Informing reproductive health policy through epidemiologic research: three papers on unintended pregnancy among women worldwide

by

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ABSTRACT

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Worldwide, women struggle to control the timing and spacing of childbearing, resulting in a high number of pregnancies that are unintended. In order to achieve many of the United Nations Millennium Development goals related to maternal and child health, gender equality and HIV prevention, the incidence of unintended pregnancy and its consequences must be significantly reduced. The three papers comprising this dissertation represent distinct analyses related to the general theme of unintended pregnancy among disadvantaged women, with a particular focus on research that is responsive to and can directly inform pressing policy questions.

Paper 1 synthesizes the observational evidence on the relationship between use of hormonal contraception (HC) and women's risk of HIV acquisition using quantitative meta-analysis. Given the central role of HC in preventing unintended pregnancy, policymakers and practitioners are struggling to translate an inconsistent body of observational evidence on this question into balanced contraceptive guidance for women, in particular in high prevalence HIV settings such as sub Saharan Africa. Pooled effect estimates from studies that use a comparable approach to identify the effect of use of various forms of HC on risk of HIV acquisition, and adequately address confounding and selection bias, suggest that use of certain forms of HC is associated with an elevated risk of HIV acquisition, but not of the magnitude that would merit complete withdrawal of these methods.

Paper 2 capitalizes on a unique study design to examine the role of an unintended birth on women's educational attainment in the United States. Despite over three decades of research, there remains debate over the extent to which reduced educational attainment among women with an unintended pregnancy is a function of childbearing itself, or a consequence of common selection factors that predispose women to both early childbearing and poor socioeconomic outcomes. By exploiting a discontinuity in the timing of presentation for abortion care, this

paper compares the incidence of graduation or drop out from school among exchangeable groups of women, half of whom had an unintended birth and half of whom received an abortion. Unlike previous research, this analysis finds no difference in the educational achievements of women who experience an unintended birth and those that experience an unintended pregnancy that they do not carry to term.

Finally, paper 3 explores the extent to which minors seeking abortion in the U.S. involve parents and other important individuals in their decision-making process, and how these relationships influence their confidence in and projected coping with their abortion decision. Despite the fact that a majority of states require parental involvement in minors' abortion, little is known about the effect of involving a parent on minors' abortion decision-making and anticipated coping after abortion. This analysis reveals that in the absence of a law mandating involvement, a majority of minors involve parents, primarily mothers, and male partners in their abortion decisions. For a minority of minors, experiencing pressure or lack of support from mothers reduces confidence in their decision and increases their likelihood of anticipating poor coping after an abortion.

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DEDICATION

To Benjamin, my joy.

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INTRODUCTION

Worldwide, women struggle to control the timing and spacing of pregnancies. In 2012, an estimated 40% of the 213 million pregnancies occurring to women worldwide were unintended(1). While women in divergent settings and across diverse backgrounds experience unintended pregnancy, research clearly demonstrates that this outcome is disproportionately concentrated among socioeconomically disadvantaged or otherwise marginalized women. For example, in the United States, rates of unintended pregnancy among women living in poverty are nearly double those of women living above the poverty line(2). In sub-Saharan Africa, where women also face the concurrent risk of human immunodeficiency virus (HIV), the burden of adverse reproductive health outcomes also remains concentrated among young, impoverished women who often lack autonomy over reproductive and other decisions(3).

Achieving consensus on the appropriate policy responses to address high rates of unintended pregnancy are often complicated by complex political landscapes, entrenched gender norms and inequalities, and resource-limited health care environments(4). The three papers that comprise this dissertation seek to offer new and rigorous evidence related to three outstanding and policy-relevant questions on unintended pregnancy. First, what are the effects of an unintended pregnancy carried to term on women's educational attainment? Second, does hormonal contraceptive use increase women's risk of HIV acquisition, and, if so, does the magnitude of increased risk merit its withdrawal from women's contraceptive options given its role in preventing unintended pregnancy? Finally, do minors involve parents in their decision making around abortion, and what are the consequences of this involvement on their experience with decision-making around unintended pregnancy?

Unintended childbearing and education

Despite agreement that the burden of unintended pregnancies rests disproportionately with socioeconomically and otherwise disadvantaged women, there is ongoing debate on the direction of the causal relationship between unintended pregnancy and women's socioeconomic status, and thus the appropriate policy responses to enable women to balance their goals of family and career. Traditionally, early and unintended childbearing was thought to directly interfere with women's ability to simultaneously or eventually complete other education or career goals, thereby resulting in reduced educational attainment or labor participation over the life course(5). However, an alternative argument emerged that women select into early childbearing based on some pre-existing characteristics (e.g., baseline socioeconomic disadvantage). Proponents of this viewpoint would argue that unintended childbearing does not necessarily alter women's socioeconomic trajectory, and that childbearing may be a rational adaptive response for these women in certain settings given limited other socioeconomic opportunities(6). It is impossible to randomize women to early and unintended childbearing; thus, researchers must employ innovative study designs to answer this important question.

Hormonal contraception and HIV

High rates of unintended pregnancy are in large part driven by high levels of unmet need for contraception. Despite intensive efforts by both domestic and international family planning and development programs to address high levels of unmet need for contraception, unmet need has not declined in recent years(7). In fact, between 2003 and 2012, the prevalence of unmet need for contraception worldwide rose steadily from 54% to 57%(8). The benefits to use of highly effective contraception are undisputed. In 2008 alone, use of modern contraceptive methods averted nearly 188 million unintended pregnancies, 1.2 million infant deaths, and 230 thousand maternal deaths(9). Contraception is one of the most cost-effective health care services available, as the costs of contraceptive methods almost always outweighs the costs associated with an unintended birth and its associated mother and infant morbidity and mortality (9, 10).

However, efforts to expand women's access to and uptake of highly effective contraception have been complicated in recent years by some evidence that use of two of the most commonly used methods, injectables (e.g., Depo) and oral contraceptive pills (OCPs), might increase women's risk of HIV acquisition(11, 12) or progression among women already living with HIV(13). Globally, more than 140 million women use hormonal contraception (HC), including 41 million injectable HC users and 100 million oral contraceptive pill users. For now, the uncertain tradeoffs between unintended pregnancy prevention (and its related health outcomes) and HIV risk complicate the development of robust policy responses. In February 2012, following a systematic review of existing observational studies, the World Health Organization (WHO) concluded that women at high risk of HIV can continue to use all existing hormonal contraceptive methods without restriction; however, women using progestin-only injectables were strongly advised to also use condoms(14). The nuanced and complicated nature of this recommendation highlights the inconsistent evidence and need for further in-depth, critical analyses on the body of evidence. Given high fertility levels and rates of maternal mortality, especially in areas hard hit by HIV, there is an urgent need for women to be able to control the timing of pregnancies, without inadvertently increasing their HIV risk(15).

Parental involvement in minors' abortion

Given that approximately 50% of unintended pregnancies end in induced abortion(1), it is often difficult to disentangle discussions about effective unintended pregnancy prevention strategies from the highly politicized issue of abortion. Further, many policy makers and advocates have supported abortion-related policies with the argument that they are primarily targeted at reducing unintended pregnancy. One such example is laws requiring a physician to obtain the consent or notification of a minor's parents in advance of her receipt of abortion care. Support for parental involvement laws has largely been justified by the reasoning that that the presence a requirement to involve parents in their abortion will deter young women from having sex or from having unprotected sex, thus reducing unintended pregnancy and abortion rates among young women(16). Although this theory of reduced sexual risk taking is not necessarily supported by other research(17), these types of laws remain in effect in over 30 states. Despite their widespread enforcement, there has been little research conducted in recent years on minors' patterns of consultation when faced with an unintended pregnancy and the impact of mandated involvement on young women's experience with decision-making around pregnancy.

Chapter 1: The effects of an unintended birth on women's short term educational achievement: Findings from a prospective study of women seeking abortion in the United States

BACKGROUND

Despite over three decades of research, there remains debate over the fundamental causes of lower educational attainment among women who initiate childbearing at a young age. While some support a causal argument linking the demands of childrearing with a woman's inability to simultaneously or eventually complete their education(5, 18), others maintain that differences in the educational attainment of women who initiate childbearing earlier and those that delay are almost fully explained by pre-existing differences in these two groups (e.g., baseline socioeconomic disadvantage)(6). Thus, the observed adverse effects of early childbearing on education are in fact an artifact of selection into childbearing, and not the causal effect of childbearing itself.

These differing arguments highlight a fundamental challenge in estimating the effects of early childbearing on women's educational attainment, and in causal inference more generally. The ability to produce an unbiased estimate of the relationship between early childbearing and educational attainment rests on proper estimation of women's outcomes under two exposure conditions (e.g., early childbearing vs. delayed childbearing) and only one of these conditions is actually observed(19). Therefore, researchers must identify a comparison group of women who do not experience early childbearing but who are similar to early childbearers in all other pre-existing characteristics, in an attempt to approximate what young mother's educational outcomes might have been had they not become early mothers. Alternatively, researchers have to measure and control for all of the differences between two groups of women - early and delayed childbearers - that might be explaining differences in their observed outcomes.

Early studies on the relationship between early childbearing and women's educational attainment primarily have focused on the latter approach, controlling for observed differences between young women who experienced an early birth and those that did not using multivariate regression approaches. In general, these studies found large and negative effects of early childbearing on women's socioeconomic outcomes, including number of years of school completed (20-24). However, in addition to being critiqued for their inability to measure all potential confounders, these studies did not address the potential bias arising from including young women who may have experienced pregnancy (but not a birth) or young women who were not even sexually active in the comparison group.

Rather than control for differences between groups, others sought to find or generate a more appropriate comparison group of women. In a seminal study, Zabin et al. recruited young women seeking pregnancy tests at Baltimore area clinics and followed them for two years; young women who had a positive pregnancy test and chose to have the child fared significantly worse than women who had a positive test and sought abortion or those that had a negative test(25). A widely cited example by Geronimus & Korenman(26) explored differences in the educational attainment of sisters in the 1979 National Longitudinal Survey of Young Women

(NLSY), who presumably shared similar background and family characteristics, but differed in their experience of teenage childbearing. Findings revealed attenuated but still negative effects of early childbearing on differences in educational attainment as compared to earlier studies. However, other researchers were not able to replicate these findings using a different yet comparable dataset(27) limiting the generalizability and confidence of the results obtained in this small sample.

Others exploited the randomness of natural events such as miscarriage or experiencing twin vs. singleton births to generate treatment and comparison groups(28). Also using data from the 1979 NLSY, Hotz, McElroy and Sanders(29) compared teens that had become pregnant at age 17 or younger to women who had become pregnant by the same age but had experienced a miscarriage, and found small, non-significant effects of early childbearing on the likelihood of receiving a high school diploma or GED by age 28. In separate analyses, Lee(30) and Levine and Painter(31) employed propensity score matching on the 1994-95 National Longitudinal Study of Adolescent Health and 1988 National Longitudinal Survey of Education, respectively, to compare educational outcomes between women that had experienced a teen birth and those who did not, but, based on a set of covariates, had a similar propensity or likelihood of becoming a teen mother. Both found adverse effects of teenage childbearing on the likelihood of dropping out of school or not continuing their education beyond high school, but not of the magnitude found in early research.

Despite this large and often innovative body of research, the results obtained to date still face significant limitations. Most notably, studies to date have estimated the effects of early childbearing making the assumption that all births to young women are unintended. However, approximately one-quarter of adolescents report that their pregnancies are intended(32). Thus, there remains a striking paucity of research that isolates the effect of an *unintended* birth(33). In addition, the focus on teenage childbearing, though warranted from a public policy perspective, offers no evidence the educational consequences of planning and spacing births for women beyond their teenage years. Young adult women ages 20 to 29 currently have the highest unintended pregnancy rate of any age group(2), and over one-half of young adults seeking abortion care cite concerns that having a baby with school or career as one of the primary reasons motivating their decision(34). In addition, the majority of past studies have relied on large panel datasets, which benefit from large samples, long follow-up periods, and measurement of an abundance of confounders. However, they are limited in that there is often substantial underreporting of sensitive subjects such as abortion and miscarriage that are central to the study's ability to appropriately classify women's exposure status (35). Finally , with some notable exceptions(30, 36), much of existing research uses data collected prior to 1990, when educational opportunities and expectations for young women were more limited and educational options for pregnant and parenting teens were almost non-existent(37, 38). Given women's increasing enrollment in secondary education and the availability of programs that keep pregnant and parenting teens in school, the effect of an early and unintended birth on women's education and other socioeconomic outcomes may be very different today than it was when many of these surveys were fielded(39).

The present analysis is able to overcome many of these limitations inherent to previous research. Capitalizing on the innovative design of the Turnaway Study, a longitudinal study of women recruited at abortion clinics across the U.S., we are able to compare the educational outcomes of women seeking abortion care, some of whom were not able to get an abortion (and therefore experienced an unintended birth) because they presented just after the clinic's gestational limit. This design generates treatment and comparison groups that should be comparable with respect to other confounders and thus overcome the concern that selection bias is explaining differences in educational attainment. We include women ages 15 to 29 in the analysis to permit exploration of the effects of unintended childbearing beyond the teenage years. Finally, since data collection for this study began in 2008, we are able to provide a contemporary perspective on the influence of unintended childbearing on women's educational attainment.

METHODS

Study design

The Turnaway Study is a prospective, longitudinal study of women who sought, but did not necessarily receive, abortions at U.S. clinics between January 2008 and December 2010. Detailed methods for this study have been described elsewhere (40-43). In brief, English and Spanish speaking women aged 15 and older presenting for abortion care were eligible to participate. Minors aged 17 and under were eligible only in states where a parental consent or notification requirement for abortion was not in effect. Twenty study clinics were selected from the National Abortion Federation's directory of abortion providers. Facilities were eligible if they had the latest gestational limit of all other clinics within 150 miles. Gestational limits varied by site due to both state-level legal restrictions and facility-level restrictions, and ranged from 10 weeks through the end of the second trimester.

