
Age at sexual debut					0.42[F]					0.14 [F]
	1	1	16	8		6	1	12	7	
14 years old or younger	(3.85)	(3.85)	(61.54)	(30.77)		(23.08)	(3.85)	(46.15)	(26.92)	
	4	9	24	21		22	7	12	16	
15-17 years old	(6.90)	(15.52)	(41.38)	(36.21)		(38.60)	(12.28)	(21.05)	(28.07)	
	5	12	28	16		21	12	15	13	
18 years or older	(8.20)	(19.67)	(45.90)	(26.23)		(34.43)	(19.67)	(24.59)	(21.31)	
Lifetime total number of sexual partners					0.1[F]					0.22

	4	13	17	11		17	10	8	10	
1-2 partners	(8.89)	(28.89)	(37.78)	(24.44)	0.05	(37.78)	(22.22)	(17.78)	(22.22)	
	4	5	26	12		14	7	15	10	
3-5 partners	(8.51)	(10.64)	(55.32)	(25.53)		(30.43)	(15.22)	(32.61)	(21.74)	
	2	4	26	21		20	3	14	16	
6 or more partners	(3.77)	(7.55)	(49.06)	(39.62)		(37.74)	(5.66)	(26.42)	(30.19)	
		5	14	10		13	2	8	8	
Used alcohol or drugs before last sex	2 (6.45)	(16.13)	(45.16)	(32.26)	0.97[F]	(41.94)	(6.45)	(25.81)	(25.81)	0.55
	2	1	3	1		6	0	0	1	
Wants to get pregnant at all during the next month	(28.57)	(14.29)	(42.86)	(14.29)	0.17[F]	(85.71)	(0.00)	(0.00)	(14.29)	0.03[F]

*= between group differences; F= Fishers exact test used; A = ANOVA

Table 3.3. Bivariate Relationships between Contraceptive Safety Concerns (Independent Variables) and dependent variables, moderators, and covariates, n=148.

	Concern about a serious health problem n (%) / mean (SD)	Concern about side effects n (%) / mean (SD)	Concern about pain n (%) / mean (SD)	Concern about irregular bleeding or spotting n (%) / mean (SD)	Concern about a method interfering with sexual life or sexual enjoyment n (%) / mean (SD)	Concern about any adverse event n (%) / mean (SD)	Number of concerns r / Mean (SD)
			Dependent Variables				
Most effective method ever used							
No method	3 (30.00)	3 (30.00)	1 (11.11)	2 (20.00)	0 (0.00)	4 (44.44)	1.00 (1.32)
Tier 1	10 (45.45)	18 (81.82)	8 (36.36)	5 (22.73)	4 (18.18)	19 (86.36)	2.05 (1.43)
Tier 2	33 (47.14)	44 (62.86)	22 (31.88)	23 (32.86)	14 (20.00)	49 (71.01)	1.97 (1.68)
Tier 3	14 (31.11)	24 (53.33)	7 (15.56)	12 (27.27)	12 (26.67)	25 (55.56)	1.55 (1.69)
p-value	0.31	**0.03**	0.11	0.71	0.29	**0.03**	0.90
Most effective method currently used							
No method	23 (45.10)	30 (58.82)	10 (20.41)	11 (21.57)	7 (13.73)	34 (69.39)	1.65 (1.42)
Tier 1	11 (55.00)	18 (90.00)	8 (40.00)	9 (45.00)	6 (30.00)	19 (95.00)	2.60 (1.54)
Tier 2	18 (46.15)	24 (61.54)	16 (14.03)	15 (38.46)	11 (28.21)	26 (66.67)	2.15 (1.89)
Tier 3	8 (22.22)	17 (47.22)	4 (11.11)	7 (20.00)	6 (16.67)	18 (50.00)	1.17 (1.45)
p-value	0.054	**0.02**	**0.009**	0.07	0.24	**0.007**	0.32
			Moderators				
Heard bad things about contraceptive methods on TV or in the newspaper	36 (69.23)	42 (80.77)	20 (39.22)	25 (48.08)	17 (32.69)	43 (84.31)	2.75 (1.70)
p-value	**<0.001**	**0.003**	**0.01**	**0.002**	**0.01**	**0.002**	**<.0001**

Friends or relatives have had bad experiences with contraceptive methods	30 (61.22)	42 (85.71)	22 (44.90)	23 (26.94)	19 (38.78)	43 (87.76))	2.78 (1.61)
p-value	**<0.001**	**<0.001**	**<0.001**	**0.001**	**<.0001**	**0.002**	**<.0001**
			Covariates				
Race							
Black or African American	28 (46.67)	36 (60.00)	13 (22.41)	17 (28.3)	9 (15.00)	29 (69.05)	1.93 (1.81)
White	11 (26.19)	27 (64.29)	16 (38.10)	13 (31.71)	13 (30.95)	41 (70.69)	1.78 (1.52)
Hispanic or Latino	6 (35.29)	8 (47.06)	4 (23.53)	6 (35.29)	3 (17.65)	8 (47.06)	1.59 (1.87)
Asian or Pacific Islander	7 (7.00)	9 (90.00)	3 (30.00)	5 (50.00)	3 (30.00)	9 (90.00)	2.70 (1.49)
Other race/ ethnicity	9 (27.37)	10 (52.63)	3 (15.79)	2 (10.53)	3 (15.79)	11 (57.89)	1.42 (1.54)
p-value	0.07	0.22	0.33	0.22	0.32	0.16	0.62
Age	21.03 (2.31)	21.07 (2.37)	21.21 (2.58)	20.95 (2.36)	21.26 (2.16)	21.02 (2.46)	-0.05
p-value	0.57	0.80	0.90	0.55	0.89	0.30	0.55
Accessed healthcare within past year	53 (39.85)	80 (60.15)	34 (25.95)	37 (28.03)	26 (19.55)	87 (66.41)	1.76 (1.64)
p-value	1.00	1.00	0.29	0.29	1.00	1.00	0.83
Insurance status							
Own insurance plan, college/university-sponsored plan, or another plan	15 (37.50)	22 (55.00)	8 (20.51)	13 (33.33)	8 (20.00)	24 (61.54)	1.73 (1.27)
Parent's insurance plan	41 (42.27)	59 (60.82)	30 (31.25)	28 (28.87)	21 (21.65)	65 (67.71)	1.86 (1.65)
No health insurance/ not sure	6 (54.55)	9 (81.82)	1 (9.09)	2 (18.18)	2 (18.18)	9 (81.82)	1.71 (1.78)
p-value	0.84	0.27	0.17	0.62	0.95	0.44	0.88
Frequency of sexual intercourse							
Weekly or more often	27 (42.86)	37 (58.73)	18 (28.57)	25 (40.32)	20 (31.75)	41 (65.08)	2.03 (1.82)
A few times a month to every two months	23 (41.82)	36 (65.45)	15 (27.78)	14 (25.45)	7 (12.73)	38 (70.37)	1.76 (1.52)
A few times a year or less often	11 (37.93)	17 (58.62)	6 (21.43)	4 (13.79)	4 (13.79)	19 (67.86)	1.50 (1.50)
p-value	0.91	0.72	0.77	**0.03**	**0.02**	0.83	0.35

Ever been pregnant	20 (58.82)	18 (52.94)	8 (23.53)	10 (9.95)	7 (20.59)	21 (61.76)	
p-value	**0.02**	0.28	0.63	0.98	0.95		
Age at sexual debut							
14 years old or younger	16 (59.26)	20 (74.07)	11 (40.74)	12 (44.44)	8 (29.63)	11 (81.48)	2.48 (2.63)
15-17 years old	23 (39.66)	35 (60.34)	13 (22.81)	17 (29.82)	13 (22.41)	36 (63.16)	1.79 (1.78)
18 years or older	22 (36.07)	35 (57.38)	15 (24.59)	14 (22.95)	10 (16.39)	40 (65.57)	1.57 (1.48)
p-value	0.12	0.32	0.19	0.13	0.36	0.22	0.06
Lifetime total number of sexual partners							
1-2 partners	14 (31.11)	29 (64.44)	13 (29.55)	12 (27.27)	9 (20.00)	32 (72.73)	1.77 (1.57)
3-5 partners	22 (46.81)	28 (59.57)	14 (30.43)	14 (29.79)	9 (19.15)	31 (67.39)	1.89 (1.63)
6 or more partners	24 (44.44)	31 (57.41)	11 (20.37)	16 (29.63)	12 (22.22)	33 (61.11)	1.74 (1.76)
p-value	0.25	0.77	0.45	0.96	0.92	0.48	0.90
Used alcohol or drugs before last sex	12 (38.71)	21 (67.74)	6 (19.35)	8 (25.81)	7 (22.58)	24 (77.42)	1.74 (1.37)
p-value	0.75	0.37	0.30	0.64	0.80	0.17	0.79
Wants to get pregnant at all during the next month	3 (42.96)	4 (57.14)	1 (16.67)	4 (57.14)	2 (28.57)	5 (83.33)	2.33 (1.37)
p-value	1.00	1.00	1.00	0.20	0.64	0.66	0.44

*= between group differences; F= Fishers exact test used

Table 3.4 Multivariable Relationships between contraceptive safety concerns and method use, baseline cross-sectional analyses, n=148.

Concern about a serious health problem

	Ever use				Current use		
	aOR	95% CI OR	p		aOR	95% CI OR	p
No method	0.81	(0.14, 4.52)	0.81	No method	3.27	(1.13, 9.43)	**0.03**
Tier 1	2.70	(0.83, 8.83)	0.10	Tier 1	9.56	(2.36, 38.51)	**0.002**
Tier 2	1.86	(0.80, 4.32)	0.15	Tier 2	2.56	(0.86, 7.58)	0.09

Concern about side effects

	Ever use				Current use		
	aOR	95% CI OR	p		aOR	95% CI OR	p
No method	0.28	(0.05, 1.62)	0.16	No method	2.27	(0.86, 6.00)	0.10
Tier 1	4.33	(1.10, 17.04)	**0.04**	Tier 1	16.59	(2.75, 99.98)	**0.002**
Tier 2	1.51	(0.66, 3.42)	0.33	Tier 2	2.25	(0.80, 6.27)	0.12

Concern about pain

	Ever use				Current use		
	aOR	95% CI OR	p		aOR	95% CI OR	p
No method	0.83	(0.08, 8.69)	0.88	No method	2.85	(0.72, 11.20)	0.13
Tier 1	4.76	(1.18, 19.22)	**0.03**	Tier 1	8.63	(1.80, 41.40)	**0.01**
Tier 2	2.55	(0.91, 7.21)	0.08	Tier 2	5.87	(1.58, 21.72)	**0.01**

Concern about bleeding

	Ever use				Current use		
	aOR	95% CI OR	p		aOR	95% CI OR	p
No method	0.53	(0.08, 3.58)	0.52	No method	1.34	(0.42, 4.28)	0.62
Tier 1	0.96	(0.25, 3.74)	0.95	Tier 1	4.77	(1.19, 19.18)	**0.03**
Tier 2	1.34	(0.52, 3.27)	0.52	Tier 2	1.80	(0.93, 9.36)	0.11

Concern about a method interfering with sex life or enjoyment

					aOR	95% CI OR	p
--	--	--	--	No method	1.10	(0.31, 3.86)	0.89
--	--	--	--	Tier 1	3.70	(0.84, 16.36)	0.08
--	--	--	--	Tier 2	2.42	(0.72, 8.14)	0.18

Concern about any contraceptive-related adverse event

	aOR	95% CI OR	p		aOR	95% CI OR	p
No method	0.23	(0.03, 1.80)	0.16	No method	2.72	(1.02, 7.24)	**0.046**
Tier 1	6.08	(1.35, 27.36)	**0.02**	Tier 1	34.55	(3.36, 355.42)	**0.003**
Tier 2	2.23	(0.93, 5.32)	0.07	Tier 2	2.06	(0.75, 5.68)	0.16

Adjusted for age, insurance status, history of pregnancy, frequency of sexual intercourse, age at sexual debut, and lifetime number of sexual partners.

Reference group = Tier 3 method use.

-- = Quasi-complete separation of data points. Estimates and model fit not reliable.

Figure 3.1. Forest Plots depicting odds ratios and confidence intervals for models using most effective method ever used as independent variable.