Nearly 1,000 women were recruited in a 2:1:1 ratio into the following three study groups: 1) Women presenting for abortion in the two weeks prior to the facility's gestational age limit who received abortions (*Near-limit Abortion Group*); 2) Women presenting for abortion within three weeks after the facility's gestational limit who were denied abortions (*Turnaways*), and 3) Women who received first trimester abortions (*First Trimester Abortion Group*). This final group was primarily recruited to explore whether women presenting close to the gestational limit were substantively different from women presenting in the first trimester, when the vast majority of women obtain abortion care(44).

Baseline interviews were conducted via telephone approximately eight days after enrollment. Women were subsequently interviewed at six month intervals for five years; data collection is ongoing. This analysis uses data from the baseline and first six follow up interviews, all of which were completed by December 2013. The University of California, San Francisco Committee for the Human Research approved all study procedures.

Measures

Dependent variables. At the baseline interview, women were asked to describe the highest level of education they had completed to date, as well as whether they were currently in school either full or part time and the degree that they were seeking. At all follow up interviews, women were asked whether they were currently in school or not and the degree they were seeking.[*] For those who were not currently enrolled in school but reported being enrolled in the previous interview, a follow up question was asked that referred back to the specific degree goal they had mentioned in the prior interview, and asked if they had "graduated or finished since [the last interview]." The answers these women provided were coded by the interviewer as "Graduated degree", "Quit/dropped out", "Don't know/Refused." Using these variables we construct two dichotomous outcome variables in this analysis: 1) graduation or completion of a degree and 2) drop out from school, defined further as follows (see Appendix A for specific interview details):

> Graduation: Graduation is a measure created and analyzed for women who at baseline were enrolled in school or were not in school and were educationally "stalled", meaning that their highest level of education obtained to date was progress toward but not completion of a degree (e.g., some high school, some community college). There were 470 such women. Graduation is coded as "1" at the first follow up interview in which two conditions are met: 1) the woman is not currently enrolled in school and 2) she reported graduating since the last interview in response to Q4 (see Appendix A). However, since study data were collected at six month intervals, and it is plausible that a woman might graduate from one degree and enroll in another in that time frame, we also searched the dataset for instances where the type of degree a woman was seeking increased between two interviews, and entrance into the degree at the second time point required completion of the degree at the first time point (e.g., from a HS diploma to an associate's degree). Conservatively, we assumed that a HS diploma was required for entrance into community college or 4- year college programs, but not necessarily for technical or certificate degree programs. Women who reported this transition were coded as having graduated from their initial degree despite not formally reporting a graduating event.
>
> Dropout: Dropout is a measure created and analyzed only for women who were enrolled in school at baseline. There were 278 such women. It is coded "1" at the first follow up interview in which three other conditions are present: 1) the woman is not currently enrolled in school; 2) she reported dropping out since the last interview in response to Q4 (see Appendix A); and 3) she does not report returning to school (irrespective of degree) at a subsequent interview. Thus, this measure captures permanent drop out over the duration of the study.

[*] In general, if women said they were on school break or vacation at the time of the interview, they were coded as enrolled in school. If they said they were waiting to enroll at the start of the next semester or had plans to return the following semester, they were coded as not currently enrolled in school.

Since our research question is focused on the effect of an unintended birth on education, we limit our analysis to the educational event most proximal to the pregnancy itself. Thus, if a woman graduated and subsequently returned to school, we only capture her first graduation event in the analysis. However, since an unintended birth might have the effect of prolonging but not necessarily preventing women from completing her education, we do not consider a woman as dropped out unless she does not return to school over the course of follow up. Further, if a woman's degree goal was downgraded between interviews (e.g., from an associate's degree to a technical degree), but she remains enrolled in some type of program, we do not count her as dropping out, even though the degree she eventually completes or drops out from might not be the one she reported at baseline.

Independent variables. Women's study group (*Near-limit abortion, parenting Turnaway, Non-parenting Turnaway, First-trimester abo*rtion) served as the primary exposure of interest. We split the original Turnaway group into two separate categories: 1) *parenting Turnaway*, which included women who gave birth and raised the child, and *2) Non-parenting Turnaway*, to include women who were denied an abortion but did not go on to parent a child, either because they received an abortion at another clinic after being denied the procedure at the recruiting clinic, they experienced a miscarriage, or they placed the child for adoption after delivery. One-quarter of women (n=41) in the original *Turnaway* group was in this latter category. Women's duration of time in the study, or the time she spent in the study until graduating or dropping out, was also a primary independent variable of interest.

Several potential confounders of the relationship between unintended childbearing and educational attainment were considered, including the respondent's age, race/ethnicity, previous parity, history of childhood abuse or neglect, recent history of intimate partner violence, history of depression and anxiety diagnoses, drug use prior to pregnancy recognition, problem alcohol use (drinking first thing in the morning or not being able to remember what happened the night before) prior to pregnancy recognition, and relationship status with the baby's father at the time she became pregnant. We also considered her baseline schooling status (in school vs. not) and the type of degree she sought as potential confounders. For women not enrolled in school at baseline, we assume that their degree goal is the one that they reported having partially completed at baseline. To capture women's socioeconomic status, we included her mother's educational attainment since household income, and therefore poverty level, was not reported by many women or was reported but reflected parental plus individual income (especially for young women) and therefore might be misleading.

Statistical analysis

Information on the outcome was collected at discrete time intervals. Therefore, we do not know the precise moment at which women graduated or dropped out of school, only that it occurred within a given 6-month interval. Once a woman experienced graduation or dropout she is removed from the analysis.

Further, the data is inherently right censored since women who did not experience an educational event (graduation or drop out) during the three year follow up period may do so at

a later date necessitating use of survival analysis methods. Specifically, we used a discrete-time proportional hazards model. Given that time was categorized we used a complementary log-log link function so that exponentiated coefficients could be interpreted as hazard ratios(45, 46). We calculated robust standard errors to account for the non-independence of observations within each clinic site.

We first plotted Kaplan-Meier curves by study group to display the unadjusted probability of experiencing an educational event by each interval, as well as to visually inspect whether the ratio of the hazards appeared to be constant across all time intervals by study group. We then performed a log rank test to formally assess whether the survival curves differed by study group; a p value of less than 0.1 was considered evidence of non-proportionality of hazards and an indication to include interval x study group interaction terms(46).

We assessed baseline differences between study groups in potential confounders via mixed effects linear and logistic regression to account for clustering by clinic. We chose to use the *Near limit abortion* group as the reference group for all comparisons in order to permit simultaneous comparisons between the *Near limit* group and those in the *Turnaway birth, Turnaway-no parenting,* and *First trimester abortion* groups. Post-estimation permutation tests were performed to assess differences between levels of categorical variables. Those variables that were found to differ between study groups at $p<0.10$ were included in all multivariate analyses. All analyses were conducted using Stata 13.0(47).

When graduation was the outcome of interest, we restricted our analysis to women who were enrolled in school at baseline or who indicated at baseline that their highest level of education obtained to date was progress toward but not completion of a degree (e.g., *some* high school, *some* community college). When drop out was the outcome of interest, we restricted our analysis further to only women who were enrolled in school either full or part time at baseline. Women were censored from the analysis when they experienced an educational event (graduation or drop out) or were lost to follow up.

Although our initial plan was to stratify our analyses according to the type of degree sought at baseline (e.g., seeking a high school diploma or GED versus a college degree), small sample sizes, particularly for women seeking a high school diploma, prevented us from presenting these analyses as our primary results.

RESULTS

Among eligible women approached, 37.5% consented to participate in the five year study, of which 85% (n=956) completed the baseline interview. Participation rates varied by clinic; rates for eleven of the 30 facilities were over 50%. We excluded responses from women at one clinic where 95% of women initially denied an abortion later received care at another facility. Additionally, we excluded responses for three participants who, after study enrollment, reported that they had not had their planned abortion. A total of 877 women remained. Restricting the sample to women who were enrolled in school at baseline left a final sample of

278 women for the drop out analysis. Restricting the sample to women who might receive a degree, either because they were enrolled in school at baseline or were stalled in their education, left a final sample of 470 women for the graduation analysis (See Figure 1).

Table 1 summarizes the descriptive characteristics of women in the larger sample (N=470) by the four study groups: Near-limit abortion (n=211, 45%), Parenting Turnaway (n=86, 18%), Non-parenting Turnaway (n=41, 9%), and First trimester abortion (n=132, 28%).

The four study groups were balanced on most covariates at baseline with several notable exceptions. Women in the *Near limit abortion* group differed from women in the *Turnaway* groups in several important respects. Non-parenting Turnaways were more likely to be enrolled in school at baseline (68.3 vs. 54.0%, p=0.010). Further, among those enrolled in school, women in the *Parenting Turnaway* group were less likely to be seeking a college or graduate degree at baseline (57.0% of *Near limit* vs. 48.9% of *Parenting Turnaways*, p=0.095). Further, women in the *Non-parenting Turnaway* group had a higher level of baseline educational attainment then women in other groups. Specifically, they were more likely to have completed an associates or technical degree or some college than women in the *Near limit* group (57.1 vs. 39.5, p=0.078).

Near-limit women were more likely to report having recently experienced physical violence than women in the *parenting Turnaway* group (16.6 vs. 9.3%, p=0.060). However, they were less likely to report an alcohol problem symptom in the month prior to pregnancy than women in the *parenting Turnaway* or *Non-parenting Turnaway* groups (3.3% vs. 8.2 and 12.2%, respectively; p-value of 0.056 and 0.039).

Women in the *Near limit abortion group* also differed from women in the *First trimester abortion group* in several respects. First, they were slightly younger (mean age 22.5, vs. 23.6, p=0.013). Second, they were less likely to report that their mother had less than a high school education (10.9 vs. 18.2%, p=0.095). Finally, by study design, mean gestational age differed significantly by study group.

In the full sample, 145 women had not completed high school (31%) at baseline, one-half of whom (n=68, 47%) were aged 19 or under (data not shown).[†] A small minority of women had completed college (n=14, 3%), while the majority had completed high school and some form of post-secondary education (n=261, 55%). Among those enrolled in school at baseline, most were seeking a college or graduate degree (n=157, 57%). Among women who were stalled in their education at baseline, approximately equal proportions had completed less than a high school education (42%) or some college (46%), and were thus classified as having an educational goal of a HS diploma or college degree, respectively. Nearly 4 in 10 (n=71, 38%) of women not enrolled in school at baseline returned to school at some point during follow up.

[†] Note that this is not representative of the full study population since our analysis is limited to those currently enrolled in school or those reporting having progressed toward but not completed a degree. In the full sample, 19% of women had less than a high school education [23].

Two-thirds (67%) of women completed all six follow up interviews. There was no evidence of differential attrition by study arm. However, there was evidence that African American women were less likely to be lost to follow up compared to their white counterparts (33.6 vs. 41.9%, p=0.063). Finally, women who had less than a high school education at baseline were significantly more likely to be lost to follow up than those who had completed at least some post-secondary education (46.2 vs 34.9%, P=0.046) [data not shown].

Graduation

Less than one in five (n=84, 17%) of women enrolled in school or stalled in their education at baseline graduated during the 3-year follow up period (Table 2). The adjusted hazard of graduating was significantly reduced in Wave 3 (adjusted HR=0.38, 95% CI: 0.16, 0.90); however, in general, differences in the hazard of graduating by duration in the study did not achieve statistical significance. There were significant differences in the hazard of graduating by study arm. Non-parenting Turnaways were less likely to graduate (aHR=0.43, 95% CI: 0.19, 0.98) than women who obtained abortion care and presented close to the clinic's gestational limit. Although not statistically significant, compared to women who presented for care just under the gestational limit and received abortion care, those who were denied an abortion and experienced an unintended birth appeared no more likely to graduate (aHR=0.70, 95% CI: 0.36, 1.30). Further, those presenting for abortion care in the first trimester also appeared no more likely to graduate than those who presented close to the clinic's gestational limit (aHR=0.93, 95% CI: 0.55, 1.58) (Table 3).

When the analyses were limited to women seeking a post-HS degree (n=325, results not shown), overall results were comparable but were associated with greater uncertainty (e.g, wider confidence intervals) given the small sample size. In this subsample, 53 women (16.3%) graduated over the follow up period. The hazard of graduating did not differ by study interval or study arm.

When the analyses were limited to women seeking a high school diploma or GED (n=143, results not shown), there were no Non-parenting Turnaways who graduated. Therefore, we analyzed the data using women's initial exposure groups, without considering whether they eventually parented a child or not. Approximately one in five women (n=30, 21%) graduated over the study follow up. Multivariate survival analysis revealed no difference in the hazard of graduation by study arm or interval.

Drop out

Just over one-third (n=101, 36%) of women enrolled in school at baseline dropped out over the course of the 3 year follow up period (Table 1). The adjusted hazard of dropping out was greatest in the first follow up interval (HR=3.76, 95% CI: 1.32, 10.67), and generally declined over time; differences in the hazard of dropping out were not statistically significant beyond six months of follow-up. Women who were denied an abortion but did not parent were more likely to drop out of school as compared to women presenting close to the gestational limit and receiving care (aHR=1.83, 95% CI: 1.14, 2.95) as compared to women who presented for care just under the gestational limit and received abortion care. Other differences by study arm

were not statistically significant. Those who were denied an abortion and experienced an unintended birth (aHR=0.95, 95% CI: 0.54, 1.69) and those who presented for abortion care in the first trimester (aHR=0.94, 95% CI: 0.59, 1.52) were no more likely to drop out (Table 4).

When the analysis was restricted to women seeking a post-high school degree (n=216, results not shown), overall findings were similar but, similar to above, due to small sample sizes, point estimates had wider confidence intervals. Nearly 40% (n=83) of women dropped out over the course of study follow up. The hazard of dropping out was greatest and statistically significant in the first interval (aHR=6.65, 95%CI: 2,48, 17.85), and gradually declined over time. There were no differences in the hazard of dropping out by study arm.

When the analysis was restricted to women seeking a high school diploma or GED (n=62, results not shown), as discussed in the graduation results above, we analyzed data according to women's assigned exposure group. Nearly 30% (n=18) dropped out over study follow up. Multivariate survival analysis revealed no difference in the hazard of graduation by study arm or interval.

DISCUSSION

Unlike much of the research conducted to date, we find no difference in the educational achievements of women who experience an unintended birth and those that experience an unintended pregnancy that they do not carry to term. The sample size for this analysis makes it somewhat difficult to disentangle whether our null findings represent a true lack of association between unintended childbearing and education in this population or insufficient power to detect differences in this subsample of the larger study. Although the Turnaway Study enrolled nearly 1000 women, only one-quarter to one-half of these women were enrolled in school or stalled in their education at the onset of the study and were therefore at risk of the outcomes of interest. This sample size limits our ability to detect differences when results are stratified by important variables such as the age of women or the type of degree that they are seeking. As a result, our models estimate the hazard of graduating or dropping out of school generally, while it is clear that the economic returns to graduating from high school, technical school, and college are quite different, and the time, cost, and logistical barriers to obtaining each of these degrees are not necessarily comparable(48). Further, there is some evidence that the adverse effects of childbearing on education do not extend to women in their 20s(49). Thus, by combining women of all ages in our analysis, we may have simply masked an effect in one age category.

In a previous analysis of Turnaway data (50), 14% of women cited a desire to pursue their education as one of the reasons for which they sought abortion care. However, only three-quarters of these women were currently enrolled in school. Thus, women citing education as a reason for abortion clearly conceptualize it as both education in-progress and future educational aspirations. This distinction motivated our decision to include a model exploring time to graduation among women who were currently in school *and* those that reported being stalled in their education at baseline, the latter group having the potential to return to school to

complete their education despite not being enrolled at the time of pregnancy. Given that the majority of women in the time to graduation analysis were seeking a college or graduate degree, the three year follow up period employed in this analysis may have been insufficient time to complete their education, particularly if unintended childbearing has the effect of extending the duration of time in school, but not necessarily the likelihood of completing a degree. We plan to repeat these analyses with the full five year follow up period as those data become available.

We find that women who were denied an abortion but did not go on to parent a child were less likely to graduate then women who sought abortion just before the clinic's gestational limit and were able to obtain care. This finding was contrary to our hypothesis that women who did not have to manage the demands of unintended childrearing would be more likely to be able to adhere to their educational goals, which would suggest that the educational attainment of these two groups would not differ. Our unexpected finding stems in part from baseline differences in the study groups, specifically higher levels of in-progress education and educational attainment among non-parenting Turnaways. Thus, at the time of their pregnancy, they are seeking more costly and time-consuming degrees that they may not be able to complete over the study follow up period. Still, this finding remains after statistical adjustment for these baseline differences in educational goals, suggesting that there might be additional differences between these women and the other groups. Of note, the women comprising this group were randomly (miscarriage) and non-randomly (deciding to pursue adoption, seeking abortion care elsewhere) selected into their childbearing outcome. One could argue that the women in the non-random groups are more resourceful or dedicated to avoiding an unintended birth. However, this would suggest that they had more perseverance for other endeavors, including education, and therefore would not be more likely to drop out or less likely to graduate, as we observed. Further, a sensitivity analysis that excluded women who experienced miscarriage revealed substantively similar, although no longer statistically significant, findings to the overall results presented here.

A potential critique of this study is that the sampling approach employed, in which recruitment focused on women who were presenting for abortion care close to a clinic's gestational limit, might limit the generalizability of findings. In general, nulliparous women and young women are less likely to recognize pregnancy, and therefore present later for abortion care(41). However, by also recruiting women presenting for abortion care in the first trimester at these same clinics, we are able to explore differences in these two groups and find that, with the exception of being slightly younger and having mothers with lesser educational attainment, women presenting close to the gestational limit are generally comparable to those presenting in the first trimester. Further, the sample for this analysis is similar to a recent representative survey of women seeking abortion in the U.S. (51).

This analysis has several important strengths. Most notably, our study population is generated from women seeking abortion care, thereby isolating our analysis to women with unintended (not just early) births. The vast majority of previous research has compared young women who experience early childbearing to those who do not, assuming that all births to young women

are unintended. However, approximately one-quarter of adolescents and four in 10 young adults report that their pregnancies are intended(32). For these women, childbearing may not pose a similar level of disruption to their existing plans, as they may have already completed their education or permanently entered the workforce.

In addition, unlike previous research, we are able to generate the appropriate comparison group to isolate the effect of an unintended birth on women's educational attainment. Here, by using women who were similarly motivated to avoid childbearing and presented for abortion care at nearly the same time as women who were denied an abortion, we are able to approximate what would have happened to women had they not been denied an abortion. Finally, these data offer important contemporary insights on the relationship between unintended childbearing and educational attainment for young women, not just for adolescents who have been the almost exclusive focus of past research.

FIGURE 1. Selection of participants for inclusion in (1) drop out and (2) graduation analysis

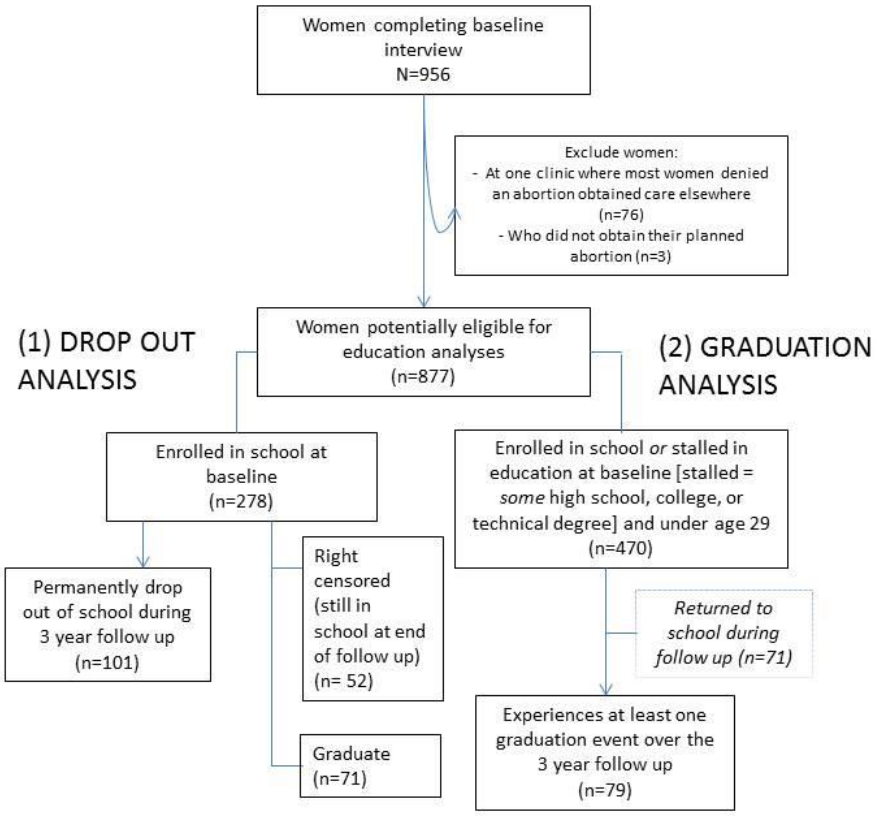


TABLE 1. Socio-demographic characteristics of study population by exposure groups, N=470

	Near Limit Abortion (n=211)	Parenting Turnaway[a] (n=86)	Non-parenting Turnaway[b] (n=41)	First Trimester Abortion[c] (n=132)	Full sample (N=470)^
Demographic characteristics					
Age, years (mean, SD)	22.4 (± 3.9)	21.8 (± 4.14)	22.5 (± 4.34)	23.6 (± 4.48)**	22.6 (± 4.22)
Race/ethnicity					
White	62 (29.4)	22 (25.6)	17 (41.5)	47 (35.6)	148 (31.5)
African American	73 (34.6)	24 (27.9)	14 (34.2)	44 (33.3)	155 (33.0)
Hispanic/Latina	47 (22.3)	28 (32.5)	6 (14.6)	32 (24.2)	113 (24.0)
Other	29 (13.7)	12 (14.0)	4 (9.8)	9 (6.8)**	54 (11.5)
Mother's educational attainment					
Less than HS	23 (10.9)	9 (10.5)	2 (4.9)	24 (18.2)*	58 (12.3)
High school or GED	76 (36.0)	24 (27.9)	20 (48.8)	45 (34.1)	165 (35.1)
Associates, some college, or technical school	43 (20.4)	23 (26.7)	7 (17.1)	23 (17.4)	96 (20.4)
College	50 (22.1)	19 (22.1)	10 (24.4)	32 (24.2)	111 (23.6)
Missing	19 (9.0)	11 (12.8)	2 (4.9)	8 (6.0)*	40 (8.5)
Relationship status with baby's father (at time of conception)					
Husband	13 (6.3)	7 (8.2)	4 (10.5)	10 (7.6)	34 (7.4)
Partner, boyfriend, or fiance	152 (74.2)	63 (74.1)	27 (71.1)	92 (69.7)	334 (72.6)
Dating or unofficial relationship	3 (1.5)	2 (2.4)	1 (2.6)	3 (2.3)	9 (2.0)
No romantic relationship	37 (18.0)	13 (15.3)	6 (15.8)	27 (20.5)	83 (18.0)
Raising other children	125 (59.3)	39 (45.4)*	21 (51.2)	69 (52.3)	254 (54.0)
Other personal characteristics					
History of depression or anxiety symptoms[#]	61 (28.9)	22 (25.6)	13 (31.7)	37 (28.0)	133 (28.3)
Alcohol problem symptoms in the month prior to pregnancy recognition[$]	7 (3.3)	7 (8.2)*	5 (12.2)**	4 (3.1)	23 (4.9)
Heavy drug use in the month prior to pregnancy recognition[%]	25 (11.9)	6 (7.0)	4 (9.8)	16 (12.1)	51 (10.9)
Experienced violence in the last year[&]	35 (16.6)	8 (9.3)*	6 (14.6)	19 (14.4)	68 (14.5)
Childhood experience of physical abuse or neglect[^]	53 (25.1)	19 (22.1)	8 (19.5)	35 (26.5)	115 (24.5)
Education characteristics					
Highest level of education attained					
Less than high school (HS)	64 (30.3)	35 (40.7)	10 (24.4)	36 (27.3)	145 (30.9)
HS or GED	25 (11.4)	7 (8.1)	5 (12.2)	14 (10.6)	50 (10.6)
Associates degree, some college, certificate or technical degree	119 (45.6)	44 (51.2)	24 (58.5)	74 (56.1)	261 (55.5)
College	4 (1.9)	0	2 (4.9)	8 (6.1)	14 (3.0)
Pregnancy characteristics					
Gestational age, weeks (mean, SD)	19.9 (± 3.9)	23.0 (± 3.9)***	20.0 (± 4.1)**	7.5 (± 2.2)***	17.0 (± 7.0)
Study related characteristics					
Number of follow up visits (mean, SD)	5.84 (1.87)	5.51 (2.19)	5.73 (1.99)	5.70 (2.04)	5.73 (1.98)

* $p < 0.10$; ** $p < 0.05$; *** $p < 0.001$ comparing Near-limit abortion to other study groups

[a]Turnaway births compared to near limit abortion group

[b]Turnaway no births compared to near limit abortion group

[c]First trimester abortion comparison group compared to near limit abortion group

[#] Self-reported lifetime diagnosis of a depressive or anxiety disorder , or recent depressive symptoms that interfered with regular activities

[$] In the month prior to pregnancy recognition, reported needing a drink in the morning to steady nerves or get rid of a hangover, or was unable to remember what happenened the night before while drinking

[%] Heavy drug use defined as use of marijuana more than once a week, or use of any other non-prescription drug at any frequency

[&] Defined as having been pushed, hit, slapped, kicked choked or physically hurt in any way by another person in the last year

[^] Reported experiencing child physical abuse or neglect or sexual abuse, or being a victim of sexual assault prior to age 18

^Full sample included women who were enrolled in school at baseline or stalled in their education, defined as having completed progress toward a degree but not having completed that degree. Thus, this group included women who, at baseline, reported that their highest level of education obtained to date was some high school, some technical school, some community college, or some college.