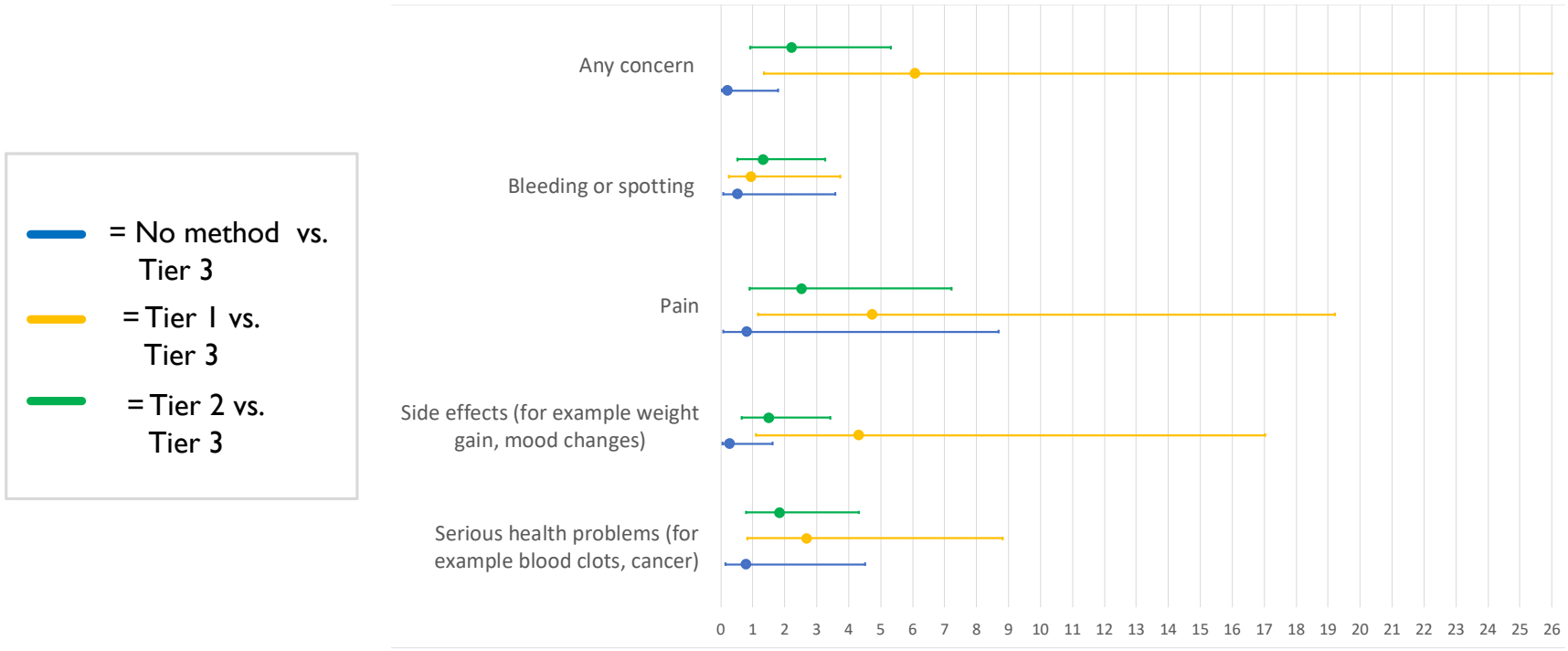


Figure 3.2. Forest Plots depicting odds ratios and confidence intervals for models using most effective method currently used as independent variable.

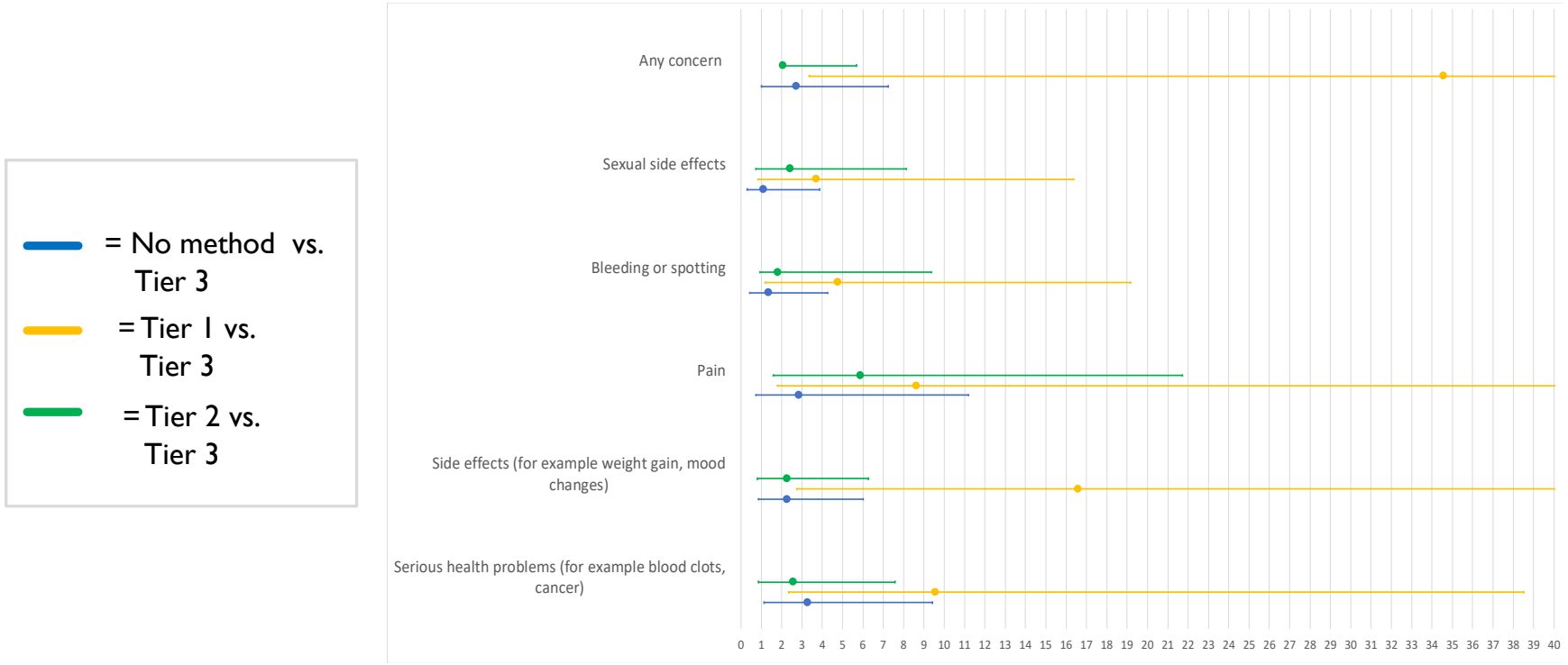


Figure 3.3. "Spaghetti" Plot depicting contraceptive use patterns over 11 months, n=78.

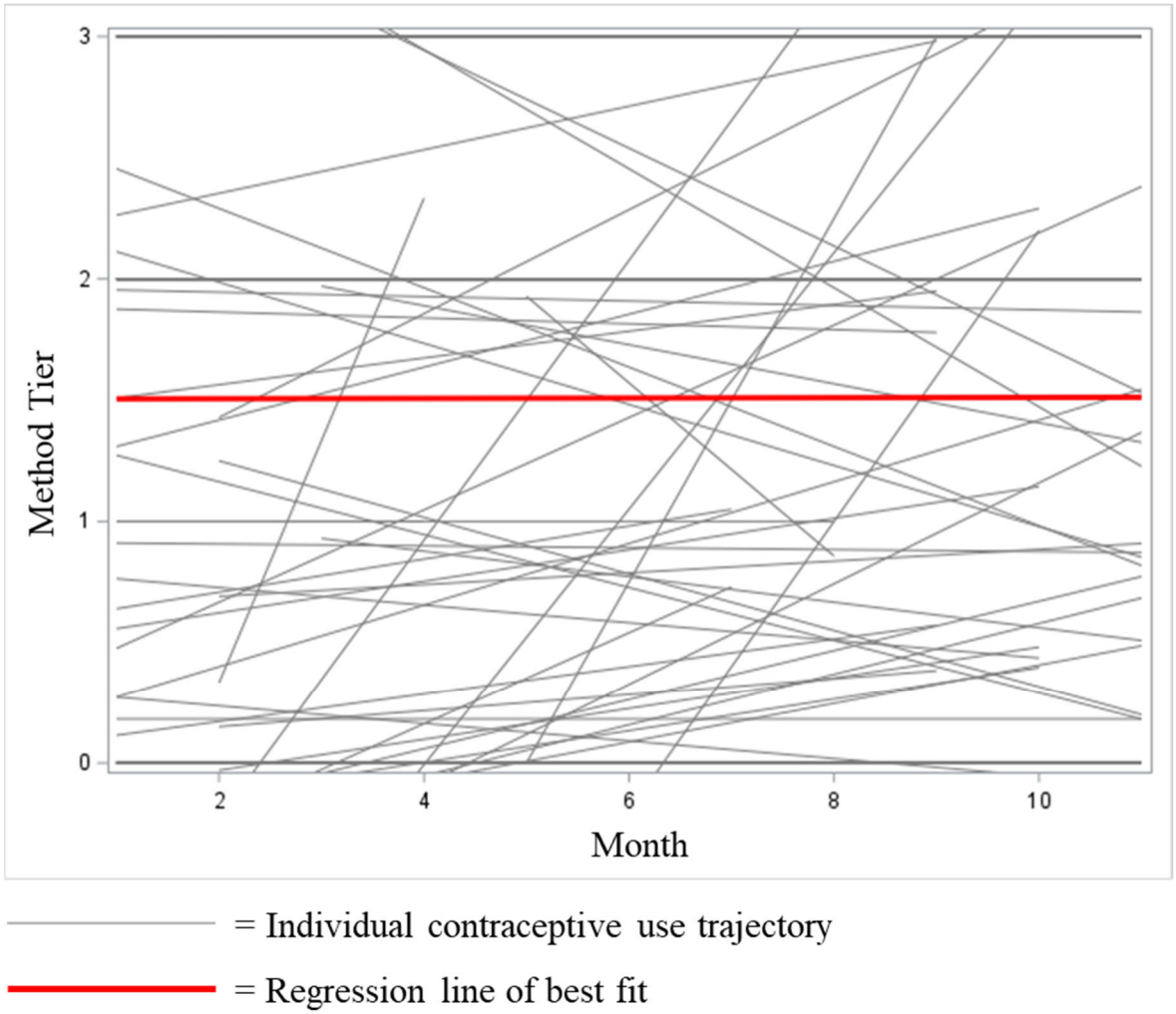


Table 3.5. Multivariable Relationships between contraceptive safety concerns and monthly method use over 12-months.

	Concern about a serious health problem		
	aOR	95% CI OR	p
No method	1.65	(0.72, 3.75)	0.24
Tier 1	3.61	(1.07, 12.16)	**0.04**
Tier 2	2.84	(1.08, 7.43)	**0.03**
	Concern about side effects		
	aOR	95% CI OR	p
No method	1.29	(0.63, 2.66)	0.49
Tier 1	7.03	(2.05, 24.11)	**0.002**
Tier 2	1.52	(0.60, 3.86)	0.38
	Concern about pain		
	aOR	95% CI OR	p
No method	1.41	(0.58, 3.44)	0.45
Tier 1	1.28	(0.36, 4.58)	0.71
Tier 2	3.00	(1.04, 8.53)	**0.04**
	Concern about bleeding		
	aOR	95% CI OR	p
No method	1.01	(0.40, 2.53)	0.99
Tier 1	2.91	(0.84, 10.10)	0.09
Tier 2	2.16	(0.78, 5.99)	0.14
	Concern about any contraceptive-related adverse event		
	aOR	95% CI OR	p
No method	1.24	(0.58, 2.64)	0.58
Tier 1	9.21	(2.03, 41.80)	**0.005**
Tier 2	1.76	(0.65, 4.76)	0.26

Adjusted for frequency of sex and lifetime history of pregnancy.
Reference group = Tier 3 method use.

Appendix 3.A. Goodness of fit statistics for Baseline Multivariable Models.

DV_1: Ever Use

IV_1: Worried about serious health problem

Fit statistic	Value	Value/ Df	χ^2 p-value	Indicative of good fit?
Deviance	271.8218	0.7679	0.7679	Yes
Pearson's	371.0105	1.0481	0.2565	Yes
Hosmer and Lemeshow χ^2	20.7669	N/A	0.6524	Yes
IV_2: Worried about side effects				
Deviance	271.3528	0.7665	0.9996	Yes
Pearson's	412.5678	1.1654	0.0172	No
Hosmer and Lemeshow χ^2	18.1036	N/A	0.7980	Yes
IV_3: Worried about pain				
Deviance	271.9474	0.7748	0.9994	Yes
Pearson's	376.9853	1.0740	0.1629	Yes
Hosmer and Lemeshow χ^2	20.3203	N/A	0.6784	Yes
IV_4: Worried about bleeding				
Deviance	274.8127	0.7966	0.9978	Yes
Pearson's	359.5320	1.0421	0.2840	Yes
Hosmer and Lemeshow χ^2	11.4690	N/A	0.9853	Yes

IV_6: Worried about any AE				
Deviance	265.1416	0.7619	0.9997	Yes
Pearson's	283.4340	0.9354	0.7839	Yes
Hosmer and Lemeshow χ^2	14.5656	N/A	0.9328	Yes
		DV_2: Current Use		
IV_1: Worried about serious health problem				
Deviance	302.9076	0.8630	0.9699	Yes
Pearson's	400.3593	1.1406	0.0354	No
Hosmer and Lemeshow χ^2	25.0149	N/A	0.4050	Yes
IV_2: Worried about side effects				
Deviance	302.0784	0.8606	0.9722	Yes
Pearson's	460.4767	1.3119	<.0001	No
Hosmer and Lemeshow χ^2	25.5582	N/A	0.3760	Yes
IV_3: Worried about pain				
Deviance	301.6133	0.8667	0.9654	Yes
Pearson's	368.6845	1.0594	0.2135	Yes
Hosmer and Lemeshow χ^2	17.4642	N/A	0.8282	Yes
IV_4: Worried about bleeding				
Deviance	303.8994	0.8886	0.9318	Yes
Pearson's	357.1187	1.0442	0.2759	Yes

Hosmer and Lemeshow χ^2	27.8515	N/A	0.2664	Yes
IV_5: Worried about a method interfering with sexual life or enjoyment				
Deviance	305.6004	0.8782	0.9507	Yes
Pearson's	364.2627	1.0467	0.2636	Yes
Hosmer and Lemeshow χ^2	26.5528	N/A	0.3257	Yes
IV_6: Worried about any AE				
Deviance	293.9413	0.8520	0.9785	Yes
Pearson's	601.3955	1.7432	<.0001	No
Hosmer and Lemeshow χ^2	27.6188	N/A	0.2764	Yes

Appendix 3.B. Moderation Assessment, Baseline cross-sectional analyses.