TABLE 2. Educational attainment, goals, and outcomes of study participants, by study group

	Near Limit Abortion (n=211)	Turnaway Parenting[a] (n=86)	Non-Parenting Turnaway[b] (n=41)	First Trimester Abortion[c] (n=132)	Full sample (N=470)
IN SCHOOL: Enrolled in school (full or part time) at baseline	114 (54.0)	48 (55.8)	28 (68.3)*	90 (68.2)**	278 (59.1)
Type of degree sought at baseline					
High school (HS) diploma or GED	26 (22.8)	18(38.3)	2 (7.1)	16 (17.9)	62 (22.3)
Technical, community college, or certificate	23 (20.2)	6 (12.8)	7 (25.0)	23 (25.7)	59 (21.2)
4 year college or graduate degree	65 (57.0)	23 (48.9)*	19 (67.9)	50 (56.2)	157 (56.5)
Highest level of education completed to date					
Less than HS	27 (23.7)	16 (33.3)	4 (14.3)	17 (18.9)	64 (22.9)
HS or GED	38 (33.3)	12 (25.0)	6 (21.4)	22 (24.4)	78 (27.9)
Associates degree, some college, certificate or technical degree	45 (39.5)	20 (41.7)	16 (57.1)**	43 (47.8)	124 (44.3)
College	4 (3.5)	0	2 (7.1)	8 (8.9)	14 (5.0)
STALLED: Stalled in education but not enrolled in school at baseline	97 (46.0)	38 (44.2)	13 (31.7)*	42 (31.8)**	192 (40.9)
Highest level of education completed to date ///Presumed educational goal					
Less than HS///HS diploma or GED	37 (38.1)	19 (50.0)	6 (46.2)	19 (45.2)	81 (42.6)
Some technical school or some community college ///Technical, community college, or certificate	10 (10.3)	4 (10.5)	1 (7.7)	6 (14.3)	21 (11.1)
Some college /// 4 year college degree	50 (51.5)	15 (39.5)	6 (46.1)	77 (40.5)	88 (46.3)
GRADUATION [$$]	**211 (44.9)**	**86 (18.3)**	**41 (8.7)**	**132 (28.1)**	**470 (100.0)**
TOTAL PROPORTION GRADUATING OVER FOLLOW UP	39 (18.5)	13 (15.1)	5 (12.2)	26 (15.7)	83 (17.7)
In school at baseline + seeking a bachelor's degree or higher	65 (41.4)	23 (14.7)	19 (12.1)	50 (31.9)	157
Graduated over follow up [$]	*16 (24.6)*	*5 (21.7)*	*3 (15.8)*	*7 (14.0)*	*31 (19.8)*
In school at baseline + seeking less than a bachelor's degree	49 (40.5)	24 (19.8)	9 (7.3)	39 (32.2)	121
Graduated over follow up [$]	*18 (36.7)*	*8 (32.0)*	*2 (22.2)*	*16 (41.0)*	*44 (36.4)*
Not in school at baseline but returned to school to seek a bachelor's degree or higher	25 (58.1)	6 (14.0)	2 (4.6)	10 (23.2)	43
Graduated over follow up [$]	*2 (8.0)*	*0*	*0*	*2 (20.0)*	*4 (9.3)*
Not in school at baseline + returns to school to seek less than a bachelor's degree	15 (53.6)	8 (28.6)	2 (7.1)	3 (10.7)	28
Graduated over follow up [$]	*3 (20.0)*	*0*	*0*	*1 (33.3)*	*4 (14.8)*
Not in school at baseline + does not return to school during follow up	57 (47.9)	24 (20.2)	9 (7.6)	29 (24.4)	119
Graduated over follow up [$]	*0*	*0*	*0*	*0*	*0*
DROP OUT [^^]	**114 (40.7)**	**48 (17.1)**	**28 (10.0)**	**90 (32.1)**	**280 (100.0)**
TOTAL PROPORTION DROPPING OUT OVER FOLLOW UP	39 (34.2)	15 (31.3)	14 (50.0)	33 (36.3)	101 (36.1)

* $p < 0.10$; ** $p < 0.05$; *** $p < 0.001$ comparing Near-limit abortion to other study groups

[a] Parenting Turnaway compared to Near limit abortion group

[b] Non-parenting Turnawy compared to Near limit abortion group

[c] First trimester abortion comparison group compared to Near limit abortion group

[$$] The graduation analysis includes all women, including those who are enrolled in school at baseline and those who are stalled in their education at baseline.

[^^] The drop out analysis is restricted to women who are enrolled in school at baseline

[$] Differences in statistical significance not assesed; data are presented here for descriptive purposes.

TABLE 3. Discrete time survival analysis estimating the hazard of graduation among women enrolled in school or stalled in education and under age 29 at baseline, N=470

	Unadjusted			Adjusted[#]		
	HR	95% CI	p-value	HR	95% CI	p-value
Key exposures						
Study group						
Near limit abortion (reference)						
Parenting Turnaways	0.83	(0.50, 1.39)	0.480	0.70	(0.36, 1.30)	0.253
Non-parenting Turnaways	0.63	(0.27, 1.50)	0.298	0.43	(0.19, 0.99)	0.046
1st trimester abortion	1.11	(0.44, 1.32)	0.689	0.93	(0.55, 1.57)	0.786
Time to graduation						
0 to 6 months (reference)						
6 to 12 months	0.71	(0.40, 1.29)	0.262	0.76	(0.41, 1.38)	0.365
12 to 18 months	0.34	(0.15, 0.82)	0.016	0.38	(0.16, 0.90)	0.027
18 to 24 months	0.44	(0.21, 0.92)	0.030	0.49	(0.23, 1.05)	0.069
24 to 30 months	0.59	(0.32, 1.08)	0.088	0.67	(0.36, 1.23)	0.199
30 to 36 months	0.47	(0.24, 0.91)	0.026	0.54	(0.27, 1.07)	0.076

Notes: aHR = adjusted Hazard Ratio; CI=Confidence Interval; [#]Models adjusted for respondent's age, race/ethnicity, maternal education, previous parenting, recent history of drug or alcohol abuse, recent history of physical violence, schooling status at baseline and educational goals; Robust standard errors and CIs calculated adjusting for clustering by clinic site

TABLE 4. Discrete time survival analysis estimating the hazard of dropping out of school among women enrolled in school at baseline, N=278

	Unadjusted			Adjusted[#]		
	HR	95% CI	p value	HR	95% CI	p value
Exposures						
Study group						
Near limit abortion (reference)						
Parenting Turnaway	0.89	(0.53, 1.50)	0.668	0.99	(0.58, 1.71)	0.985
Non parenting Turnaway	1.69	(1.01, 2.84)	0.046	1.83	(1.14, 2.95)	0.012
1st trimester abortion	1.15	(0.72, 1.84)	0.571	1.09	(0.69, 1.73)	0.694
Time to drop out						
0 to 6 months	4.14	(1.44, 11.87)	0.008	3.76	(1.32, 10.67)	0.013
6 to 12 months	1.82	(0.46, 7.19)	0.392	1.62	(0.41, 6.38)	0.491
12 to 18 months	1.53	(0.51, 4.61)	0.443	1.48	(0.50, 4.36)	0.479
18 to 24 months	0.81	(0.22, 3.00)	0.757	0.80	(0.22, 2.94)	0.742
24 to 30 months	0.84	(0.25, 2.80)	0.780	0.85	(0.25, 2.79)	0.777
30 to 36 months (reference)						

Notes: aHR = adjusted Hazard Ratio; CI=Confidence Interval; [#]Models adjusted for respondent's age, mother's education, previous parenting, recent history of drug or alcohol abuse, recent history of physical violence, and educational goals; Robust standard errors and CIs calculated adjusting for clustering by clinic site

Chapter 2: Does hormonal contraceptive use increase women's risk of HIV acquisition? A meta-analysis of observational studies

BACKGROUND

Despite over two decades of scientific inquiry, uncertainty remains regarding whether use of hormonal contraception (HC) increases women's risk of HIV acquisition(52). The potential implications of an elevated risk are significant. Globally, 140 million women use HC, including 41 million injectable users and 100 million oral contraceptive pill (OCP) users(53). Use of these methods prevents unintended pregnancies, reduces maternal and infant morbidity and mortality, and enables women to achieve other life goals(9). Given high fertility levels and rates of maternal mortality, particularly in settings of high HIV prevalence, women must be able to avoid pregnancy without increasing their risk of HIV.

After reviewing available epidemiologic evidence, an expert panel convened by the World Health Organization (WHO) in 2012 recommended leaving HC a "Category 1" method with no restrictions for use. However, the panel also recommended that women using progestin-only injectables like DMPA be "strongly advised to *also always use condoms*"(14). Despite this guidance, some countries in sub-Saharan Africa (SSA) are considering withdrawing DMPA from their family planning programs, while modeling studies suggest that the effects of such a decision on unintended births and maternal and infant morbidity and mortality would be substantial in most settings (54-56). Thus, the decision to remove HC will depend not only on whether there is an actual association, but importantly its magnitude to determine whether the increased HIV risk outweighs the tremendous benefits of highly effective contraception.

Given the public health urgency of this question, it is critical to maximally leverage existing observational evidence. Several recent systematic reviews concluded that existing evidence suggests an increased risk of HIV associated with use of progestin-only injectables, potentially isolated to high risk women, but stopped short of quantitatively summarizing results due to perceived heterogeneity in study designs and populations (11, 57, 58). However, up to now, heterogeneity has never been quantitatively assessed, and even a moderate amount should not preclude moving forward with meta-analyses of observational data, especially when randomized control trial data are not available to address an urgent public health issue requiring policy decisions(59, 60). Furthermore, as research on this topic has intensified in recent years, the methodological approaches to answering this question have increased in rigor and similarity, making it an opportune time for meta-analysis.

Here, we build on one recent review(57) to quantitatively summarize observational evidence, offering a series of pooled estimates of the effect of HC use on HIV risk by method type. We focus our analyses on studies of sufficient quality and comparability, and explore heterogeneity through a series of a priori secondary analyses.

METHODS

This meta-analysis was conducted in accordance with the PRISMA guidance(61). All statistical analyses were guided by Egger, Davey-Smith, and Altman(62).

Study identification and selection

We used the WHO technical review(14) to identify studies.[‡] However, to ensure inclusion of recent research, we searched PubMed for articles published after December 2011. In addition, we identified relevant abstracts presented at the 2011 through 2014 International AIDS Society and Conference on Retroviruses and Opportunistic Infections meetings and followed up with authors to determine if their analyses had been published. Finally, we reviewed lists of studies with experts in the field.

Two investigators reviewed the full text of articles identified to determine if they met the following inclusion criteria:

1. Employed a prospective design and excluded HIV positive women at baseline, ensuring exposure assessment preceded detection of an incident HIV infection;
2. Assessed hormonal contraceptive use as an exposure, including at least one of the following categories: depot-medroxyprogesterone acetate (DMPA), norethisterone enanthate (Net-En), combined oral contraceptives (COCs), or progestin only pills (POPs);
3. Analytic approach minimized confounding and selection bias by:
    a. Adjusting for confounders in multivariate models, including at a minimum age and condom use;
    b. Having minimal loss to follow up (defined as $\leq$ 30%);
4. Published in a peer-reviewed journal by May 2014;
5. Data collection took place in a low or middle income country as defined by the World Bank.

Data extraction and coding

Two reviewers independently extracted data using a custom, piloted spreadsheet. One investigator compared extractions to ensure inter-coder reliability; when discrepancies arose, a third investigator was brought in to arbitrate.

Given the array of hormonal contraceptive methods available, studies often differed in their classification of contraceptive types and many presented multiple effect estimates. We focused extraction on estimates disaggregated by hormone formulation (e.g, DMPA, Net-En, COCs, or POPs). When only method type (e.g., “injectable” or “pill”) was specified, we reviewed the article to identify whether a specific formulation (e.g., DMPA vs. NetEn) predominated. We coded how comparison groups were constructed, noting whether women using condoms (either alone or in addition to HC), other types of HC, or no contraception were included.

[‡] The WHO used an unpublished version of the systematic review later published by Polis and Curtis (8), which was subsequently updated and published in October 2014 (10).

We extracted effect estimates and 95% confidence intervals (CIs) for each model. We made note of the confounders adjusted for in multivariate models and the analytic strategy used [e.g., Cox, inverse probability of treatment weighted marginal structural model (IPTW-MSM)]. In one instance, we also extracted a DMPA specific estimate and its 95% CI from a letter (63) submitted in response to an original manuscript (64).

We extracted information on features that might influence internal or external validity (and overall study quality) or explain heterogeneity, including: study retention rates, inter-survey intervals, the risk profile of study participants, and the study design underlying the estimate. For the risk profile of participants, we distinguished high-risk women or key populations (e.g., commercial sex workers, injection drug users, or women in serodiscordant [SD] partnerships) from women in the general population. Finally, we extracted details on the demographic characteristics of participants, recruitment sites, study durations, and exclusion criteria.

Statistical analysis

Effect estimates and their 95% CIs were log transformed and the standard error of each estimate was calculated. Funnel plots were generated to assess publication bias.

We selected one effect estimate per HC formulation per study[§] to include in primary pooled analyses.[**] When multiple effect estimates were available, we selected the estimate from the most fully adjusted multivariate model. Although four studies(64-67) presented estimates derived using IPTW-MSMs, we did not include these estimates in our primary pooled analyses as they estimate different parameters than traditional regression approaches and the two should not be compared or combined. Specifically, traditional Cox models estimate the average effect of treatment on an individual, whereas MSMs provide the average effect of treatment on the population(68). However, we performed separate analyses that combined only those estimates generated using IPTW-MSMs.

Evidence for statistical heterogeneity between studies was assessed for each HC formulation (DMPA, OCPs/COCs, NetEn) using the I^2 statistic and its 95% CI; an $I^2 \geq 50\%$ was considered evidence of sufficient heterogeneity to contraindicate a pooled estimate. (69). When the I^2 was less than 50%, pooled effect estimates were calculated using DerSimonian and Laird random effects models(70).

[§] When analyses on the same study population were published in multiple articles and all articles met inclusion criteria, we selected only the most comprehensive or recent paper to include in pooled analyses. See Appendix B for details.

[**] Although some authors did not explicitly describe the OCP under study as either combined or progestin-only method, use of POPs is less common in sub-Saharan Africa, and typically restricted to postpartum, breastfeeding women. Thus, we assumed that OCP categories would be comprised predominantly of COC users, and combine those studies that offer estimates for COCs specifically or OCPs generally in our analysis, to produce pooled effect estimates that represent the COC-HIV relationship. Four studies did present separate COC and POP estimates, and we use the COC estimate in pooled analyses.

We assessed the robustness of findings and explored heterogeneity through a series of a priori secondary analyses. First, we conducted an influence analysis to identify whether any one study disproportionately affected the results. Second, we stratified meta-analyses according to: 1) the risk profile of the study population (high risk vs. general population), and 2) the original study design (prospective cohort *vs.* randomized trial). Third, given concerns that having a reference group that is composed largely of condom users may artificially inflate the risk of HIV acquisition for HC users(71), we explored whether our results were sensitive to the exclusion of condom users from the comparison group. Finally, we explored whether results were qualitatively different when studies with inter-survey intervals longer than the duration of the contraceptive methods under study (1 to 3 months) were excluded. All analyses were conducted in Stata 12.0.

We refer to effect estimates as hazard ratios (HRs) since all of the studies in our pooled analyses used this measure, with one exception (72). That study estimated an incidence rate ratio (IRR), which is comparable in practical interpretation to the HR (19, 73).

RESULTS

We identified 26 articles (64-67, 72, 74-94), 12 of which met our inclusion criteria (64-67, 72, 84-87, 91, 92, 94) [See Figure 1 and Appendix B]. Two represented analyses on the same population; however, since they employed different analytic approaches (Cox regression (87) vs. IPTW-MSM (65)), both were included but in separate pooled analyses to prevent double counting.

All studies in the final sample were conducted in SSA. Three, all prospective cohort studies, were designed specifically to assess the HC-HIV relationship (84, 86, 87). The rest were secondary analyses on cohorts enrolled in randomized trials of various HIV (64, 66, 67, 72, 91, 92, 94) and one cervical cancer (85) prevention interventions. Two study populations consisted of high risk women, either CSWs (84) or women in SD partnerships (64). The remainder were composed of women in the general population, typically recruited at family planning or other health centers. The median age of participants ranged from 25 to 40. With the exception of two studies that surveyed women every six (85) or ten (72) months, the remainder surveyed women at least every three months. With the exception of one study which followed a subset of women for six months(85), all studies planned to follow women for at least one year. The median follow up ranged from 12 to 31.2 months. Given heterogeneity in how study authors presented estimates of loss to follow up, we did not quantitatively summarize this metric. However, in general, study retention was high, with a minimum of six of 12 studies having retention rates over 85%.

Funnel plots for studies assessing injectables and OCPs were symmetrical, suggesting no major evidence of publication bias (Figure 2).

DMPA-HIV

Ten articles examined the DMPA-HIV association. In pooled analyses, DMPA use was associated with an elevated risk of HIV acquisition as compared to use of non-hormonal or no methods

[pooled relative risk (RR) =1.40, 95% CI: 1.16, 1.69] (Figure 3). An influence analysis revealed that no single study was driving results. The pooled effect estimate across the two studies that used IPTW-MSMs was comparable to the overall estimate [pooled relative risk (RR)=1.41, 95% CI: 1.15, 1.72].

In subgroup analyses, the pooled relative risk among the three prospective cohort studies was 1.44 (95% CI: 1.04, 2.01). A high level of between-study heterogeneity (I^2=51.1%, 95% CI: 0%, 79.3%) among the seven secondary analyses of cohorts from RCTs precluded calculating a pooled estimate among this subgroup (Table 2).

The eight studies conducted among women in the general population had a lower amount of heterogeneity (I^2=27.3%, 95% CI: 0%, 67.3%) than the primary analysis (42.5%, 95% CI: 0%, 72.5%). The pooled estimate suggested a moderate increase in risk of HIV acquisition [pooled relative risk=1.31, 95% CI: 1.10, 1.57]. Individual study-level estimates were higher in the two studies with high-risk women (HR=1.73 [95%CI:1.28, 2.34] among CSWs (84) and 3.93 [95% CI: 1.37, 11.2] among women in SD partnerships(64)) (Table 2). However, a high level of heterogeneity (I^2= 54%, 95% CI: 0%, 88.7%) between these two studies contraindicated pooling estimates.

In an analysis restricted to the nine studies in which the reference group included women using condoms (in addition to other methods or no method), the pooled effect estimate did not change substantively from the primary analysis (pooled RR = 1.44, 95% CI: 1.20, 1.73). An analysis restricted to the eight studies in which the inter-survey interval did not exceed three months revealed a pooled effect estimate that was slightly larger than our primary analysis (pooled RR=1.48, 95% CI: 1.24, 1.76) (Table 2).

COC/OCP-HIV

Ten studies presented estimates of the COC/OCP-HIV relationship. There was no elevated risk of HIV acquisition among COC/OCP users as compared to those using non-hormonal or no methods (pooled relative risk = 1.00, 95% CI: 0.86, 1.16) and our influence analysis revealed that no one study was driving these results. There was minimal evidence of between study heterogeneity (I^2=0%, 95% CI: 0%, 48.6%). The pooled estimate among five studies using IPTW-MSMs was similar to the primary pooled result (pooled RR= 1.03, 95%CI: 0.81, 1.32). A subgroup analysis of the two studies conducted among high risk women revealed an elevated risk of HIV acquisition among COC/OCP users (pooled RR= 1.49, 95%CI: 1.04, 2.13) (Table 3).

NetEn-HIV

Analysis of the five studies that presented estimates on the Net-En-HIV relationship revealed no elevated risk of HIV acquisition (pooled RR=1.10; 95% CI: 0.88, 1.37) and minimal heterogeneity (I^2=0%, 95% CI: 0%, 74.6%). Similar results were observed for the two studies estimated using IPTW-MSMs (pooled RR=1.08, 95% CI: 0.78, 1.52) (Table 3). An influence analysis was non-significant and subgroup analyses were not possible given the small number of studies.

DISCUSSION

Our meta-analysis found that among observational studies with similarly and precisely defined exposures, adjustment for key confounders, minimal selection bias, and sound analytic approaches, there is evidence of a small but increased risk of HIV acquisition associated with DMPA use. Consistent with an earlier meta-analysis on OCPs (95), no elevated risk was observed for OCP/COC users in the general population. Further, there was no elevated risk among Net-En users; however, the few studies contributing to this analysis precludes making any definitive statements on its association with HIV.

The results from this analysis, particularly for DMPA, should be used as an input parameter in ongoing modeling studies quantifying the tradeoffs associated with removing injectables from the contraceptive method mix. For example, Butler et al. (55) used both a hypothetical (RR=1.2) and a single study (OR=2.19)(64) estimate to predict changes in the numbers of HIV and maternal deaths following reductions in injectable HC use. Their findings suggest that, except in southern Africa where both HIV incidence and injectable use are high, the effect of removing HC on the number of maternal and HIV related deaths is sensitive to the effect estimate chosen. Given these results, it is possible that an increased risk of the magnitude found in our study (RR=1.4), particularly for women in the general population, would not merit complete withdrawal of DMPA as maternal mortality would still exceed HIV related deaths in most settings, particularly if women did not immediately have access to and uptake alternate, effective contraceptive options in the absence of DMPA, one of the assumption in Butler et al.'s models. Moving forward, we encourage Butler et al. (55) and others (54, 56) to apply our estimates and more fully explore regional/geographic and subpopulation differences so that context-specific contraceptive policy can be developed.

Our analysis also offers insight into potential sources of heterogeneity in results. Studies among women in the general population, which constitute the majority in our analysis, provide estimates of the average population level effect of HC on women's risk of HIV acquisition. In contrast, those conducted among high risk women, of which there were two in our analysis, provide estimates of the effect of HC conditioned on a high likelihood of HIV exposure. For the millions of HC users worldwide, most of whom are *not* in serodiscordant or other high risk partnerships, this distinction is critical. While the elevated risks for DMPA and COC/OCP users reported in the two studies with CSWs (84) and women in SD partnerships(64) may warrant consideration of changing contraceptive guidelines for these populations, it would be premature to do so based on two studies. Further, it is critical that their results not be inadvertently generalized to women in the general population, which our study found had a more modest increase in risk that may only warrant a policy change in specific local contexts.

A priori, we established a strict set of inclusion criteria for our meta-analysis. Although this left us with fewer studies, and less power in our planned secondary analyses or to explore heterogeneity through meta-regression, it ensured that only comparable estimates were combined. Contrary to the perception that this literature is too diverse for meta-analysis, we did not uncover levels of heterogeneity that would preclude pooling estimates in most

analyses. One notable exception is that although they contribute to the primary pooled analyses, we were unable to present a separate pooled estimate among the subset of studies conducted as secondary analyses of randomized controlled trials. The heterogeneity statistic for this group (I^2=51.1%, 95% CI: 0%, 79.3%) rests on the border between "moderate" and "substantial" according to current Cochrane guidance(96). Whereas the prospective cohort studies were all designed specifically to answer this research question, the trials had divergent research objectives that may be reflected in the higher level of heterogeneity. Given this, a very conservative application of our findings would be to use the pooled RR and CI from only the prospective cohort studies. However, the strengths of the randomized trials, notably their large sample sizes, frequent assessment of contraceptive method use and switching, and efforts to ensure high retention, are compelling. Regardless, in the absence of another prospective cohort study or data from the proposed RCT on HC-HIV(97), the results of which would not be available for several years, other HIV prevention trials represent the primary source of data with which to explore this important question in the near future(98).

Our study findings should be interpreted in the context of several limitations. First, meta-analyses of observational studies, like observational studies themselves, are inherently more prone to concerns about bias and are not able to address whether the association between HC and HIV is causal (62). There has been extensive discussion about whether studies to date have sufficiently addressed the potential confounding effects of misreported condom use (71, 99), particularly since many study populations were drawn from HIV prevention trials where condom use is strongly encouraged and women may feel pressure to report socially desirable behaviors(100, 101). However, recent modeling studies suggest that the practical effects of condom misreporting may be overstated. For example, Smith et al. (102) demonstrate that only a substantial amount of condom use underreporting by non-hormonal contraceptive users, an unlikely scenario, could explain the elevated effect estimate observed in the recent Heffron et al. study (HR=2.19 for all injectables and HR=3.93 for DMPA specifically). Further, our own work with biomarkers of unprotected sex has demonstrated that misreporting of condom use is not statistically different between women using HC and those using other methods, and therefore may not bias effect estimates to the extent suggested(103). Note that even a randomized controlled trial will likely not be able to overcome many of the measurement challenges inherent to studying this question (54, 104). Likewise, the limitations of the original studies remain limitations of our analysis. For example, none of the studies prospectively assessed acute HIV infection, which would strengthen our confidence in the timing of exposure to HC and women's subsequent acquisition of HIV.

A second limitation is that, despite our efforts to ensure systematic inclusion of all studies that assessed the HC-HIV relationship and explore publication bias using funnel plots, as with all meta-analyses, our results may be biased if only studies with significant results have been published. However, here, publication bias is less likely because over the past two decades, a null finding was equally compelling in terms of advancing the debate. Regardless, if studies that found positive and significant effects of HC on women's risk of HIV acquisition were more likely to be published, that would imply that our findings represent an overestimate of the true association between HC and HIV.

Although our study findings echo what was previously presented qualitatively in two systematic reviews(11, 57, 58) (ie, there is evidence of a moderate increase in risk of HIV for injectable users, potentially isolated to high risk women), this study is the first to quantitatively summarize existing evidence, particularly for DMPA, and offer a series of weighted, pooled estimates of effect and their variances, by precise HC method type, for all studies published through May 2014. Since we approached data extraction and definitions of study quality independently from the other reviews, our study also contributes another perspective on the methodological rigor of the existing body of evidence.

Given concerns about the observational evidence collected to date, efforts are currently underway to fund a randomized trial on the HC-HIV relationship. Some might argue that the moderate increase in risk found in our study for DMPA users, who would comprise one of the intervention arms, might violate the principal of equipoise required for a trial (105). Importantly, also of concern is whether, given the methodological challenges inherent to studying this question (104), the randomized trial will offer evidence superior to that which currently exists, especially when also considering the personal and financial investments required for a trial(52). Our pooled estimates can immediately inform contraceptive policy, without waiting several years for trial data. In addition, our findings highlight an immediate need to refocus secondary analyses on CSWs and women in serodiscordant partnerships, because evidence for these high risk women is limited but suggests an elevated risk. Meanwhile, basic science research must continue to definitely document the biological mechanisms underlying the observed association documented here(106). Finally, it is the public health imperative to continue to promote a wider array of existing methods and develop and promote long-term reversible contraceptive options for women worldwide.