DV 1: Ever use	Wald Chi Square p-value, interaction term
M1: Heard bad things	
Concern about a serious health problem associated with contraceptive use	0.64
Concern about side effects associated with contraceptive use	0.48
Concern about pain associated with contraceptive use	0.63
Concern about irregular bleeding or spotting associated with contraceptive use	0.59
Concern about a contraceptive method interfering with sexual life or sexual enjoyment	0.30
Concern about any adverse event associated with contraceptive use	0.65
Number of contraceptive safety concerns	0.98
M2: Family or friends had bad experiences	
Concern about a serious health problem associated with contraceptive use	0.50
Concern about side effects associated with contraceptive use	0.27
Concern about pain associated with contraceptive use	0.94
Concern about irregular bleeding or spotting associated with contraceptive use	0.88
Concern about a contraceptive method interfering with sexual life or sexual enjoyment	0.51
Concern about any adverse event associated with contraceptive use	0.78
Number of contraceptive safety concerns	1.00
DV 2: Current Use	
M1: Heard bad things	
Concern about a serious health problem associated with contraceptive use	0.73
Concern about side effects associated with contraceptive use	0.65
Concern about pain associated with contraceptive use	0.47
Concern about irregular bleeding or spotting associated with contraceptive use	0.45

Concern about a contraceptive method interfering with sexual life or sexual enjoyment	0.32
Concern about any adverse event associated with contraceptive use	0.47
Number of contraceptive safety concerns	0.99
M2: Family or friends had bad experiences	
Concern about a serious health problem associated with contraceptive use	0.81
Concern about side effects associated with contraceptive use	0.87
Concern about pain associated with contraceptive use	0.62
Concern about irregular bleeding or spotting associated with contraceptive use	0.82
Concern about a contraceptive method interfering with sexual life or sexual enjoyment	0.73
Concern about any adverse event associated with contraceptive use	0.92
Number of contraceptive safety concerns	0.98

Appendix 3.C. Multivariable Relationships between contraceptive safety concerns and method use among Black-identifying participants, baseline cross-sectional analyses, n=60.

Concern about a serious health problem

	Ever use				Current use		
	aOR	95% CI OR	p		aOR	95% CI OR	p
No method	0.24	(0.01, 4.81)	0.35	No method	7.05	(0.79, 63.07)	0.08
Tier 1	3.02	(0.25, 36.29)	0.38	Tier 1	28.82	(1.26, 658.40)	**0.04**
Tier 2	3.14	(0.57, 17.21)	0.19	Tier 2	7.23	(0.55, 95.74)	0.13

Concern about side effects

	Ever use				Current use		
	aOR	95% CI OR	p		aOR	95% CI OR	p
No method	--	--	--	No method	12.45	(0.88, 176.39)	0.06
Tier 1	11.389	(0.53, 246.92)	0.12	Tier 1	--	--	--
Tier 2	4.20	(0.58, 30.41)	0.16	Tier 2	10.25	(0.52, 201.90)	0.13

Concern about pain

	Ever use				Current use		
	aOR	95% CI OR	p		aOR	95% CI OR	p
No method	6.76	(0.11, 399.56	0.36	No method	2.19	(1.44, 3.32)	**0.0002**
Tier 1	--	--	--	Tier 1	1.88	(1.15, 3.09)	0.01
Tier 2	8.41	(0.41, 173.61)	0.17	Tier 2	11.34	(7.27, 17.69)	**<0.0001**

Concern about bleeding

	Ever use				Current use		
	aOR	95% CI OR	p		aOR	95% CI OR	p
No method	0.50	(0.01, 2.35)	0.12	No method	1.46	(0.11, 19.24)	0.62
Tier 1	1.46	(0.11, 19.58)	0.77	Tier 1	12.89	(0.43, 391.18)	0.14
Tier 2	0.62	(0.08, 4.53)	0.64	Tier 2	1.41	(0.07, 27.88)	0.11

Concern about a method interfering with sex life or enjoyment

					aOR	95% CI OR	p
No method	--	--	--	No method	1.65	(0.07, 40.26)	0.76

Tier 1	--	--	--	Tier 1	--	--	--
Tier 2	--	--	--	Tier 2	1.70	(0.04, 78.33)	0.79

Concern about any contraceptive-related adverse event

	aOR	95% CI OR	p		aOR	95% CI OR	p
No method	0.28	(0.01, 7.59)	0.45	No method	25.73	(1.43, 462.83)	**0.03**
Tier 1	6.67	(0.38, 115.97)	0.19	Tier 1	--	--	--
Tier 2	**7.83**	**(1.06, 57.98)**	**0.04**	Tier 2	12.80	(0.56, 293.02)	0.11

Adjusted for age, insurance status, history of pregnancy, frequency of sexual intercourse, age at sexual debut, and lifetime number of sexual partners.
Reference group = Tier 3 method use.
-- = Quasi-complete separation of data points. Estimates and model fit not reliable.

Chapter 4: "I'm not necessarily sure if it's safe": Perspectives on Contraceptive Safety among young people who can get pregnant in Georgia

Abstract

Background: Many factors, including beliefs about safety, impact contraceptive decision-making. Little is known about how safety beliefs are developed and the processes through which they translate to contraceptive behavior, especially among young people in the U.S. Southeast.

Objectives: We sought to collect data directly from people who can get pregnant aged 15-24 in Georgia to learn more about how safety beliefs, social, and interpersonal influences shape contraceptive decision-making,

Methods: We conducted online in-depth interviews with 29 participants. We purposively sampled to reflect diversity in race/ethnicity, contraceptive use status, and history of pregnancy. Interview topics included: sources of contraceptive information, beliefs about safety and side effects, personal experiences, and suggestions for educating young people about contraceptive safety. We used a grounded theory approach to analyze our data.

Results: We identified three distinct pathways though which information exposure and external influences crafted beliefs about safety and acceptability of various contraceptive methods. In one path, participants learned of others' experiences with contraceptive-related adverse events (AEs) that were not balanced by positive reports. These individuals avoided prescription method use. A second pathway learned early of non-contraceptive benefits of oral contraceptive pills (OCPs) and grew up in contexts in which OCP use was normative. These people viewed OCPs as safe and beneficial to health beyond pregnancy prevention but avoided other methods. Some expressed concerns about ongoing use. A third group followed a windy path in search of a method that they felt comfortable using. They were guided by intolerable contraceptive side effects and conversations with peers and providers. Safety concerns and misconceptions impacted method choice in all groups.

Conclusions: Perceptions of safety, which often include exaggerated beliefs about risks, impact method use. Improved sexuality education and provider training can help balance negative information about contraceptive safety gleaned from peers, parents, and the media.

Introduction

Among people who can get pregnant in the U.S., approximately 75% of pregnancies among those aged 15-19 years and 59% of pregnancies among those aged 20-24 years are considered unintended pregnancies (UIPs), meaning that are either unwanted or mistimed.[1-4] Young people experiencing UIPs may be at increased risk for adverse maternal and child health outcomes, including rapid repeat pregnancy, compared with older pregnant people,[1-3] and have higher rates of substance use and high school dropout compared with their non-childbearing peers.[52, 53, 56, 411] Younger people, women and girls of color, women of low socioeconomic status (SES), and individuals residing in certain regions of the country, including the U.S. Southeast, are generally at heightened risk of UIPs compared to other groups.[2, 4-9]

Some young people desire and plan pregnancies.[442, 443] For others, UIP is an undesirable event that may have repercussions across the life course.[53, 411, 444] For sexually active individuals seeking to avoid UIP, use of an FDA-approved contraceptive method may be an important component of reproductive life planning.[14] There are a range of safe and effective methods available in the U.S.[14] All are safe for use in healthy young people; neither age nor nulliparity are contraindication to use of any contraceptive method, including permanent sterilization.[17] Available methods vary in terms of effectiveness, side effect profiles, and ease of use.[14, 15] Contraceptive methods are often characterized by tiers based on method effectiveness by groups including the U.S. Centers for Disease Control and Prevention (CDC) and World Health Organization (WHO). In these classification systems, less effective methods with typical use failure rates >18% per year include the internal and external condoms, spermicide, withdrawal, fertility awareness methods, and the sponge. Moderately effective methods have a typical use failure rate of 6-12% per year and include the injectable contraceptive Depot medroxyprogesterone acetate (DMPA), and combined hormonal contraceptives (CHCS), the oral contraceptive pill (OCP), contraceptive vaginal ring (CVR), and transdermal contraceptive patch ("patch"), methods that contain estrogen and progestin. At the highest effectiveness tier are long-acting reversible contraceptive (LARC) methods, Copper-containing intrauterine devices (Cu IUDs),

levonorgestrel-containing IUDs (LNG IUDs), etonogestrel-containing arm implants ("implants"), and permanent sterilization. These methods have a typical use failure rate of <1% per year.[18, 71]

Over the past decade, members of the family planning community (e.g., healthcare providers and researchers) have demonstrated great enthusiasm LARC methods, given these very low typical use failure rates.[243, 282, 322, 445] However, effectiveness may not be the most important variable in the decision-making process for young people, especially among those who express ambivalence about pregnancy.[19] Authors have cautioned that an over-emphasis on LARCs could replicate or intensify ongoing reproductive injustices perpetrated against communities of color, younger people, those with low SES, people identifying as LGBT+ and individuals at the intersection of these identities.[68, 446]

Ti et al. (20201) published a systematic review on contraceptive values and preferences among young people aged 25 years or younger.[19] They identified 5 common content areas in the literature: general values and preferences about contraceptive use (e.g., side effect profiles, concerns about exposure to exogenous hormones, and privacy), method-specific benefits (e.g., safety, familiarity, effectiveness and convenience of particular methods), method-specific drawbacks (e.g., concerns about side effects and safety with certain methods, including IUDs and implants), and the influence of social contexts (e.g., religious beliefs, community norms, interpersonal influences) on values, preferences, and contraceptive choices. The fifth content area identified was the role of myths and misconceptions about contraceptive methods in determining contraceptive acceptability. Such misconceptions included concerns about long-term safety, confusion about medical eligibility for certain methods, and lack of knowledge about methods' mechanisms of action.[19]

A growing literature documents myths and misconceptions about contraceptive safety among young people in the U.S. Such non-evidence beliefs include concerns about increased risk of infertility or harm to existent or future pregnancies [22-36] cancer,[22, 35, 37-39] and infection or device migration with LARC use,[40-42]. For some of these outcomes, contraception may increase absolute risk slightly and others do not appear to be associated with use. Racial disparities have been documented, with self-identified Latina and

Black women more likely to be unsure of contraceptives safety, express less contraceptive knowledge and over-state risks of oral contraceptive pills (OCPs) and Depot medroxyprogesterone acetate (DMPA).[33, 35, 385] Such misconceptions may result in lower utilization of safe and effective contraceptive methods. Similar discrepancies have been noted by age, with younger people tending to report such concerns more than older people.[22, 23, 396]

While the literature documents the existence of such beliefs, information about the processes through which such beliefs are formed and the ways in which they translate to contraceptive behavior is lacking. We sought to fill gaps in this literature by describing how various information sources, interpersonal influences, and social influences contribute to belief development. We also sought to explore how safety beliefs compare with other influences (e.g., social norms, access) in determining contraceptive behavior. Our geographic focus also adds to the literature on determinants of UIP among young people in the U.S. Southeast, an important region given its high rates of maternal mortality and morbidity and UIP. we sought to learn more about most acceptable avenues for providing evidence-based information about contraceptive safety. These data may be useful for developing counseling protocols and education aimed at addressing commonly held concerns about contraceptive safety.

We incorporated constructs from the Health Belief Model (HBM) and Social Ecological Model (SEM) into the development of the interview guide. The HBM posits that six constructs influence individuals' preventive health behaviors. They are: perceived susceptibility, perceived severity, perceived benefits, perceived barriers, cues to action, and self-efficacy.[249] The theory posits that an individual must believe that they are *susceptible* to a health outcome and must believe that that this outcome is *severe* enough to warrant action. If these two conditions are not satisfied, then an individual may not be motivated to take preventative action. Further, individuals must believe that some effective course of action is available to them, and that the benefits of taking this action outweigh the costs or barriers. For this study, we were interested in documenting which outcomes individuals perceived themselves to be susceptible to, how severe these outcomes were perceived to be, and how these perceptions influenced use. The SEM suggests that individuals' health behaviors and decisions are influenced by external factors

at many levels. We were also interested in how external influences served as cues to action, particularly at the social and interpersonal levels.

We used in-depth interviews with young people who can get pregnant in the U.S. state of Georgia (GA) to answer the following research questions: 1) How do perceptions of contraceptive safety (perceived susceptibility and severity) influence contraceptive method use? 2) How do interpersonal and social experiences influence contraceptive beliefs and behaviors across the teenage and young adult years?

Methods

Sampling and Recruitment

We conducted a cross sectional qualitative study using one-on-one in-depth interviews with people who can get pregnant aged 15-24 years old. We decided that in-depth interviews (IDIs) were most likely to generate valid data on this topic highly personal and complex topic. While we used a cross-sectional design, we asked participants to reflect on their contraceptive use experiences leading up to the interview and were thus able to understand beliefs and behaviors across adolescence and young adulthood.

Individuals were eligible for the study if they were within the target age group, were residents of Georgia, were biologically female (sex assigned female at birth), had ever had penile-vaginal sex, and had never been told by a doctor that they had absolute contraindications to contraceptive method use or that they were infertile. We used purposive sampling to recruit a diverse sample of young people by race and ethnicity, age (teenagers vs. young adults), parity (experienced pregnancy vs. have not experienced pregnancy), current contraceptive use status, and gender identity, including individuals who could get pregnant but did not identify as female.