FIGURE 1. Flowchart of study selection

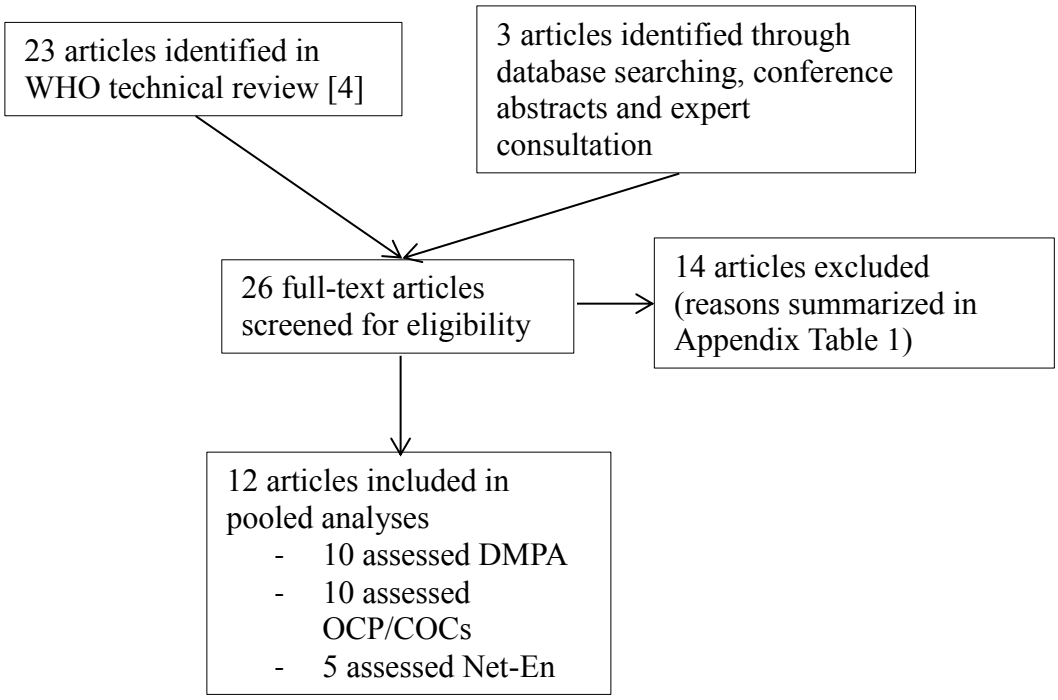
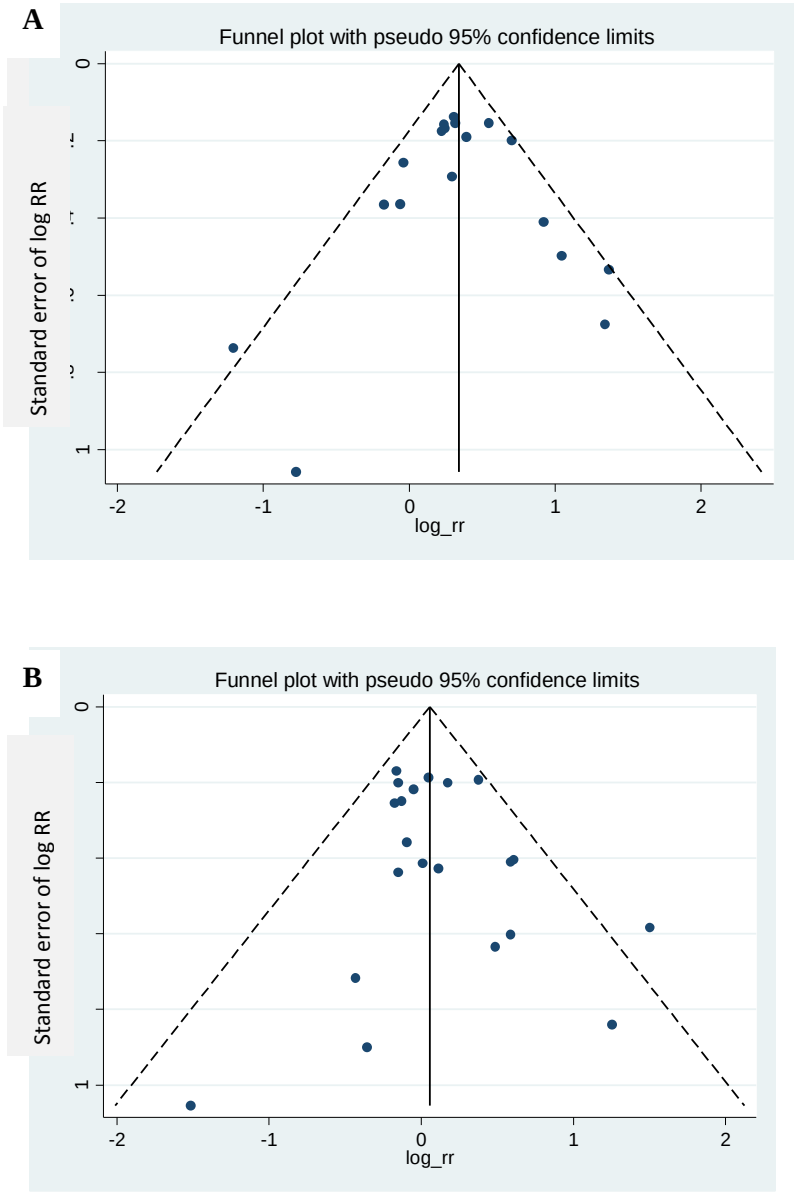


TABLE 1. Descriptive characteristics of studies included in primary DMPA-HIV, COC-HIV, and NetEn-HIV pooled analysis

First author and citation	Year	Study location(s)	Study Participants (SDP=serodiscordant partnerships; CSW=commercial sex workers)	Mean age of study popln.	Exposures assessed*	# of HIV sero-conversions	Effect Estimate (adjusted hazard ratio, unless otherwise noted)	Reference group	Inter-survey interval (months)	Duration of follow up (months)	Present IPTW-MSM^ estimates
Crook [47]	2013	S. Africa, Uganda, Tanzania, Zambia	N=8663 women in microbicide trial; 786 in SDPs	27	DMPA	146	1.45 (1.09, 1.93)	Non-hormonal or no method	1	12 (planned)	X
					Net-En	69	1.20 (0.84, 1.69)				
					OCPs	50	0.90 (0.63, 1.26)				
					Ref	117	--				
McCoy [19]	2012	Zimbabwe, S. Africa	N=4913 women in MIRA trial	27.5	DMPA	63	1.22 (0.84, 1.74)	Non-hormonal or no method	3	17.9 (median)	X
					Net-En	17	1.15 (0.58, 1.95)				
					OCPs	61	0.84 (0.57, 1.22)				
					Ref	108	--				
Morrison [18]	2012	S. Africa	N=5567 women in Carraguard trial	28	DMPA	270 (total)	1.27 (0.93, 1.73)	Non-hormonal or no method	3	24 (planned)	X
					Net-En		0.87 (0.60, 1.25)				
					COCs		0.88 (0.49, 1.30)				
					Ref		--				
Heffron [16]	2012	Bostwana, Kenya, Rwanda, S. Africa, Tanzania, Uganda, Zambia	N=1314 women in SDP in Partners in Prevention Trial	30.2	Inj	10	1.80 (0.92, 3.52)	Non-hormonal or no method	3	18 (median)	X
					DMPA#	Not reported	3.93 (1.38,11.22)				
					OCPs	3	1.80 (0.55, 5.82)				
Wand [45]	2012	S. Africa	N=2236 women in microbicide trial	27	Inj-DMPA&	Not reported	2.02 (1.37, 3.00)	Non-hormonal method^^	3	Not reported	
					OCPs	Not reported	0.95 (0.62, 1.46)				
Morrison [40][18]	2007 2010	Uganda, Zimbabwe	N=4435 women recruited at health clinics	25	DMPA	213 (total)	1.25 (0.89, 1.78)	Non-hormonal method^^	3	21.5 (mean)	X
					COCs		0.99 (0.69, 1.42)				
Reid [44]	2010	S. Africa, Zambia, Zimbabwe	N=1358 women in acyclovir trial (HPTN 039)	31	Inj	Not reported	0.94 (0.46, 1.92)	No method&&	3	18 (planned)	
					OCs	Not reported	0.91 (0.45, 1.83)				
Baeten [37]	2007	Kenya	N=1206 CSWs recruited at communicable disease clinics	26	DMPA	79	1.73 (1.28, 2.34)	No method or tubal ligation@@	1	14.9 (median)	
					OCPs	38	1.46 (1.00, 2.13)				
					Ref	118	--				
Kleinschmidt [39]	2007	S. Africa	N=551 women recruited at family planning clinics	27.7	DMPA	1	0.46 (0.06, 3.79)	Non-hormonal or no method	3	12 (planned)	
					Net-En	10	1.76 (0.64, 4.84)				
					Ref	12	--				
Myer** [38]	2007	S. Africa	N=4200 women in cervical cancer prevention trial	40	DMPA	Not reported	0.75 (0.33, 1.68)	Non-hormonal or no method	6-12**	14.3** (median)	
					Net-En	Not reported	1.60 (0.63, 4.09)				
					COC	Not reported	0.66 (0.09, 4.78)				
					Ref	Not reported	--				
Kiddugavu [24]	2003	Uganda	N=5117 women in Rakai community-based HIV prevention trial	25	Inj- DMPA*%%	16	0.84 (0.41, 1.72)$$	Non-hormonal or no method, excluding condoms	10	31.2 (median)	
					OCs	12	1.12 (0.48, 2.56)$$				

FIGURE 2. Funnel plots assessing potential publication bias among studies examining the injectable-HIV (A) and OCP-HIV (B) relationship*



*We chose to address potential publication bias separately for the injectable-HIV and OCP-HIV relationship, as both relationships were not explored in all studies. When studies presented both a DMPA-HIV and Net-En or COC-HIV and POP-HIV relationship and did not also present a combined (e.g., injectables, OCPs) estimate, we selected the DMPA-HIV or COC-HIV estimate, respectively, to include in the funnel plot.

FIGURE 3. Forest plot of primary analysis of DMPA-HIV relationship

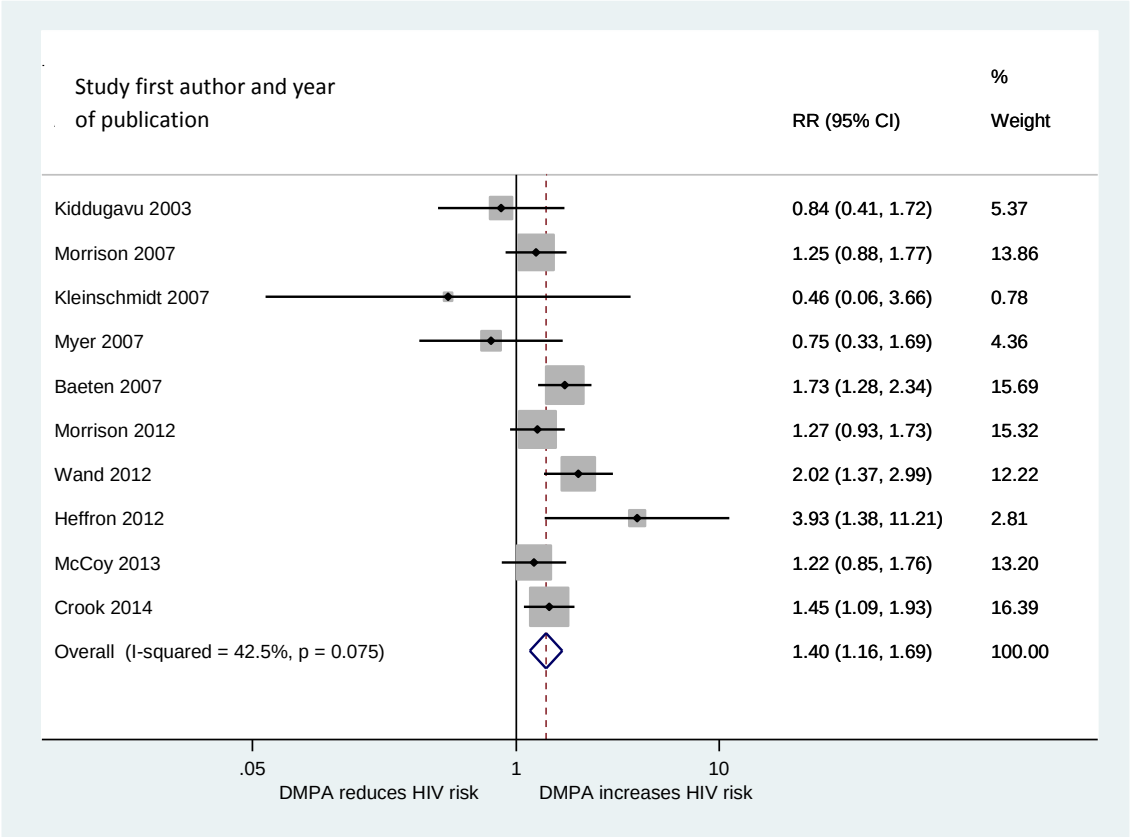


TABLE 2. Comparison of results for primary, subgroup, and sensitivity analyses of the DMPA-HIV relationship using random effects models*

	Number of studies	I^2 statistic (95% Confidence Interval)	Pooled HR (95% Confidence Interval)	Studies included
Primary analysis	10	42.5% (0%, 72.5%)	1.40 (1.16, 1.69)	(64, 66, 67, 72, 84-87, 92, 94)
IPTW-MSM analysis[#]	3	0% (0%, 58.2%)	1.41 (1.15, 1.72)	(65, 66, 94)
Subgroup analysis				
Higher risk women	2	54.0% (0%, 88.7%)	--	(64, 84)
Women in the general population	8	27.3% (0%, 67.3%)	1.31 (1.10, 1.57)	(66, 67, 72, 85-87, 92, 94)
Prospective cohort	3	36.7% (0%, 79.9%)	1.44 (1.04, 2.01)	(84, 85, 87)
Sample from RCT	7	51.1% (0%, 79.3%)	--	(64, 66, 67, 72, 86, 92, 94)
Sensitivity analysis				
Reference group includes women using non-hormonal or no methods[^]	9	40.8% (0%, 72.7%)	1.44 (1.20, 1.73)	(64, 66, 67, 84-87, 92, 94)
Inter-survey interval $\leq$ 3 months[%]	8	36.1% (0%, 71.7%)	1.48 (1.24, 1.77)	(64, 66, 67, 84, 85, 87, 92, 94)

* All pooled analyses were limited to published, prospective studies that assessed incident HIV infection where the exposure category was predominantly (or exclusively) DMPA, the comparison group was comprised of women using non-hormonal or no contraceptive method (including condom users, unless noted), the model was adjusted for potential confounders of the HC-HIV relationship, including condom use and age, and no more than 30% of the study population was lost to follow up.

[#] Two additional studies (64, 67) present estimates derived using IPTW-MSMs; however they were for injectables and not specific to DMPA and are therefore not included here.

[^] One study in which condom users were explicitly excluded from the reference group(72) was excluded.

[%] Two studies with inter-survey intervals of 6 (85) and 10 months (72) were excluded.

TABLE 3. Comparison of results for primary and subgroup analyses of the COC-HIV and NetEn-HIV relationship using random effects models*

	Number of studies	I^2 statistic (95% Confidence Interval)	Pooled HR (95% Confidence Interval)	**Studies included**
Primary analysis – COCs	10	0% (0%, 48.6%)	1.00 (0.86, 1.16)	(64-67, 72, 84, 86, 87, 91, 92, 94)
MSM-IPTW analysis – COCs	5	0% (0%, 55.2%)	1.03 (0.81, 1.32)	(64-67, 94)
Subgroup analysis – COCs				
Higher risk women	2	0% (0%, 0%)	1.49 (1.04, 2.13)	(64, 84)
Women in the general population	8	0% (0%, 0%)	0.92 (0.78, 1.18)	(65-67, 72, 86, 87, 91, 92, 94)
Prospective cohort	2	52% (0%, 88.3%)	--	(84, 87)
Sample from RCT	8	0% (0%, 0%)	0.91 (0.75, 1.10)	(64-67, 72, 86, 91, 92, 94)
Sensitivity analysis – COCs				
Reference group includes women using non-hormonal or no methods[#]	8	0% (0%, 64.8%)	1.00 (0.85, 1.17)	(64-67, 84, 86, 87, 92, 94)
Inter-survey interval $\leq$ 3 months[%]	8	0% (0%, 64.3%)	1.00 (0.86, 1.16)	(64-67, 84, 87, 91, 92, 94)
Primary analysis – NetEN	5	0% (0%, 74.6%)	1.10 (0.88, 1.37)	(66-67, 85, 87, 94)
IPTW-MSM analysis – NetEn	2	36% (0%, 78.1%)	1.08 (0.77, 1.52)	(66, 94)

* All pooled analyses were limited to published, prospective studies that assessed incident HIV infection where the exposure category was predominantly (or exclusively) COCs/NetEn, the comparison group was comprised of women using non-hormonal or no contraceptive method (including condom users, unless noted), the model was adjusted for potential confounders of the HC-HIV relationship, including condom use and age, and no more than 30% of the study population was lost to follow up.