We recruited participants through online advertisements posted on Facebook, Instagram, Google, and Craigslist. Interested individuals were directed to our study website where they could complete an eligibility screener, which also included questions about demographics, reproductive history, and current

contraceptive use. We purposively selected eligible participants based on our sampling criteria. For example, initial phases of data collection yielded a largely White, nulliparous sample, so we sampled individuals who identified as people of color and those with histories of pregnancy for subsequent interviews. We initially intended to include only participants from metropolitan Atlanta, GA based on feasibility. However, after initial data collection, we realized that the experiences of individuals in non-urban places might differ meaningfully from those in the Atlanta area. Thus, we expanded our geographic eligibility criteria to include individuals residing in other parts of GA. We hoped this would allow us to characterize any differences between urban, suburban, and rural participants.

Our sample included individuals who identified as White, Asian, Asian American, or Indian, Black, Biracial or Multiracial, and Hispanic/Latina. Four participants identified as non-binary (using she/they or she/they/he pronouns). Four participants were parents, and none disclosed histories of abortion, miscarriage, or pregnancy outcomes other than live birth. About half of the sample were in a serious relationship, engaged, or married. The mean age of the sample was 21 years (SD: 2.5 years). Over half reported some college education. All participants were living or had lived in the U.S. state of GA, but many had relocated for school or work and reported SRH experiences from throughout the U.S., including Missouri, Texas, Massachusetts, Montana, Florida, and Tennessee, and internationally, including India, Malaysia, the United Kingdom, and Indonesia. A full description of the sample can be found in Appendix 3.

All study activities were approved by the Emory University Institutional Review Board. Participants completed an online consent form. We obtained a waiver of parental consent for participants under 18 years old. Participants were offered a $40 e-gift card as reimbursement for their time and effort. Recruitment and interviewing occurred between July 2020 and July 2021.

Data Collection

A semi-structured interview guide was developed and pilot tested prior to data collection. To pilot test, members of the research team conducted interviews with each other, then conducted an initial

interview with a member of the target population. After these initial interviews, the team discussed whether refinements were necessary. The initial interview guide included 18 questions, covering the following topics: general contraceptive knowledge, knowledge of contraceptive safety and side effects, perceived susceptibility to contraceptive-related AEs, perceived severity of such AEs, attitudes about hormonal contraceptives, sources of contraceptive information, personal contraceptive history (only asked of participants who reported contraceptive use and wanted to discuss their experiences), and advice for potential contraceptive users, including the best places to seek information.

The interview guide was adapted iteratively throughout data collection. For example, questions about the impact of COVID-19 on contraceptive use and about perceptions of hormonal methods were added to further capture the emic perspective of participants, as these issues appeared recurringly in early interviews. Similarly, questions about perceived frequency of contraceptive side effects and serious adverse events were dropped, as these were interpreted by participants as knowledge-testing and seemed to fluster those who did not know the answers. Participants had the option to skip any question, including questions about personal method use, but few did so. The full interview guide contained 23 questions and can be found in Appendix A.

All IDIs were conducted virtually via Zoom, Skype, or Facetime. Interviews lasted 40-60 minutes. Interviews were conducted by one of four female interviewers (LG, HR, PR, ZR). All interviewers were Emory University public health graduate students in their 20s and 30s from various racial and ethnic backgrounds. We did not match participants and researchers based on race and ethnicity.

Throughout interviewing, we sought to practice reflexivity by constantly identifying how our perspectives and biases might impact the research process. For example, I approached this research with the underlying belief that contraceptive use is overall quite safe. Additionally, as graduate students in public health, all interviewers had access to high quality information (e.g., through peer-reviewed journals) and training in interpreting research findings and assessing evidence quality. Sharing our perspectives with participants may have biased their responses or made them feel uncomfortable for disagreeing with our opinions. To balance our subjectivity, interviewers wrote memos in which we

reflected on any emotions, assumptions, or biases that we observed within ourselves during the interviews to avoid injecting these into data collection or analysis. We also had debriefing sessions where two or more members of the research team discussed these topics. During interviews, we made sure not to share information or make comments that might affect participants' responses, even when they shared misinformation. After completing the interview, participants were asked if they would like to be directed to a website created by the study team that provided evidence-based information about contraceptive methods available in the U.S., which could help correct any such misconceptions shared during the interviews.

Interviews were collected until we reached saturation, at which point we stopped collecting new data.[447] After about 20 interviews, we reached code saturation, the point at which we were not adding or refining codes and at which our codebook began to stabilize.[448] However, we continued to conduct interviews and analyze data for two more months, until we felt that we had reached meaning saturation, because we understood our data and were not identifying new information as interviews continued.[447, 448] We ultimately conducted 29 interviews. All interviews were audio-recorded, anonymized and professionally transcribed verbatim. Data were managed and analyzed using MAXQDA 2020 (VERBI Software) qualitative data analysis software.[449]

Analysis

We used a grounded theory approach to collect and analyze our data.[450, 451] Through grounded theory, we aimed to develop a substantive theory based in our data that could help explain how safety beliefs, information sources, and interpersonal and social influences interplay to affect contraceptive use. First, we carefully read each transcript, writing memos that reflected observations about the data, drafted possible codes and code definitions, and identified patterns in the data (e.g., similarities across interviews). One researcher (HR) then re-read all transcripts and memos. An initial codebook was developed that included deductive codes based on a priori knowledge of the literature and inductive codes

identified through reading and memo writing. Detailed code definitions and examples were added for each code.

Transcripts were coded independently by two coders (ZR and HR). The codebook was refined iteratively throughout the coding process, as codes were added or dropped, and code definitions were refined). The final codebook can be found in Appendix 2. We assessed interrater consistency but found inconsistencies in coding styles. Therefore, we double-coded all transcripts and merged coded transcripts in MAXQDA for analysis. The research team met weekly to discuss the coding process, relationships between codes, and larger emerging themes in the data.

After coding the data, we searched the data by key codes and conducted lexical searches using key terms (e.g., specific concerns, like infertility). We searched by combinations of codes to explore relationships between them. We took detailed notes on code searches and discussed broader concepts and relationships between codes at weekly meetings. We created variables based on demographic and sexual and reproductive health (SRH) influences, then searched codes by different variables to identify any patterns (e.g., differences across racial/ethnic groups or by parity).

After thoroughly searching the data, we created a list of categories. For example, we observed that participants tended to characterize methods positively or negatively based on familiarity and perceived safety. We observed notable differences in how participants discussed familiar methods, like OCPs compared with how they discussed less familiar methods, like IUDs. We then went back and repeated the process of searching and re-reading and memo writing to confirm and contextualize preliminary findings. We wrote detailed, nuanced "thick descriptions" for key concepts. Through the analysis process, we identified distinct contraceptive use pathways leading to contraceptive use status at the time of interview. We created a figure to depict these pathways, as described below.

Results

Contraceptive Use Pathways

Through data analysis, we began to see distinct patterns that characterized how information exposure and external influences contributed to contraceptive use behavior. We identified three distinct pathways that defined participants' contraceptive use experiences leading up to the at time of interview. We describe these pathways using a roadmap as a visual metaphor, as depicted in **Figure 4.1**. In this figure, boxes with thick black borders represent internal and external influences, circles represent intermediary contraceptive behaviors, and "pins" (the type used in electronic maps) represent method use "destinations." The idea of contraceptive decision-making as a journey has been used to conceptualize contraceptive behavior among young people in the San Francisco Bay area.[452] Our analysis expands on this framework by focusing on the way beliefs about contraceptive safety influence these journeys.

Pathway 1, in red at the bottom of the **Figure 4.1**, was characterized by: 1) early exposure to information about contraceptive-related AEs, 2) development of concerns about safety of hormonal and prescription methods, including misconceptions, and 3) use of non-prescription methods. Pathway 2, in blue in the middle of the figure, was characterized by: 1) early experiences with menstrual pain, acne or PCOS, 2) exposure to information about use of hormonal methods, specifically OCPs, to alleviate symptoms, 3) development of positive beliefs about hormonal methods, and 4) consistent use of OCPs.

Pathway 3, in purple diverging from Pathways 2 and 3, was characterized by method switching. Participants in this group searched for method that worked for their lifestyles and had tolerable side effects. Personal experiences with AEs and side effects influenced their beliefs about safety, but external influences were also important in their decision-making processes. All participants in Pathway 3 used prescription methods, primarily OCPs, at some point, but they diverged after use of their initial method(s). One group was exposed to positive information about LARC methods or non-oral CHCs (patch and CVR) from providers or friends and developed positive opinions about such methods, choosing to try them. Others decided to discontinue hormonal method use, using barrier or behavioral methods at time of interview.

Pathway 1: "Well, I don't really use any birth control methods that affect hormone levels."

Participants in Pathway 1 were exposed to information about contraceptive-related SAEs during their teenage years or were raised in context in which hormonal contraceptive use was seen as non-normative. Thus, early in life, they were exposed to negative information about contraceptive safety and developed beliefs about personal susceptibility to serious (severe) AEs, like infertility and infection. These interpersonal and social influences started them on a path of barrier or behavioral method use. Thus, at their first sexual experiences they used barrier or behavioral methods (condoms or withdrawal), represented by the red circle at the bottom left of the figure. All participants in this group used barrier or behavioral methods (e.g., withdrawal, FAB) and maintained use of these methods until the time of interview, with no major turns in their paths, as indicated by the steady red line at the bottom of the figure. The red pin in the bottom rights indicates use of barrier and behavioral methods at time of interview.

Of the seven participants in Pathway 1, all but one identified as people of color. Given a long history of reproductive coercion targeted toward people of color, it makes sense that participants of color would be exposed to more frequent or serious concerns about contraceptive-related AEs from friends and family members. Participant 24, a 23-year-old withdrawal user who identified as a Black female, was first exposed to information about IUD-related SAEs via a television commercial about IUD-related litigation. She saw this commercial with her mother, who explained that she was a former IUD user, but that her body had not "accepted" the IUD. She had become very sick and developed a high fever and had the device removed. Her mother and best friend also shared negative experiences with OCP side effects, including bloating and itchy, dry skin, scabbing. Learning that her loved ones had experienced these events created concerns about personally using prescription methods. Like other members of this group, Participant 24 valued natural medicine and did not see the need to risk such AEs when withdrawal and condoms worked well for her.

Similarly, Participant 6, a 24-year-old participant who grew up in Southeast Asian and was using FAB methods and condoms at time of interview, described long-term fertility concerns, since her mother

had difficulty conceiving her and her sibling. She actively avoided any hormone-containing methods, stating: “I just figured, if anything, maybe I'm at like a slight percentage higher risk than everyone else that it affects me getting pregnant later on.” Like other participants in this pathway, Participant 6 knew from friends that hormonal methods could improve acne and stabilize mood while preventing pregnancy but thought the possibility of long-term infertility and the prospect of irregular periods were “terrifying.” Her one experience using ECPs led to irregular menstrual bleeding, which was distressing to her.

Participant 6 also discussed concerns caused by television commercials for contraceptive methods, commenting on the mismatch between the content and warnings about side effects: “it's just very happy people, but then also very large, long lists of possible side effects.” Participant 6 credited growing up in a country with much lower hormonal contraceptive use than the U.S. as a “very large contributing factor as to why I don't take a hormonal contraceptive.” Although she had discussed OCPs with her healthcare provider and thought they were fine for other people, she expressed concern about whether enough was known about long-term use: “People don't really know long, long-term side effects.” Others simply explained that they didn’t know about long term effects, having never been taught about them in school or by a provider.

Despite wanting to prevent pregnancy at time of participants in pathway 1, they were satisfied with their methods and valued the ease, convenience, and lack of side effects. Several participants mentioned that they did not need a more effective method given perceived low frequency of sexual intercourse. They conducted a risk-benefit analysis and determined that there was no need to depart from a pathway that was predictable and worked for them.

Pathway 2: “The short-term effects of birth control are so much better than the risks that may or may not happen.”

Participants in Pathway 2, depicted in blue, were OCP users who had not used other methods and were largely satisfied with OCPs. Most initiate OCPs at or prior to sexual initiation and use consistently until time of interview, as indicated by the blue lines in the figures. Some participants had temporary

detours after developing interest in OCPs, primarily due to concern about parental attitudes. This led them to use barrier and behavioral methods for a time prior to OCP initiation, as depicted by the dotted blue line running parallel to pathway 1 for a short period. This was the largest group of participants, containing about half of the sample. All but two participants in this group were using OCPs at time of the interview, as indicated by the blue map pin at the right side of **Figure 4.1.** These two had young children and were considering having more children in the future. Both had previously used OCPs. Most participants in this group identified as White or Asian/ Asian- American or as mixed race or biracial.

For many participants in this path, method use decision-making was influenced by non-contraceptive benefits (NCBs) of OCPs. Prior to starting a method, these participants experienced heavy, painful, or irregular menstrual periods, acne, polycystic ovarian syndrome (PCOS), or endometriosis. They learned that OCPs could alleviate their symptoms from a friend, parent, or healthcare provider, which launched them on their contraceptive use journeys. These journeys often began at young ages, long before sexual debut. For many, pregnancy prevention remained a secondary motivator for continued method use.

Participant 10, a 19-year-old Asian American OCP user, typifies many of the shared characteristic of people in Pathway 2. Participant 10 experienced debilitating menstrual cramps, heavy bleeding, and emotional lability during her menstrual period, starting at menarche. These symptoms significantly impacted her quality of life, impeding schoolwork, and extracurricular activities. She felt as though she was “missing one fourth” of her life due to menstrual pain. At age 13 or 14, witnessing her pain and discomfort, friends informed her that OCPs may be able to alleviate her symptoms. As with others in this group, her peers helped craft positive views of OCPs by sharing their experiences. She had never heard of non-contraceptive uses of OCPs and remembered thinking: "There's medicine out there that can alleviate pain?” and “"Birth control? Isn't that for people who have sex?" She ultimately had an overwhelmingly positive experience with OCPs and had used them for four or five years leading up to the time of interview. As with others in this group, she thought of OCPs as not only safe, but beneficial to health.

In some cases, healthcare providers suggested OCPs when participants presented for care for these health complaints, regardless of whether they had initiated sexual activity. For a few participants, focus on these non-contraceptive benefits presented a convenient way to start their contraceptive use journeys or initiate a more effective method. They were able to shape conversations with parents and providers around NCBs, shifting attention away from sexual activity. Participant 11, a 24-year-old Asian American medical student and OCP user described this experience: "Yeah, I think I didn't have to have that awkward, 'Oh, I'm having sex, I need birth control,' conversation with my parents, but I can imagine that would have been a big barrier for me, especially as a teenager. I got on birth control, I think earlier, just because I was having really bad acne with my period and I was having really bad menstrual pain and cramping, and so my primary care doctor was like, 'Oh, you should get on birth control. It would help you'."

Because most participants thought that parental notification was required to access contraceptive care before the age of 18, parental beliefs about contraceptive safety and attitudes about adolescent contraceptive use became largely determinative of whether a participant initiated a method when they wanted, including people who sought contraception for NCBs. For people in this pathway with parents who supported contraceptive use, either because they were open about sexuality or accepted use for NCBs, the next step in the journey was simple. For example, Participant 50, a 16-year-old Black OCP user who identified as non-binary, had been diagnosed with PCOS within the year preceding the interview, and their doctor recommended OCPs. Although their dad was initially "getting all awkward about it," their mom advocated for them, and they initiated OCP shortly after seeing their provider. Despite not being at risk of pregnancy, they appreciated OCPs because they helped with their PCOS symptoms.

For others, parents caused a delay or detour in their path, represented by the blue dotted line in **Figure 4.1**. After determining that she wanted to use OCPs, Participant 10 was met with resistance due to her mother's belief that OCPs could cause "cancer, and blood clots, and just death in general," beliefs that she had developed from reading negative things about contraception on the Internet and the Chinese

social networking platform WeChat. Participant 10 doubted the veracity of her mother's claims, since she had heard contrary information from friends and Internet sources that she deemed more reliable than those her mother used. She determined that the "pros outweigh any cons even if they were true." After receiving support from two providers, Participant 10 was able to start OCPs, but her mother continued to express concern about this decision.

Other participants felt that they could not broach these subjects with parents and were concerned being "outed" as contraceptive users via insurance claims and being unable to afford out-of-pocket payments. These people ended up waiting despite interest in contraceptive use, either because they had initiated sexual activity or sought method-related NCBs. One participant stated: "I remember being very scared. I felt like I had to tell my mom because I wasn't sure if I could get the pill without... I thought that she would know through our... Because she controlled my insurance and everything like that. So, there was a lot of fear involved in that, that probably delayed it." Only two participants reported accessing free or low-cost contraceptive care from their local Health Departments as minors, and one mentioned paying out-of-pocket. Several waited until college and were able to access OCPs from university health centers without parental notification. Participants who had difficulty broaching contraceptive use with their parents often reported that their parents who were raised in cultural contexts in which conversations about sex and contraception were taboo, were religious, or were politically conservative.

Once participants in this group initiated OCPs, their pathways to time of interview were mostly smooth and unwavering, consisting of continued OCP use. Some did experience side effects, including mood changes or weight gain, but either switched OCP formulations or found that the side effects mostly resolved over time. Overall, they reported satisfaction with OCP use, confidence in their methods ability to prevent pregnancy, and improvement of symptoms for the underlying issues that contribute to method uptake. Participant 7, a 24-year-old White OCP user who identified as non-binary, summed up their experiences and those of their friends as follows: "Yeah, I think... I know for me, with the pill it makes my periods a lot less painful. I don't always have a period every month, which is... I kind of like that. And it makes me feel safer. And I know I have friends who it makes feel safe and comfortable knowing that

that's gonna really significantly reduce their likelihood of getting pregnant." Participant 7 was at little to no risk of pregnancy, but still valued OCP use: "Again, it's been literally almost four years since I've been with my current partner, and she has a vagina and I really... I'm not at risk of being pregnant, but I think I feel like it's good just in case something were to change in that realm. And also, I feel like it is stabilizing my period. I remember I used to be in so much pain when I would have cramps and just aches all over my body, and I'm glad I don't have to deal with that, so it, yeah, feels like something that is just part of my routine habits now." For those like Participant 7, positive experiences drove their beliefs that OCPs were safe and beneficial.

However, some participants expressed concerns about hormonal exposures, despite continuing to use OCPs. Specific concerns included long-term infertility, mood changes, blood clots, and cancer. Participant 61, a 19-year-old Indian American OCP user who identified as female and volunteered as a sexuality educator, initiated OCPs when she was 17 to help with acne. Despite having used OCPs for several years, she expressed ongoing concerns about exposure to exogenous hormones due to a family history of breast cancer. While she continued to use OCPs, her pathway was bumpier than that of other participants. She grappled with her decision to use OCPs, discontinued use and then re-started. She wondered if her current use would lead to long-term problems but valued pregnancy prevention as a college student. Like participants in Pathway 1, she felt that long-term effects of hormonal exposure were largely unknown, stating: "And in the long term, I don't know how taking these excessive hormones will impact my body. I don't know if there are studies done on long-term effects and stuff like that, if there are, I just haven't read them. But I've been on birth control for two years now, hormonal birth control, and ideally I would like to stop soon." This sentiment was shared by Participant 65, an 18-year-old who identified as mixed race and female had been using OCPs for two years by the time of interview. She had developed an interest after talking to friends about acne improvements and alleviation of cramps, and ultimately initiated after she got a serious boyfriend in high school. She found OCPs easy to use and stated that "making sure that I'm not pregnant was very important, being able to reach my own goals, but still not have to worry, the pill made it easier in aspects." However, she also worried about long-term

infertility, stating “Yeah, I guess I'm more worried about if it's messing with my hormones in a way to like... I know some friends that are on it and they don't get their period at all, they're on that type of birth control, and it's like, is that gonna affect your body in a negative way later on with like... I still wanna have kids when I'm older, so I don't know.” Rather than citing a specific source that caused these concerns, Participant 65 discussed lack of education in schools and from providers. These gaps in her education created concerns that there was information about long-term effects that doctors were not telling her.

Like other participants in this group, Participants 61 and 65 felt more comfortable using OCPs than other methods, especially LARCs. Negative attitudes were developed based social media stories, accounts from friends and family, and feedback from providers. Participants shared beliefs about LARCs leading to perforation, expulsion, pregnancy during use, infertility and death. One participant discussed a friends’ experience with miscarriage and stillbirth after DMPA use. Since participants in this group had largely positive experiences with OCPs, most saw no need to experiment with other methods, which they perceived as riskier. These information sources contributed to participants’ disinterest in straying from a path that was working for them. A few participants described friends’ positive experiences with LARCs and noted that they would consider these methods in the future. However, most participants knew many OCP users and few LARC users. Thus, peers were not usually able to not share positive information about LARCs to counteract negative information received elsewhere.

Providers often contributed to these negative perceptions, either tacitly by focusing on OCPs only or actively, by sharing misinformation and negative opinions about LARCs. For some participants who had considered LARCs, providers re-directed them to OCPs. Participant 61, for example, reported that a provider told her an IUD would not be a good method for her because she did not use tampons, and Participant 50 was told that an IUD would be a bad choose because they wanted to have children “relatively soon-ish.” The long-acting nature of these methods was often seen as a deterrent. Participants in this group liked having autonomy over their method use and the ability to stop and start OCPs. Some did not seem to understand that users can discontinue LARCs early and providers did not make this clear.

Participant 13, a 20-year-old OCP user who identified as a White female described IUDs as "one of the more extreme options." While she supported IUD use for others, when it came to herself she stated that she felt "much safer on a temporary or a shorter-term contraception method." She said of IUDs: "I'm 20, I know people who want to be parents at my age, and that's not what's right for me, but I also don't see the need to put something that would prevent me getting pregnant for the next 10 years in my body at this point in my life." She had developed these attitudes after a long talk with her doctor about contraceptive options. Although she was seeking to prevent pregnancy, Participant 13 did not think the added effectiveness of a LARC method was worth the perceived risk of long-term infertility. She said: "If I'm gonna be putting something in my uterus that could potentially scar and prevent me from having kids for the next…for the rest of my life, then that maybe is something to consider versus an extra 5% effectiveness, when I'm really not that sexually active to begin with."

Additionally, several participants reported that healthcare providers had endorsed OCPs over other methods, contributing to the idea that these methods were more appropriate for young people. In some cases, combined methods were indeed the best route to alleviate healthcare complaints, and in other instances, participants were certain that they wanted to use OCPs prior to their healthcare visit. In these cases, providers steered participants down the right path, respecting their healthcare needs and autonomy. However, sometimes provider focus on OCPs seemed to run counter to best practices for contraceptive care, keeping participants on their OCP use pathways. For example, Participant 28, a 19-year-old OCP user who identified as a White female approached her college health center provider about contraceptive use. She was directed to OCPs, despite being interested in a LARC method. She described the health centers' approach to prescribing methods as: "If you don't like the pill, you can do shots, and if you don't like the shots, you can get an IUD." Other participants described similar experiences, stating that the pill was the only option presented to them by their providers or available in clinic. Here, providers served as roadblocks to use of more effective methods by failing to offer a comprehensive contraceptive method mix.

Pathway 3: "It's like I had to go through this whole four-year journey to find something that actually works."

Participants in Pathway 3 had windier paths to method use at time of interview than people in the other groups. These eight participants were method switchers who sought methods that fit their lifestyles and were well tolerated. There was more heterogeneity in the experiences of these participants. Generally, they started their journeys in Pathways 1 or 2 but diverged based on individual or health systems influences. Since all had used OCPs, either alone or with another method, prior to their current method, they diverge from Pathway 2 at the "roundabout" representing experiences with OCPs, at the center of the **Figure 4.1**. Those in Pathway 1 experienced satisfaction with OCPs at this juncture and continued with use, but those in Pathway 3 experienced dissatisfaction and either received positive information about LARCs or non-oral CHCs (or both) from peers and providers, rerouting their journeys. Others decided that OCP use was too onerous and not worth the hassle. These people also diverged from Pathway 2, entering Pathway 1, using barrier or behavioral methods instead.

Participants in this group had used OCPs, patches, CVRs, IUDs, implants and abstinence. The most common reason for switching methods was dissatisfaction with the daily requirements of OCP use. Participants in this sub-group had few concerns about method safety, but instead found daily pill use to be difficult. Participant 101, a 21-year-old who identified as a Black female and was currently practicing abstinence, said of her brief experience with OCPs: "Because it was the beginning, I was trying to be on it, checking the alarm and then taking it at the specific times and everything, but after two weeks, that got a little difficult. And I did jump around and having to take it at different times, so as a result, when I kept messing up, and then I'd try to get it back together and then mess up, then try to get it back together. I just felt like I wasn't doing it right, so I was like, 'Okay, this method isn't the best for me'." While Participant 101 discontinued method use altogether, others tried new methods, including the patch, implant, and ring, which they learned about from peers and healthcare providers.

For example, Participant 45, 23-year-old CVR user who identified as a White female, initiated OCPs to help with menstrual irregularity and prevent pregnancy. She started OCPs because they were

familiar and credited being raised in a setting with poor sexuality education ("real trash, public sex ed") and a mother who was only knowledgeable about OCPs as drivers of her limited knowledge of other methods. After two years, she found herself regularly forgetting to take the pill, at which point she talked to friends about their LARC use and became interested in the implant. She followed up with Internet research and was excited about this "low maintenance method" and the possibility of method-induced amenorrhea. She was able to easily switch to the implant at her university health center. While optimistic about the method, she had a negative experience, with prolonged spotting. Upon returning to her provider, she learned about the CVR. She decided to try it out and reported a very positive experience. She reflected on her journey, saying: "Everyone's different, and again, it's a process of figuring out what works, and it sucks that it's a process because it's a very intensive and sucky process, but that's kind of where we're at now. But yeah, just that there's a light at the end of the tunnel and something will probably work for you."

Other participants similarly cycled through two or more methods before finding one that fit, but the experiences of Participant 105, a 21-year-old Black mother who identified as non-binary, contrasted sharply with those of the White and Hispanic female participants in Pathway 3. Unlike the other participants in this group, who diverged from Pathway 2 and were largely comfortable with prescription method use, Participant 105 began their journey in Pathway 1. Like others who chose to avoid hormonal methods, they valued natural approaches to medicine, stating "I just like the natural process. I just want everything to just be natural as much as I can." They discussed herbal and natural approaches to contraceptives, which they had learned about via TikTok. They tracked their periods using an app and valued regular menstruation, which they viewed as a sign that their body was regulating properly. However, once they gave birth to their daughter, they reported pressure from healthcare providers to initiate implant use: "So, they would tell me it was very effective, it's really good. Especially since after having a baby, you're most likely to get pregnant if you don't have some type of birth control. So, I went with it." With the implant, they reported nausea, lightheadedness, numbness, difficulty walking, and nearly constant spotting, which was especially alarming because they were anemic. They also reported

anxiety and depression but was not sure if these were based on the method or life stresses as a young mother and college student. When they went back to her doctor with these concerns, they were put on OCPs in addition to the implant to control their bleeding and told to "just let the Nexplanon do its thing for the first six months."