[#] Two studies in which condom users were explicitly excluded from the reference group(72, 91) were excluded.

[%] Two studies with inter-survey intervals of 6 (85) and 10 months(72) were excluded.

Chapter 3: The role of parents and partners in minors' decisions to have an abortion and anticipated coping after abortion

BACKGROUND

Approximately 250,000 young women ages 15 to 17 in the US become pregnant annually; 30% of these pregnancies end in induced abortion(107). Although these minors account for a small proportion (7%) of induced abortions(108), they represent the focus of much abortion-related policy, including requirements that parents be notified of or give consent for the minor seeking abortion. Implicit in these laws is that minors require additional support in decision-making around pregnancy and universally benefit from parental involvement in this process. However, little is known about the nature of adolescent abortion decision-making, including the extent to which parents and other individuals positively or negatively influence adolescents' experiences in obtaining an abortion and satisfaction with their decision.

Results from multiple studies conducted in the 1980s and 1990s suggest that most minors typically turn to their parents and male partners when faced with an unintended pregnancy(109-115). For example, in Henshaw et al.'s 1992 study, the largest to date of minors seeking abortion(110), nearly two-thirds (61%) of minors living in states without parental involvement laws indicated that at least one of their parents, most often their mother, was aware of their decision to seek an abortion. A larger proportion (78%) involved their boyfriend. Minors who were younger, lived with both parents, demonstrated less financial independence, and reported a close relationship with their parents prior to the pregnancy were significantly more likely to report having parents involved in their decision, a finding echoed in other, smaller studies (109, 111, 113).

Parents' and partners' involvement in minors' abortion decisions is not always indicative of their support for the minor's decision. One-quarter of minors in Henshaw et al.'s study reported that a mother (26%), male partner (27%), or friend (21%) had attempted to persuade her to have an abortion; nearly equal percentages reported pressure from partners (20%) and friends (19%) and, to a lesser extent, mothers (7%), to continue the pregnancy. However, there is little evidence that this pressure is the central reason motivating minors' decision on unintended pregnancy, as less than one percent of minors report that pressure from a partner or parent was the most important reason for their decision to seek an abortion. Other factors, including economic hardship (80%) and interference with school or career (82%) figure much more prominently into minors' reasons for choosing abortion(34).

However, perceived lack of support can influence young women's feelings of self-efficacy to cope with her decision (116). In a longitudinal study of primarily African American, urban teenagers, Zabin et al. (25) found that 88% of minors who chose abortion expressed satisfaction with their decision one year later; however, minors who indicated that her parent had not supported her decision were more likely to be dissatisfied one year later. Similarly, Pope et al (2001) (117) found that the psychological adjustment of women ages 17 and under post-abortion was similar to that of women ages 18 to 21; however, significant predictors of a negative response to abortion for minors included baseline emotional distress, a finding that

has been observed in adult populations as well(118), and perceived pressure from male partners either to continue the pregnancy or seek abortion.

The present study will explore the extent and nature of parental and partner involvement in minors' abortion decision-making, and its influence on minors' confidence in and predicted ability to cope with their decisions. In earlier work using data from this same abortion clinic, we found that women under age 20 were less likely to report having high confidence in their abortion decision, and were more likely to report feeling pushed by a parent into their decision and to anticipate poor coping with their decision(119, 120). However, these analyses did not focus explicitly on minors and did not explore in detail the relationship between parental and partner awareness or support and young women's confidence in her decision and predicted coping. These questions represent the focus of the present analysis.

METHODS

Data

The source of data for this study has been described elsewhere(119, 120). In brief, we abstracted de-identified data from medical records and counseling needs assessment forms for all women accessing abortion services at a private clinic in 2008. The clinic is located in a state without a parental involvement requirement. The needs assessment form is a self-administered survey that elicits information about women's emotional status, decision-making process and confidence in their decision, sources of support for their decision, and anticipated reactions to having an abortion. It was developed by Charlotte Taft, MA, and revised by Anne Baker, MA, both experts in abortion counseling. The form serves as a model for abortion providers across the country, and is included in the primary textbook on abortion care disseminated to members of the National Abortion Federation(121).

The needs assessment form is used in a pre-abortion session with a counselor, the purpose of which is to confirm that each patient has come to a clear and voluntary decision, to educate her about the procedure and aftercare, and to ensure informed consent. If, following this session, the counselor is concerned that a patient shows signs of being at high risk for regret or poor post-abortion coping, or is being coerced into the abortion, an abortion is not provided and the woman is given additional time and resources to clarify her decision and resolve conflicts. This analysis includes all women seeking abortion care, including those that did not receive an abortion following the counseling session.

This study was approved by the University of California, San Francisco's Institutional Review Board (CHR#08033575).

Measures

Demographic and abortion characteristics

Women's race/ethnicity, parity, age, and gestational age was abstracted from medical charts, along with characteristics pertaining to the current pregnancy, including whether it was in the first or second trimester, would be a first or subsequent abortion, or the abortion was not

performed. Whether the pregnancy was a result of rape was obtained from the needs assessment form.

Awareness of and support from parents and partners

Measures of awareness and support were created from two questions that asked women "*Who are the only people who know you're having an abortion?",* and, for each person named, "*Is this person supportive to you in what you want to do?"* Parents and partners were considered non-supportive if the women responded "Not much" or "No" to the second question.

Confidence in the abortion decision

Confidence in the decision was captured using women's responses to four statements, similar to our previous work(119). If a woman indicated that the statements "*I am SURE of my decision to have an abortion*" and "*Abortion is a better choice for me at this time than having a bab*y" were true, and the statements "*I want to have the baby instead of abortion*" and "*I want to put the baby up for adoption instead of an abortion*" were false, she was classified as having high confidence in her decision. Women who did not provide this response pattern were classified as having low confidence in her decision.

Pressure to terminate the pregnancy

Women were classified as experiencing <u>pressure</u> in their decision-making if they responded "true" or "kind of" to the statement "*I'm here for an abortion MOSTLY because someone else wants me to*." Those who acknowledged experiencing pressure were asked to identify the source of pressure from a list of options that included their mother, father, boyfriend/husband, partner in the pregnancy, and others. Separately, women were classified as feeling <u>pushed</u> into their decision if they experienced pressure <u>and</u> expressed low confidence in the decision.

Attitudes toward abortion

Women were classified as believing abortion is killing if they responded "yes" or "kind of" to the statement "*At my stage of pregnancy, I think it [abortion] is the same as killing a baby that's already born.*"

Women were classified as having spiritual concerns about abortion if they responded "true" or "kind of" to the statement "*I have spiritual concerns about abortion*" and "false" or "kind of" to the statement "*Spiritually, I'm at peace with this decision*." Women who responded "true" or "kind of" to the statement "*I'm afraid God won't forgive me*" were classified as having concerns about God's forgiveness.

Anticipated emotions and coping

To gauge women's anticipated emotions post-abortion, women were asked "*How do you think you may feel after having this abortion*?" Women could select multiple responses from a list including "confident in the decision", "relieved", "happy", "a little guilty", "a little sad", "very guilty", "very sad", "ashamed", "angry", and "I'll wish I never went through with the abortion."

Women's anticipated coping was generated from their response to the question: "*How do you think you'll deal with the feelings you checked?*" Potential responses included: (1) "I'll deal with

my feelings fine afterwards." (2) "It might be hard at first, but then I'll be fine and won't regret my decision."(3) "It will probably be VERY hard for me afterwards. (4) "I'm afraid I'll wish I never went through with the abortion." (5) "I believe I will be able to cope with this decision better than parenting or adoption at this time." Women were classified as having poor anticipated coping if they selected #3 or #4, and did not select the other options, similar to our previous work(120).

Analysis

We assessed differences between minors and adults in demographic, pregnancy, and involvement/support measures using χ^2 or t-tests. Among the subsample of minors, separate multivariate logistic regression models predicting the odds of telling one's mother or partner about her abortion decision and the odds of having maternal support for that decision were constructed. Finally, we created separate logistic regression models predicting the odds of high confidence in the decision to have an abortion and of anticipated poor coping. Data was analyzed using STATA SE 12.0.

RESULTS

Demographic characteristics

A total of 5,109 women ages 10 to 48 sought abortion care in 2008 and completed a needs assessment form; approximately one in ten (9%) were minors aged 17 and under. Among minors, 79% were 16 or 17, 13% were 15 and <9% were 14 or under (Table 1). Most women were white (56%) or African American (39%).

Abortion history and characteristics

The majority of women (81%) were seeking abortion care in the first trimester (Table 1).On average, minors presented one week later than adults (10.7 vs. 9.6 weeks, $p<0.05$) and were more likely than adults to be presenting in the 2nd trimester (27% vs. 18%, $p<0.05$). Following completion of the counseling and medical visits, minors were more likely than adults to not receive their planned abortion (12% vs. 7%, $p<0.05$). Being past the clinic's gestational limit was more often a reason for forgoing the abortion for minors (4%) than for adults (2%). Other reasons included identifying a non-uterine pregnancy (2%) or changing their mind (3%); the frequency of these reasons did not differ significantly between minors and adults (data not shown).

Maternal notification and support

Overall, 64% of minors indicated that their mother knew that they were seeking abortion care (Table 2). In a multivariate logistic regression model, younger minors (ages 10 to 14 and 15) were more likely (OR of 5.1 and 5.0, respectively) to have informed their mother than 17 year olds. Minors who indicated that their partner was supportive of their decision were less likely (OR=0.6) to report maternal awareness. Other factors, including the young women's race/ethnicity, attitudes toward abortion, and characteristics of her pregnancy, were not significantly associated with maternal awareness (Table 3).

Among minors whose mothers were aware of their decision, the majority (93%) indicated maternal support for their decision (Table 2). The minor's age, mental health history, abortion history, and male partner's support were not significantly associated with the likelihood of mother's support. However, African American teenagers were 70% less likely and teenagers who believed that abortion was akin to killing were 60% less likely to report that their mother supported their decision (Table 3).

Partner notification and support

Similar proportions of minor (83%) and adult (82%) women indicated that their male partner was aware of their decision. Levels of partner support were similar among minor (85%) and adult (88%) women (Table 2). In a multivariate logistic regression model, younger minors ($\leq$ 14 vs. 17 year olds) (OR=0.4), those who were seeking an abortion in the second trimester (OR=0.4), and those with a supportive mother (OR=0.6) were less likely to have told their male partner. In a separate logistic regression model (not shown), only race/ethnicity significantly predicted male partner support, with African American minors less likely (OR=0.5) to report male partner support compared to their white counterparts.

Pressure to terminate pregnancy

A significantly larger percentage of minors than adults indicated that they had sought abortion care mostly because someone else wanted them to (10% vs. 3%, $p<0.05$) (Table 1). When asked specifically who had pressured them into seeking an abortion, the majority indicated their mother (57%), followed by male partners (32%), "everybody" (7%) or another family member (e.g., father, aunt, grandmother) (6%) (data not shown). Seven percent of minors were classified as having felt pushed into the abortion; this figure was significantly higher among minors than adult women (7% vs 2%, $p<0.05$) (Table 1).

Confidence in the abortion decision

Most minors (81%) had high confidence in their abortion decision (Table 1). Age, mental health history, abortion history, and maternal involvement and support were not significantly associated with having high confidence in the decision in multivariate models. However, African American respondents (OR=0.3), minors with spiritual concerns about abortion (OR=0.3), and minors who considered abortion to be killing (OR=0.3) were less likely to have high confidence. Minors who indicated that they had sought abortion care primarily because someone else wanted them to were also less likely to have high confidence (OR=0.1) [Table 4].

Anticipated emotional reactions by maternal support

Minors anticipated experiencing a range of emotions following the abortion, including feeling relieved (60%), confident (37%), a little sad (36%) or a little guilty (26%). Less common responses were anticipating feeling very sad (13%), ashamed (10%), happy (9%), or very guilty (9%). Minors' anticipated reaction to the abortion differed significantly based on maternal involvement in and support of their decision. Young women who described their mothers as not supportive were more than twice as likely to anticipate feeling very sad (29%) or ashamed (29%) compared to women who did not tell their mother (14 and 10%, respectively) or told a supportive mother (9 and 6%, respectively). Similarly, young women who told a non-supportive mother were significantly less likely to anticipate feeling relieved (29%) than women who did

not tell a mother (65%) or told a supportive mother (59%). Overall, minors who told a non-supportive mother anticipated poor coping after the abortion at a significantly higher frequency (33%) than those who did not tell their mother (7%) or told a supportive mother (7%) (Table 5).

Predictors of anticipated poor coping

In a logistic regression model, minors who indicated that they were having an abortion mostly because someone else wanted them to were significantly more likely to anticipate poor coping (OR=5.4). Those with spiritual concerns about abortion (OR=6.2), or the belief that abortion is similar to killing (OR=6.1) were also more likely to anticipate poor coping. Finally, the younger the minor, the more likely she was to anticipate having a difficult time coping with the abortion. Compared to women aged 17, those aged 10-14 (OR=7.0) or 15 (OR=4.2) had significantly elevated odds of anticipating poor coping (Table 4).