Additionally, they developed concerns about the effects of not ovulating during Nexplanon on her fertility. When they expressed these concerns, they felt dismissed by their healthcare providers, who told them that it "wasn't really a big deal" rather than taking the opportunity to educate them about what is known about long-term implant use. This caused them to believe that long-term effects were unknown, a sentiment shared by participants in Pathways 1 and 2. When they finally had the implant removed, they were pressured to start another method immediately, even though they told her doctors that they did not want to. They started the patch and found it much more tolerable than the implant but also reiterated their interest in natural medicine. Unfortunately, Participant 105's experiences are consistent the literature on the healthcare providers' devaluing of contraceptive preferences for young people and people of color, and those, like Participant 105, who are at the intersection of these identities.

Discussion

In this paper, we describe how a sample of young people navigate contraceptive decision-making and how internal and external factors influence use. Participants grouped into three pathways, based on the way they information exposure helped craft behavior. In Pathway 1, participants were influenced by negative information about hormonal method safety and decided that they did not want to risk their health to use moderately or highly effective methods. In Pathway 2, participants initiated OCPs after hearing about NCBs and learning that many friends safely used them. They were largely satisfied by their ongoing use. In the third pathway, participants encountered method-related challenges and side effects and tried several methods before landing on their current method. Understanding these pathways helped shine light on potential avenues to support young people through contraceptive decision-making journeys and ultimately improve family planning outcomes.

Interpersonal Implications:

Parents played a major role in influencing beliefs and determining access for young people in our sample. Many shared well-intentioned misinformation, seeking to protect their children from contraceptive-related AEs. As Participant 20 noted, "my mom, I think she has, probably, a more outdated view of birth control. So obviously, medicine and technology change…" In other cases, parents were exposed to misinformation via social and interpersonal sources. Parents also served as access roadblocks, since participants felt that they could not access contraception without parental permission or gain such buy-in.

Participants with parents who were open about sex and contraceptive use had fewer access barriers. These findings highlight the importance of interventions that parental sexual health knowledge and communication self-efficacy. Appropriate settings for such programming include schools, community centers, and online forums. Groups like Planned Parenthood Federation of America (PPFA) and Sex Positive Families offer evidence-based educational resources for parents,[453, 454] but generally, the onus is on parents to access these resources. Embedding programming for parents and parent-child dyads into schools and communities and formally evaluating such programs may increase parental comfort and reduce access barriers. Such programming could have implications for young people in any of the three pathways identified, especially those in Pathway 2 who sought OCPs but relied on less effective methods until they were out of their parents' homes, due to access concerns.

Social Implications:

The COVID-19 pandemic has demonstrated the rapidness through which misinformation can spread via social media and the extent to which such misinformation can influence behavior. Social media and other Internet sources were salient influences for participants in this study. Facebook has embedded formal fact-checking into its infrastructure. According to Facebook, 95% of users avoiding clicking on posts marked as misinformation.[455] However, such fact-checking has not weeded out misinformation

about contraceptive safety, perhaps because the programs rely largely on user reports to identify misinformation. Artificial intelligence has been used to identify misinformation about COVID-19. Expanding this program to identify misinformation related to family planning could be an important tactic for reducing the impact of misinformation from social media.

Health Systems Implications:

The CDC and U.S. Office of Population Affairs (OPA) have published evidence-based guidelines for healthcare professionals that taken together, can help providers offer high-quality, appropriate contraceptive care. These include the Providing Quality Family Planning Services Recommendations (QFP),[456] which services should be offered in a family planning visit and how these services should be provided, the U.S. Medical Eligibility Criteria for Contraceptive Use (U.S. MEC),[17] which provides guidelines for safe method use for individuals with medical conditions and other characteristics, and the U.S. Selected Practice Recommendations for Contraceptive Use (U.S. SPR),[457] which lays out recommendations for common contraceptive-related clinical questions, like missing a pill or switching methods. Additional guidelines provide recommendations for teen-friendly SRH services.[458] Similarly, Dehlendorf et al. call for person-based counseling in contraceptive care -- care that involves "...treating each person as a unique individual with respect, empathy and understanding, providing accurate, easy to understand information about contraception based on the patient's needs and goals, and assisting patients in selecting a contraceptive method that is the best fit for their individual situation in a manner that reflects the patients' preferences for decision making."[459, 460] Dehlendorf has identified such a model of care as one that family planning patients prefer,[459] and preferences for this type of care were echoed by our participants.

The provider encounters described by our participants demonstrate that providers are not providing evidence-based care. Examples included telling patients that OCPs were the most appropriate method for young people, sex shaming, pressuring participants to use certain methods, and failing to take

patients' preferences seriously in counseling. These descriptions indicate the need for better provider training, including better incorporation of these guidelines, in private obstetrics and gynecology (OB/GYN), family medicine, and university-based healthcare settings. Participants routinely described care that was not client-centered ("respectful of, and responsive to, individual client preferences, needs, and values") or evidence-based ("integrating science-based interventions with community preferences to improve the health of populations).[456] Participant 105, the young mother who felt coerced into implant and OCP dual use, was the most egregious example of paternalistic care in this study, but nearly half of the sample shared experiences with providers that were misaligned with best practices.

In the U.S., training is available from the Reproductive Health National Training Center for Title X and Teen Pregnancy Prevention (TPP) federal grantees, but other providers, including OB/GYN and family medicine practitioners are not required to complete continuing education related to high quality family planning care. Such offerings should be readily available and promoted to all board-certified providers and integrated into both continuing education and training for medical, nursing, and allied health professions.

Policy Implications:

Our interview guide included questions about preferred sources for learning about sex and sexuality, contraception, and contraceptive safety. Participants described their sexuality education experiences in very negative terms, with the vast majority reporting that in-school education covered abstinence and condoms only. When asked how they thought young people should learn about contraception, participants overwhelmingly cited school as an important setting. For students with parents who are unwilling to talk about sex and those who might seek information from unreliable Internet sources, school represented a missed opportunity to receive vetted, evidence-based information.

In the U.S. Southeast (Alabama, Florida, Georgia, Kentucky, Mississippi, North Carolina, South Carolina, and Tennessee), sexuality education is mandated in all states except Alabama..[461] However, state

laws to ensure that such education is of high quality are lacking. An overview of these laws is depicted in **Table 4.1**. For example, all states require that such education emphasize abstinence, and none prohibit incorporation of religion. In Georgia, in which this study was set, sexuality education is not required to be medically accurate, age appropriate, culturally appropriate or unbiased or free of religious influence. While it must emphasize abstinence and include importance of sex only within marriage, education is not required to include information about contraception or condoms, and parental opt out options are required. These caveats chip away at the potential effectiveness of educational offerings, making informal information sources important. Those with vested interest in better sexuality education infrastructure, including parents, youth, and those from the public health and medical communities, should advocate for changes to local and state policy. Groups like PPFA and Advocates for Youth provide materials to help such stakeholders effectively advocate for comprehensive sexuality education in their communities.[462, 463]

Additionally, parental notification served as a barrier to contraceptive use among young people in this study. Providers and sexuality educators should be informed of parental notification laws in their states, in order to empower young people in states in which contraceptive services can be received without parental notification or consent. Less than half of U.S. states explicitly allow minors to consent to contraceptive services. Thus, policies to facilitate receipt of services without parental notification are another target for advocacy.

Limitations and Strengths

Some limitations to this research exist. While we included individuals from several racial and ethnic groups, nearly half the sample identified as White. However, in reporting our results, we included voices from across the racial and ethnic groups represented. Additionally, this was a particularly well-educated sample, with over half of the sample reporting at least some college. Because we did not ask about education on our eligibility screener, we were not able to purposively sample based on this criterion. While we expanded our sample to include non-urban participants, we did not include specific

questions about how geographical context might have impacted knowledge, use, or access. Differences may have emerged if we had explored these further. Finally, we focused largely on individual and interpersonal determinants of contraceptive use, but research has shown that structural factors are important determinants of use. Generally, participants did not discuss access barriers, but we may have learned more if we had explicitly asked about them.

The strengths of this research were its focus on processes through which information impacts use, which can be useful for understanding contraceptive use patterns and identifying opportunities for interventions. We focused on an important age group at risk of UIP and included a mix of teenagers and young adults. Despite the over-representation of White participants, we recruited a diverse sample in terms of race and ethnicity. Finally, we focused on an understudied region with high rates of adverse maternal morbidity and mortality.

Conclusion

In this sample, knowledge gaps and misinformation exist, primarily regarding long-term effects of hormonal contraceptive use. A common concern was that long-term method use was largely untested, a belief that could be corrected by sharing information about longitudinal studies on contraceptive use. However, participants were largely satisfied with their methods, even those using lower effectiveness methods. This finding serves as a reminder that factors other than method effectiveness impact contraceptive decision-making and satisfaction.

We noticed important differences by race and ethnicity within this sample. Nearly all participants in Pathway 1, who expressed skepticism about hormonal method safety and used less effective barrier or behavioral methods, identified as people of color. Among White participants, only one person reported never having used a moderate or highly effective method. Participant 105, a young Black mother, experienced contraceptive coercion from providers who pressured them to use a LARC method after giving birth, retain the method after experiencing unacceptable AEs, and initiate another hormonal

method after discontinuing, despite their objections. Their experiences differed starkly from the White mothers in the sample, both of whom had small children but neither of whom had initiated prescription methods after giving birth. Unfortunately, these findings are consistent with the literature on disparities in contraceptive use across racial and ethnic groups and on racism in SRH care.[464-466]

The results of this study suggest several opportunities for policy and practice changes to facilitate contraceptive knowledge and access for young people in the U.S. Improving the quality of formal and informal knowledge provision can help empower young people to make decisions based on the best available evidence about contraceptive safety. This, in turn, will support young people in making the best decisions for themselves, based on values, preferences, and reproductive goals.

Figure 4.1. Contraceptive Use Pathways.

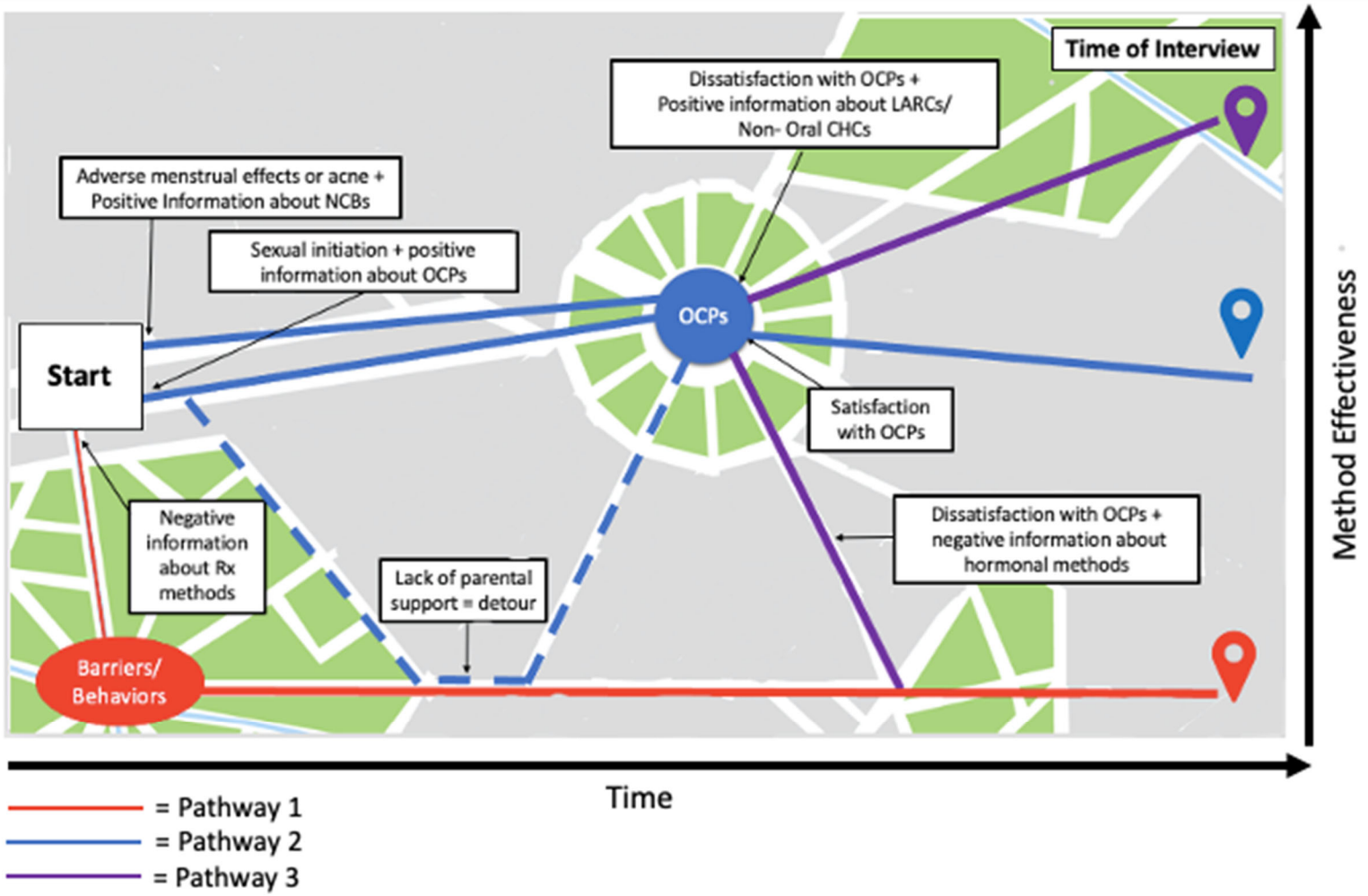


Table 4.1 State Laws on Sexuality Education in the U.S. Southeast.

	Alabama	Florida	Georgia	Kentucky	Mississippi	North Carolina	South Carolina	Tennessee
Sexuality Education Mandated		X	X	X	X	X	X	X
Must be medically accurate						X		X
Must be age appropriate	X	X			X	X	X	X
Must Be Culturally Appropriate & Unbiased								X
May not promote religion								
Parental Opt-Out Option	X	X	X			X	X	
Must include information about contraception	X					X	X	
Must emphasize abstinence	X	X	X	X	X	X	X	X
Must include importance of sex only within marriage	X	X	X		X	X	X	X
Must cover condoms	X					X	X	

Adapted from: Guttmacher Institute (2021). State Laws and Policies: Sex and HIV Education. Available at: https://www.guttmacher.org/state-policy/explore/sex-and-hiv-education.[461]

Appendix 4.A. Interview Guide

Hey [participant name]! I'm [your name]. It's great to "meet" you. How are you doing today?

Did you receive your gift card earlier today?

Introduction:

Thank you again for agreeing to do in this interview. As I've mentioned, I'm a researcher at Emory, and I'm doing this study to better understand sources of information about birth control and how young people like you make decisions about whether to use birth control and which methods to use. This interview should take about an hour.

Just as an FYI, there are no wrong answers to any of these questions—we're just really interested in your thoughts and experiences.

Importantly, your participation is totally voluntary. If you want to skip some questions, that's absolutely fine. If you change your mind, you can leave the interview at any time and still be fully reimbursed for your time. Anything you tell me will be kept confidential and only used for this study. Your name won't be connected with anything you say.

Would it be ok for me to record this interview to make sure that I don't miss anything you say? If you don't want me to record it, that's fine too.

If yes: The recording will only be used for this research project and will not be shared with anyone else. It will be securely stored and then deleted when we're done with the project. I may also take some notes as we go.

If no: Ok. I may take some notes throughout the interview to make sure I remember what you tell me.

Do you have any questions before we get started?

Demographic questions:

First, I have a couple of basic questions for you:

What gender pronouns should I use to address you?

How do you identify in terms of race and ethnicity?

General contraceptive knowledge:

Now, I'm going to ask you some questions about what you've heard about birth control methods in general - they don't have to be methods you've used.

By birth control methods we mean anything people to do prevent pregnancy.

1. What birth control methods have you have heard about? [note methods]

2. Can you describe what you have heard about these methods? I'll go down the list of the methods you've mentioned. To start, please tell me what you know about [method #1]
    Probe: How do you use them?
    Probe: How do they work?
    Probe: What have you heard from people who have used them?

Ask participant about each method they have named in question 1.

Contraceptive Safety

3. What have you heard about the safety of using different methods of birth control?
    Probe: How safe do you feel/would you feel using different methods of birth control?
    Probe: What are some things that could happen to your body if you use birth control?
    Probe: What are some changes to your health that people might experience when they use birth control?

Ask participant about each method they have named in question 1.

4. Some people experience side effects when they use some birth control methods. These can be good or bad. What have you heard about the side effects of birth control methods?
    Probe: Good side effects?
    Probe: Bad side effects?

Ask participant about each method they have named in question 1.

5. What about more serious health problems that could happen when people use birth control—things that are more than just inconvenient-- what have you heard about these kinds of events?

    Probe: What do you know about more serious changes to your health that might happen if you use birth control?
    Probe: What do you know about more serious things that might happen to your body if you use birth control?

6. How do you feel about birth control methods with hormones?

    Probe: Why do you think you feel that way?

6.b. [If participant mentions wanting to avoid hormonal methods]: Why don't want to use them?

Probe: What might happen if you use birth control with hormones?

Sources of Contraceptive knowledge:

Now, I'm going to ask you some questions about how you've learned the things you know about birth control.

7. How did you *first* learn about birth control?
    Probe: What did you learn?
    Probe: Any other sources?
    Probe: [If they don't mention all the methods listed in #1]: How did you learn about [method]?

8. How did learn about birth control *safety* specifically?
    Probe: What did you learn?
    Probe: [If they don't mention all the methods listed in #1]: How did you learn about safety of [method]?

9. Which sources of information about birth control do you trust the most?
    Probe: Why trust these sources?
    Probe: Why distrust other sources?

10. How do you think young people should learn about birth control?
    Probe: Why?
    Probe: Any other sources?

Personal contraceptive use history:

[If participant is < 18 years old]: Now, I'm going to ask you some questions about your own contraceptive use. These questions are completely voluntary. We can finish now if you prefer not to discuss your personal experience of birth control. Do you want to continue?

11. If participant has not discussed personal contraceptive use: Which birth control methods, if any, have you ever used?

    If participant has spontaneously mentioned method use: You mentioned you've used [method], are there any other methods you've used?

[If participant reports not using a method]:

11a. What are some reasons you have not used a birth control method?
    Probe: What were some things you thought about?
    Probe: Any other reasons?

11b. What else influences decisions about birth control?
    Probe: Are there any other people who have been involved with deciding if you use birth control or not?
    Probe: Are there any other factors that led you to not use birth control?

[Skip to question #19]

[If participant reports using a method]:

12. How did you choose your *first* birth control method?
    Probe: Who helped you make this decision?
    Probe: What were some things you thought about?
    Probe: Why did you choose that method at that time?

13. How did you feel about using that method?
    Probe: What was good about it?
    Probe: What was bad about it?
    Probe: If participant mentions stopping method: Why did you stop using it?

[If participant mentions more than 1 method]:
14. How did you choose your current/ most recent method of birth control?
    Probe: Who helped you make this decision?
    Probe: What were some things you thought about?

15. How did you feel about using that method?
    Probe: What is/was good about it?
    Probe: What is/was bad about it?
    Probe: If participant mentions stopping method: Why did you stop using it?

16. How did the safety of different birth control methods affect the methods you used?
    Probe: How much did you consider safety over other things?
    Probe: How much did thoughts about safety influence the methods you chose to use?

17. What else influences your choice of birth control methods?
    Probe: Are there any other people who have been involved with deciding what methods you use?
    Probe: Are there any other factors that led you to use certain methods?

Closing questions:

18. If a friend asked for advice about starting birth control, what would you tell them?

19. If someone asked you the best place to find more information about birth control, where would you tell them to go?

20a. What's one thing that you think everyone should learn about birth control?

Those are all the questions I have for you today. Is there anything else that you want to share with me?

If you are interested, we can send you an aggregated summary of what people say in these interviews. It won't contain anything that will identify you or anyone else who participated in the study. Do you want me to send you that when the study's done?

Additionally, if you're interested in learning more about birth control methods available in the U.S., we can send you a link to a website we've developed. Would you like us to send you that?

Thank you so much for participating today. It was really great to meet you and I really appreciate you taking the time to talk to me.

Chapter 5. Conclusion

In the U.S., UIP is associated with increased risk for adverse health pregnancy outcomes. [1-3] This is especially true among adolescents and young adults who experience UIP and subsequent births.[56, 467] Groups who have experienced marginalization, including those who identify as Black, Indigenous, and People of Color (BIPOC), and individuals with low socioeconomic status (SES) are at higher risk of experiencing UIP and negative effects related to UIP.[2, 4, 6-9, 468] UIP rates are high in the Southeast (SE), the main geographical focus of this dissertation research.[469]

Contraceptive use is a critical component of reproductive life planning for people for many of the 46 million people in the U.S. who are sexually active but not seeking pregnancy.[468] There are at least 19 contraceptive method options available in the U.S.[470] Across this method mix, there are notable variations in effectiveness, side effect profiles, and ease of use. In the U.S., the most commonly used reversible methods are OCPs and coital-dependent methods, like withdrawal and condoms,[468] while about 12% of people who can get pregnant use no method.[471] This research explored drivers of these contraceptive use patterns. The literature shows consistent concerns about safety among users and potential users.[17, 21-42] Since many contraceptive methods have excellent safety profiles and few absolute contraindications for users without existing medical conditions,[17] these beliefs may be grounded in misinformation.

Overview

I conducted this dissertation research to gain understanding about the apparent disconnect between scientific evidence to date and persistent beliefs about modern contraception that drive family planning behaviors and outcomes. Through this original three-aim mixed methods study, I sought to address gaps in the literature by characterizing which beliefs are most common, exploring how beliefs develop and under what circumstances beliefs translate to behavior, and assessing the role of information sources and other external influences. This dissertation study was informed by the HBM and SEM theories. I was especially interested in the roles of perceived susceptibility and perceived severity of

contraceptive-related AEs in driving contraceptive behaviors. I sought to explore how these behaviors were situated within external layers of influence, including social and interpersonal influences.

In Aim 1, via a systematic review of the literature on contraceptive safety beliefs in the U.S., I characterized the content and quality of previous quantitative work on beliefs about contraceptive safety and identified areas for future research. I found that research to date was largely atheoretical and included important methodological limitations. In Aim 2, I contributed to this body of literature through an original analysis, assessing the relationship between perceived susceptibility to various types of contraceptive-related AEs and contraceptive method use. I addressed several limitations in the current literature identified in Aim 1, by using a longitudinal design, advanced statistical methods, and nuanced operationalization for independent and dependent variables. In Aim 3, I used a qualitative approach to explore how beliefs about perceived susceptibility and perceived severity of contraceptive-related AEs impact method use, and the sources of information that individuals use to develop these beliefs.

This aim allowed me to better understand my Aim 1 and 2 findings. For example, while I observed that concerns about infertility were prominent in the literature reviewed for Aim 1. Through Aim 3, I learned that parents and social media were sources of these beliefs and that individuals were most worried about IUD use causing infertility. While Aim 1 included a national scope and a broad age range, Aims 2 and 3 contribute data about young people in the S.E., an important group in an understudied region. Together, the findings from this study help characterize beliefs about contraceptive safety in the U.S., describe how such beliefs impact use, and suggest areas for improvement in policy, education, and provider training.

Summary of findings

In chapter 2, I report the results of a systematic review on contraceptive safety beliefs among people in the U.S. (Aim 1). I assessed quality of the published literature on this topic and abstracted data on beliefs about serious adverse events (SAEs), side effects, and non-contraceptive benefits. I also abstracted data about individual and higher-level factors associated with these beliefs. I identified 48 articles that

reported relevant results. Identified studies generally reported results from cross-sectional surveys, included convenience samples, and failed to report multivariable findings. Within this body of literature, the most commonly reported SAEs infertility (n=15 articles), adverse pregnancy (n=13 articles) or fetal outcomes (n=6 articles) primarily related to OCP or emergency contraceptive pill (ECP) use, and physical problems with LARC devices (n=8 articles). Generally, less than half of a given sample reported these beliefs, but there were notable exceptions. For example, 78% of female respondents in Craig et al.'s 2014 analysis of the National Survey of Reproductive and Contraceptive Knowledge believed that IUD use might lead to infertility,[22] and over 80% of the sample in Schwarz et al.'s 2008 survey on ECP beliefs thought that ECP use could cause birth defects or miscarriage.[34] Furthermore, even beliefs reported by small proportions in any of the studies represent large numbers of people across the body of literature. For example, in Lehan-Macklin's 2015 study on ECP safety beliefs, 28% of the sample reported that they believed that ECPs could lead to birth defects if taken during pregnancy, which represented 555 people.[31]

Importantly, many commonly reported beliefs were not supported by current literature on contraceptive safety. In terms of infertility, a 2018 systematic review on return to fertility after contraceptive use, Girum and Wasie identified 22 articles that estimated the rate of pregnancy after contraceptive use. They found a pooled pregnancy rate of 83% (95% CI: 78-88%) within 12 months of method discontinuation,[472] similar to Trussel's estimate of one-year pregnancy rate with method non-use (85%).[473] Thus, is commonly reported belief does not appear to be grounded in data. Similarly, use of OCPs or ECPs have not been shown to lead to pregnancy disruption or birth defects if used during pregnancy,[474, 475] and problems with LARC devices are rare.[83] These studies show us that many individuals overestimate risk of SAEs. Individuals holding these beliefs may very reasonably avoid a method, so providers should address them directly.

Commonly reported beliefs about side effects included: bleeding changes (n=15 articles), pain with LARC insertion or removal (n=11 articles), weight changes (n=7 articles), and nausea (n=7 articles). Other than weight changes, for which a causal relationship is not clear, individuals using contraceptive might reasonably expect these side effects to occur. It makes sense that knowledge about side effects is

more accurate, since these events are much more common than SAEs. Many participants may have experienced side effects themselves or witnesses them vicariously through peers or family members.

Similarly, beliefs about non-contraceptive benefits tended to be more accurate, with a notable exception. The most commonly reported belief was related to the ability of methods other than condoms or abstinence to protect against sexually transmitted infections. Across samples, 3% (n=1, Gilliam, 2003) -28% (n=28, Hoopes, 2016) reported these beliefs. This is still an alarming and unexpected finding that deserves greater attention. Improving knowledge on this topic should be a target of educational interventions. Across this body of literature, we observed analyses of differences across racial and ethnic groups and age. As shown in the Figure 2.10, results assessing differences by race/ethnicity were inconsistent across articles, but findings suggest that Black participants may have more concerns about IUD safety than White participants. In Figure 2.11, we display odds ratios and 95% confidence intervals from studies that compare younger and older participants and find that results were generally non-statistically significant. However, through this work, I identified the need for more rigorous study designs, so all findings must be contextualized within the limitations of the literature. Additionally, I identified a need for more data on how higher-level factors (e.g., healthcare system, geographic area, educational experiences) impact beliefs, more rigorous analytical approaches, and for studies that embrace health behavior theory.

In Chapter 3 (Aim 2), I analyze data from the Young Women's Stress Study (YWSS), a cohort study of 148 young people who could get pregnant in Atlanta, GA. I used data from a comprehensive baseline psychosocial survey and 11 months of data from brief web-based surveys that assessed sexual health and mental well-being. I assessed the relationship between self-reported concerns about contraceptive-related AEs (serious health problems, side effects, bleeding changes, pain, sexual side effects, and any contraceptive related AE) and contraceptive method use. By including this range of outcomes, I was able to assess whether relationships differed based on perceived severity of these outcomes. In addition to embracing theory in variable selection, this study expanded on the literature identified in Chapter 2 by: 1) assessing the relationship between several types of contraceptive safety concerns, 2) operationalizing

contraceptive use in several ways, 3) prospectively linking beliefs with behavior, 4) controlling for possible confounding variables, 5) assessing moderation by information sources, and 6) using random intercepts in longitudinal models to allow for heterogeneity in odds of baseline method use. I used a four-level categorical variable to measure effectiveness tier of contraceptive method use—no method, tier 1 effectiveness methods (barrier and behavioral methods), tier 2 methods (moderately effective methods, including OCPs, CVR, patch, and DMPA), and tier 3 methods, highly effective LARC methods. Using tier 3 as a reference group, I was able to examine which beliefs might serve as barriers to use of the most effective reversible contraceptive methods.

Over half of the sample (67%) reported some concern, which is consistent with my findings in Aims 1 and 3 that concerns are common. Some, but not all, concerns were associated with behavior. In multivariable models using data from the baseline survey, concerns about side effects and pain, were associated with increased odds of reporting a tier 1 method (barrier or behavioral method) than a LARC both as the most effective method ever used and the most effective method currently used. Concerns about serious health problems and having any concern were also significantly associated with increased odds of currently using a tier 1 method or no method rather than a LARC. Pain was also significantly associated with tier 2 use rather than LARC use.

In longitudinal models, using 11 months of follow-up data, concern about a serious health problem, side effects, and having any concern were all associated with significantly higher odds of using a tier 1 method rather than a tier 3 method (aOR 3.6 – 9.2). Additionally, concern about a serious health problem and pain were associated with increased risk of using a tier 2 method rather than a tier 3 method (aOR: 2.8- 3.0).

Concerns about LARC devices were common in the literature identified in Aim 1. Through Aim 2, we found that these concerns were associated with use of less effective method. For example, those with concerns about pain were less likely to use LARC methods. This may indicate that individuals accurately understand risks of pain with LARC insertion and removal and make evidence-based decisions about avoiding such methods. However, individuals who were worried about serious health problems also

had lower odds of using LARCs in cross-sectional and longitudinal analyses. SAEs associated with LARC use are quite rare. Education about absolute risk of serious health problems associated with LARC use could remove knowledge-related barriers to use for those who might be interested in highly effective methods but believe LARCs to be more dangerous than clinical data suggests that they are.

Finally, in Chapter 4, I report results form a qualitative in-depth interview study of 29 young people who can get pregnant from around GA and the U.S. S.E. Through primary data collection, I sought to learn more about how the beliefs documented in Aims 1 and 2 were developed, how they influenced behavior, and acceptable settings for sharing information. Using grounded theory, I was able to identify distinct patterns through which beliefs emerged and impacted behavior, which are displayed in Figure 4.1. One group of participants developed concerns about prescription methods that were not counterbalanced by positive endorsements from friends or providers, leading participants to avoid methods. Another group valued OCPs, particularly for non-contraceptive benefits, normativity, and user control. A third group tried LARCs, the patch, and the ring, after receiving positive information about these methods from friends and providers.

Most participants were satisfied with the method that they were using at the time of interview, but many expressed concerns and misconceptions related to method safety. Such concerns were often gleaned from well-meaning peers and parents, as well as social media accounts. Concerns about long-term infertility and LARC device safety were present among participants in this sample, consistent with the findings from Aim 1. While the literature warns of provider overenthusiasm for LARC, I largely observed the opposite in this study. Providers tended to steer young users away from LARCs and toward OCPs, which impacted negative perceptions of the former and positive perceptions of the latter. I also observed instances of providers failing to use person-centered contraceptive counseling or shared decision-making. This suggests the need for better provider training, including training on the CDC's evidence based SRH guidelines-- the U.S. MEC, U.S. SPR, and QFP. Such guidelines should be integrated into medical, nursing, and allied health training and continuing education materials. Additionally, participants called for better school-based sexuality education, often bemoaning the quality of the education that they received.

Comprehensive sexuality education should address the range of contraceptive options, contraceptive safety, and access issues. Evidence-based sexuality education could counter-balance the effects of misinformation gleaned from informal settings.

Strengths

I used a theory informed, mixed methods approach, allowing me to capitalize on strengths of systematic reviews, quantitative, and qualitative research methods. My aims provided complementary information that help me develop a nuanced understanding of the relationship between safety beliefs and contraceptive behavior.

Aim 1, the systematic review, brought together the existing literature in a way that, to my knowledge, had not previously been done. This allowed me to observe patterns across the literature, such as the persistence of certain misconceptions across time. Systematic review methodology is a strong and efficient study design that allowed me to develop a "clear and comprehensive overview" of the data on contraceptive safety beliefs and identify areas in which further research is needed.[476] After identifying beliefs about contraceptive safety, I was able to assess links with behavior in Aim 2 and determined that relationships differ based on the severity of beliefs. Finally, in Aim 3, I integrated HBM constructs into research questions and interview guide, in order to contextualize and better understand findings from Aims 1 and 2.

I used health behavior theory to develop research questions, select variables, craft my interview guide, and situate my findings from all aims within higher level influences. In Aim 1, I was able to see that perceived susceptibility to contraceptive-related AEs and the perceived severity of such beliefs did influence contraceptive use, even if participants might not have used these terms to describe their decision-making. In Aim 2, we were able to assess whether more "severe" events (SAEs vs. side effects) were more strongly associated with use of less effective methods, though we did not observe a clear association. Finally, in Aim 3, we centered research questions on HBM constructs and embraced a social

ecological perspective by asking participants directly about higher level influences and developing a theory about how such influences affect understandings of contraceptive safety.

Throughout my studies, I sought to include a diversity of identities. In Aim 1, we used forest plots to visualize relationships between contraceptive beliefs and race/ethnicity and age, determining no clear patterns of statistical significance. Purposive sampling in Aim 3 allowed me to include individuals with different racial and ethnic identities, gender identities, and experiences with pregnancy and contraceptive use. These techniques allowed us to explore patterns in the data.

Limitations

This study largely focused on individual drivers of contraceptive behavior. Although we sought to contextualize such behaviors by collecting data on external influences in Aim 1, we found that most of the published literature included only individual-level data, with the exception of one study that looked at healthcare quality. In Aim 3, we asked broad questions about influences on contraceptive use and found that most participants discussed individual-level and interpersonal factors, including the roles of parents. However, we also learned about the role of insurance policies (e.g., parents being notified about contraceptive care), sexuality education policies, access barriers, and importantly, health services factors, including the need for better provider training. Finally, although we used the HBM, we relied on only a handful of constructs, rather than operationalizing the theory in full.

The small sample size in our quantitative study was a limitation. The small sample size also meant that we were unable to control for important potential confounders, including race. In longitudinal models, we were only able to control for history of pregnancy and frequency of sex. Additionally, our study may have been underpowered to detect relationships. We relied on self-reported measures of contraceptive use and retrospective measures of contraceptive safety concerns. Thus, our findings may have been influenced by social desirability or recall biases. Finally, there were some external generalizability considerations. While our focus on the U.S. Southeast was a strength, given limited data

on the region, our results from Aim 2 might not be generalizable to individuals outside of the metropolitan Atlanta area.

Implications for research

This dissertation research highlights persistent gaps in understanding about contraceptive safety and the need for further research to advance this field. Our review of the literature on contraceptive safety beliefs identified largely lower-quality, cross-sectional research using convenience samples. Future research should embrace more rigorous methods, including prospective designs, intentional sampling, and advanced analytical approaches. Prospective studies are needed to further assess the relationship between safety beliefs and contraceptive behavior. Additionally, we found that HBM constructs were useful for guiding our research question development, but that theory-based research was lacking in the published literature. Additional research should further test the HBM and other appropriate health behavior theories, including higher level theories that extend beyond conceptualizing individual behavior.

Prospective research can identify how beliefs change over time by repeatedly measuring such beliefs. This is a gap in the literature-- I identified only four prospective cohort studies and four RCTs in Aim 1. While my Aim 2 study used a longitudinal design, adequately powered prospective studies are needed. The last nationally representative study focused on beliefs about contraceptive safety was published in 2009, and this study used a cross-sectional survey design. Given changes in contraceptive use patterns and modes of information sharing that have occurred over the past decade, another nationally representative survey on the topic is warranted. Finally, large quantitative studies can collect data on information sources that shape beliefs. This will help researchers identify intervention targets.

Since many people in Aim 3 reported accessing information via informal sources, predominantly social media, evidence-based information campaigns should be developed and evaluated via social media applications. Research on the impact of evidence-based information interventions via targeted ads and influencer accounts should be implemented and evaluated. Additionally, through Aim 3, I call for

improvements to provider training, interventions targeted toward parents, and changes to sexuality education policies. Any such interventions should be paired with rigorous evaluation.

I sought to include individuals from various racial and ethnic groups and gender identities in this research, but the Aim 2 study was underpowered to assess differences by race and ethnicity and included a sample of entirely female-identifying participants. While I was able include some gender diversity in my Aim 3 qualitative study, the study sample was nonetheless predominantly White and cisgender. Future research should delve into how beliefs differ across gender spectrums and racial/ethnic groups and the mechanisms through which any group differences emerge.

Implications for Policy and Practice

The findings from this dissertation work, especially Aims 1 and 3, point to areas for improvement in policy and practice. I identified common and enduring beliefs about contraceptive safety, many of which reflected concerns about outcomes that are very rare among contraceptive users. I also determined that some of these concerns were associated with method non-use or use of less effective methods. Participants routinely expressed concern about methods other than OCPs and condoms, reflecting a tendency to exaggerate risks about methods with which they were unfamiliar. Exposing young people to information on the range of contraceptive methods in healthcare settings, schools and via evidence-based Internet sources can demystify methods, like LARCs, increasing comfort. By failing to teach young people about the range of contraceptive methods that they can safely use, providers, parents, and educators limit their ability to explore available methods and choosing the best method for them at a given time.

In Aim 3, parents were frequently cited as barriers to adolescent contraceptive use. Young people need better education about contraceptive access policies, given that they can legally access contraceptive services without parental permission in most U.S. states., including in the S.E. Other parent-related barriers could be alleviated by interventions focused on parental knowledge and self-efficacy related to

conversations about sex, reduced out-of-pocket costs for youths who do not have insurance or cannot use their parents, and integration of information about access into sexuality education.

Participants in Aim 3 wanted formal education about contraception. When asked where they thought young people should learn about contraception, participants consistently cited schools. Most described their own non-evidence-based and brief sexuality education experiences, which were focused on abstinence and included fear and shame tactics. They wanted more comprehensive curricula that included information on contraceptive options, method safety, and access. As noted in Chapter 4, while sexuality education is mandatory in most states in the U.S. S.E., state laws limit the effectiveness of this education by requiring emphasis on abstinence and sex within marriage, being silent on the need for unbiased, secular messaging, and failing to require that curricula discuss contraceptive methods. Since more than 40% of U.S. adolescents report penile-vaginal sex by the age of 18,[45] such education fails students who need valuable information about pregnancy prevention options. Addressing contraceptive safety in schools might help resolve contraceptive safety concerns, including those that we found to be associated with non-use in Aim 2. Educational programs should correct common misconceptions identified in this research and share information about access. A major overhaul of U.S. sexuality education policy is vitally needed to empower students with the information that they need to make informed choices about contraceptive use.

This research also points to the need for more provider training related to best contraceptive counseling practices and medical eligibility criteria for young and nulliparous people. In Aim 3, participants described providers who gave biased opinions about appropriateness of LARCs for young people or failed to listen to their contraceptive preferences. Medical, nursing, and allied health education programs should include training on the CDC's evidence-based family planning guidelines—the U.S. Medical Eligibility Criteria and Selected Practice Recommendation and the CDC/U.S. Office of Population Affair's Providing Quality Family Planning Recommendations. Additionally, any staff member in a healthcare or pharmacy setting who provides contraceptive counseling should be trained on person-centered counseling, be equipped with evidence-based and unbiased information, be prepared to

solicit contraceptive values and preferences, and have practice working with a client to select the appropriate method for them. Those providing education or care need to be equipped with information about common contraceptive concerns, which I compiled in Aim 1 and prepared to address such concerns proactively. Continuing education options and workplace trainings are vital for those already in the field to correct problems reported by Aim 3 participants.

This study adds to the literature on drivers of contraceptive use and helps contextualize contraceptive use patterns in the U.S. I characterized common concerns, identified gaps in the literature, and made important contributions to the quantitative and qualitative literature. After completing this research, I call for better formal and informal education for young people, their parents, and their providers. Future research directions include conducting larger quantitative studies, prospective quantitative and qualitative studies to capture changes over time, and the development and evaluation of evidence-based education and counseling interventions. Such research and policy changes can support individuals' abilities to make the best family planning decisions for their lives

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