DISCUSSION

The present study provides new evidence on the frequency with which minors voluntarily involve others in their decision-making around pregnancy, confirming that mothers and male partners represent the individuals young women who eventually seek abortion most often turn to when faced with an unintended pregnancy, and that these individuals are most often supportive of their decision. The study also offers additional evidence that in many respects, minors experience abortion similarly to adults (119). They anticipate feeling a range of emotions in response to having an abortion, and most feel prepared to cope with those emotions. Low confidence in their decision, as well as anticipated poor coping, are largely predicted by the same set of factors: having spiritual concerns about abortion, thinking abortion is akin to killing, and feeling pressured to have an abortion by someone else. Abortion remains a highly stigmatized topic in the United States and some young women have internalized this in their own feelings on abortion (122-124). The fact that some young women have some negative feelings about abortion, yet are still presenting for abortion care, is not uncommon, and suggests pre- and/or post-abortion counseling for young women may help ensure that they can discuss these feelings, carefully consider their options, and receive necessary post-abortion support referrals.

In this study, one out of 10 minors indicated that they were seeking an abortion mostly because someone else wanted them to. While these minors were in the minority, this finding is concerning because, for them, pressure to seek an abortion was associated with being less confident in their decision and anticipating poor coping after the abortion. Male partners have received a great deal of negative attention for their potentially coercive role in women's decision-making around birth control use, pregnancy, and abortion (117, 125). This study broadens the perspective, providing evidence that, among the minority of minors at this clinic who reported feeling pressure to have an abortion, mothers were the primary source of pressure, cited twice as often as partners. This finding reinforces the critical role that abortion providers play in ensuring that women arrive at a final decision on their own and without undue influence from anyone. At this clinic, if pre-abortion counseling revealed coercion from partners, parents or other sources, women were counseled to delay abortion care and received additional counseling and/or referrals.

The study's finding that African American youth were significantly less likely than white youth to have high confidence in their decision to have an abortion, a finding echoed in adult women in this study(119), highlights potentially important differences in the way abortion is perceived. Other studies that have explored unintended pregnancy with young African American women and their families reveal less favorable attitudes toward abortion, with parenting often preferred to abortion (126, 127). Despite these cultural or familial norms, many young African American women choose abortion; however, they may more frequently have to resolve individual or family level opposition to their decision.

The findings from this study should be considered in the context of several limitations. First, this study was cross-sectional in nature, and we captured women's experience with abortion at one point time – when they presented for abortion care. Women's attitudes likely evolve as they move from recognizing pregnancy to choosing whether to parent; however, we believe that the feelings they are experiencing when present for care are highly salient in understanding their decision-making process and predicting post-abortion coping. The cross-sectional nature of the data means that we do not know the order in which young women involve others in their decision-making. Our finding that young women who have partner support are less likely to involve their mother and conversely, that young women who have maternal support are less likely to involve a partner, does not necessarily offer evidence of who young women consult first; rather, it suggests that young women who find support from someone early on are less likely to inform others. Second, this study captures young women's perceptions of support for their decision and we did not probe further to identify what indicated support. Lack of support could range from a parent simply expressing dissatisfaction with her decision to more drastic measures such as kicking her out of the house, and these are likely to have very different implications. Similarly, pressure to seek an abortion could have taken on various forms, ranging from strong encouragement to overt coercion. Finally, these results are representative of youth seeking abortion services in one region of the US and are not generalizable to all minors seeking abortion care. In particular, although our study is able to elucidate important differences between African-American and white youth, given small sample sizes we are unable to identify any differences for Hispanic or Asian Pacific Islander youth.

The extent to which policy should mandate parental involvement in minors' reproductive decision-making remains heavily contested in the US. Consistent with past research, this study finds that the majority of youth seeking abortion indicate that a parent, most often their mother, is aware of their decision. However, this study also highlights that when minors involve a non-supportive parent, they are less likely to have confidence in their decision and are more likely to anticipate having difficulty coping with their decision. This evidence suggests that broad mandates for parental involvement, particularly more stringent forms that require parental consent, without consideration of the unique and diverse circumstances of young women, may not be the best policy to ensure the health and well-being of all minors.

TABLE 1. Demographic, pregnancy, and attitudinal characteristics of women seeking abortion at the study clinic

		Minors (age ≤ 17)	Adults (ages ≥ 18)	Total
		%	%	%
Demographic characteristics		N=476	N=4633	N=5109
	Race/ethnicity			
	Hispanic	1	1	1
	African American	40	39	39
	Non-Hispanic white	53	57	56
	Asian	1	1	1
	Other/Missing	5	3	3
	Parity *			
	0	93	33	39
	1 birth	7	31	28
	2 births	0	23	20
	3+ births	0	14	13
	Age of minors			
	10	<0.5	-	-
	12	<0.5	-	-
	13	2	-	-
	14	6	-	-
	15	12	-	-
	16	30	-	-
	17	49	-	-
	History of depression	3	5	5
Attitudes toward abortion				
	Thinks abortion is similar to killing a baby that is already born*	31	16	17
	Has some spiritual concerns about abortion*	49	43	43
	Concerned about God's forgiveness*	24	18	24
Characteristics of abortions sought		N=490	N=4823	N=5313
	Mean gestational age (weeks) **	10.7	9.6	9.7
	Trimester			
	First (< 13 weeks) *	73	82	81
	Second (≥ 13 weeks) *	27	18	19
	History of having previous abortion*	10	52	48
	Pregnancy is result of being forced to have sex	1	1	1
	Procedure not performed *	12	7	7
	Due to being beyond gestational limit of 25 wks*	4	2	2
	High confidence in abortion decision*	81	88	87
	Seeking abortion mostly because someone else wants them to (*pressure*) *	10	3	4
	Low confidence in decision + experienced pressure (*pushed*) *	7	2	2

*χ^2 p<0.05, **t-test significant at p<0.05

TABLE 2. Parents' and partners' awareness of and support for women's decision

	Minors (≤ age 17)	Adults (ages ≥ 18)	Overall
Parents	%	%	%
Mother is aware of decision*	64	**33**	36
Percentage of mothers who are aware who are supportive of decision	93	91	92
Father is aware of decision*	38	29	30
Percentage of fathers who are aware who are supportive of decision	85	87	87
Partners			
Partner is aware of decision	83	82	82
Percentage of partners who are aware who are supportive of decision	85	88	87

*χ^2 test demonstrates significant difference between minors and adults at $p<0.05$

TABLE 3. Predictors of maternal and partner notification and maternal support among minors seeking abortion

		Odds of telling mother	***Odds of telling male partner***	***Odds of mother being supportive^***
		N=473		N=302
		Odds Ratio (95% CI)	Odds Ratio (95% CI)	Odds Ratio (95% CI)
Age	10 to 14	5.0 (1.8, 13.8)*	0.4 (0.2, 0.8)*	1.1 (0.3, 4.3)
	15	5.0 (2.3, 10.8)*	1.3 (0.5, 2.8)	1.4 (0.4, 5.8)
	16	1.4 (0.9, 2.2)	1.4 (0.7, 2.7)	0.6 (0.2, 1.4)
	17	reference		reference
Race/ethnicity	African American	1.1 (0.7, 1.7)	1.0 (0.6, 1.6)	0.3 (0.1, 0.6)*
	White and other	reference	reference	reference
History of depression	History of depression	1.9 (1.0, 3.7)	0.7 (0.3, 1.5)	1.1 (0.3, 4.2)
Pregnancy characteristics	Had a previous abortion	1.0 (0.5, 1.8)	0.7 (0.3, 1.5)	1.2 (0.3, 4.6)
	Seeking abortion in the 2nd trimester	1.4 (0.9, 2.3)	0.4 (0.2, 0.7)*	1.5 (0.6, 3.5)
	Pregnancy is the result of rape	0.9 (0.1, 9.4)	1.1 (0.1, 12.5)	0.2 (0.0, 2.5)
Abortion attitudes	Has some spiritual concerns about abortion	1.1 (0.7, 1.7)	0.8 (0.4, 1.4)	1.6 (0.6, 4.1)
	Thinks abortion is killing baby that's already born	1.2 (0.8, 1.9)	1.4 (0.8, 2.8)	0.4 (0.2, 0.9)*
	Concerned about God's forgiveness	1.0 (0.6, 1.8)	1.4 (0.7, 2.8)	1.0 (0.2, 3.8)
Partner or parent support	Has a supportive male partner	0.6 (0.4, 0.9)*	--	1.3 (0.6, 3.0)
	Has a supportive mother	--	0.6 (0.3, 1.0)*	--

*p<0.05; ^ Analysis limited to those whose mother was aware of their decision.

TABLE 4. Predictors of having high confidence in decision to have an abortion and of anticipated poor coping among minors seeking abortion

		High confidence in decision to have an abortion	Anticipated poor coping after abortion
		N=472	N=473
		Odds Ratio (95% CI)	Odds Ratio (95% CI)
Age	Age 10-14	2.5 (0.7, 8.8)	6.7 (1.6, 28.5)*
	Age 15	0.9 (0.4, 2.2)	4.0 (1.1, 14.5)*
	Age 16	0.9 (0.5, 1.7)	1.4 (0.5, 4.0)
	Age 17	reference	reference
Race/ethnicity	African American	0.5 (0.3, 0.9)*	2.2 (0.9, 5.4)
	White and other	reference	reference
History of depression	History of depression	0.4 (0.2, 1.1)	2.4 (0.7, 7.9)
Pregnancy characteristics	Had a previous abortion	0.8 (0.4, 1.9)	0.7 (0.2, 3.5)
	Seeking abortion in the 2nd trimester	1.2 (0.6, 2.4)	1.3 (0.5, 3.5)
Social Support	Told a non-supportive mother	0.8 (0.2, 3.1)	1.7 (0.4, 7.9)
	Told a supportive mother	1.3 (0.7, 2.4)	0.6 (0.2, 1.7)
	Did not tell mother	reference	reference
	Have a supportive male partner	1.9 (1.0, 3.5)*	2.3 (0.8, 7.0)
	Seeking abortion mostly because of someone else (pressure)	0.1 (0.0, 0.2)*	5.6 (2.1, 15.9)*
Abortion Attitudes	Has some spiritual concerns about abortion	0.6 (0.3, 1.3)	2.7 (0.8, 9.6)
	Thinks abortion is killing a baby that's already born	0.3 (0.2, 0.5)*	5.2 (2.0, 13.4)*
	Concerned about God's forgiveness	0.5 (0.2, 0.9)*	2.3 (1.0, 6.0)

*$p<0.05$

TABLE 5. Minors' anticipated emotions post-abortion by type of maternal engagement

	Did not tell mother	Told a supportive mother	Told a non-supportive mother	Total
	Percent	Percent	Percent	Percent
Confidence	37	39	14*	37
Relieved	65	59	29*	60
Happy	6	12	5	9
A little guilty	29	23*	29	26
A little sad	39	33	33*	36
Very guilty	9	8	19	9
Very sad	9	14*	29*	13
Ashamed	6	10	29*	10
Angry	2	3	10*	3
Anticipate poor coping	7	7	33*	8
N	177	283	21	481

*χ^2 test demonstrates significant difference from baseline category ("did not tell mother") at $p<0.05$

CONCLUSION

The results from our meta-analysis of observational studies examining the hormonal contraception-HIV relationship suggest that use of one of the most popular forms of contraception used by women worldwide, DMPA, is associated with a small increase in risk of HIV acquisition. Despite these results, we are cautious not to encourage immediate withdrawal of this method from women's contraceptive options given the tremendous role it plays in avoiding unintended pregnancy and its associated morbidity and mortality. Instead, we encourage modelers to more formally apply our estimates, ideally with country- or region-specific data on HIV incidence and prevalence of HC use that could more directly inform local policy making. Our pooled effect estimates offer the best evidence to date on the HC-HIV relationship, weighted, pooled estimates of effect, by precise HC method type, and their associated variances. However, our analysis does not overcome the persistent methodological challenges inherent to studying this complex question. There is extensive ongoing debate about whether the proposed trial to study the HC-HIV relationship will be able to overcome these challenges (52, 104, 105). At the very minimum, the trial will offer additional data points for DMPA and the Jadelle implant to include in future pooled estimates, thereby improving their precision. However, in an era of very scarce resources for women's sexual and reproductive health, it is not clear that the financial investment required for the trial is warranted given its potential limitations.

Our finding that experiencing an unintended birth is not associated with a reduced likelihood of graduating or increased likelihood of dropping out of school, at least in the short term, for young women who are enrolled in school or stalled in their education, was contrary to our hypothesis and much of the previous literature on this topic. One potential explanation for this null finding is that the political and social landscape today is vastly different than it was when most of the original research on this topic was conducted. Since 1972, Title IX of the Education Act required that pregnant or parenting students have equal access to school and activities, thereby reducing the likelihood that a teenage birth necessitated dropping out of high school(37, 38). Since 1996, the Temporary Assistance for Needy Families (TANF) program has expanded state's leverage in providing low income residents with funding for childcare, either directly through its Child Care and Development Block Grant or indirectly through other support programs. As a result, experiencing an unintended birth might not prevent women from completing her educational goals, though it may certainly delay them or downgrade her educational expectations. Future analyses with this same dataset will focus on the impact of an unintended birth on educational goals and time to complete a degree and may offer a more nuanced perspective on this complex relationship.

Our final paper confirms what previous research(110) on this topic demonstrated nearly two decades ago, namely that mothers and male partners represent the individuals young women who eventually seek abortion most often turn to when faced with an unintended pregnancy, and that these individuals are most often supportive of their decision. Given the tremendous changes in abortion-related policy and access over the past two decades, including passage of over twenty new parental involvement laws, the implementation of other restrictions such as waiting periods and ultrasound viewing requirements(128), and an overall decline in the

number of abortion providers(129), the consistency of findings over this time period is striking. Although our study did not directly address the important question of whether parental involvement laws reduce minor's unintended pregnancy or abortion rates, our finding that parents are the most common source of pressure to seek abortion suggests that these policies are not likely to have the effect maintained by their supporters. The popularity of these types of laws among voters and legislators suggests that they are unlikely to be repealed; however, the results of this study could be helpful in informing adaption of existing law to reflect the diversity individuals minors consult when seeking abortion care, without assuming that minors will universally benefit from the involvement of a parent.

REFERENCES

1. Sedgh G, Singh S, Hussain R. Intended and unintended pregnancies worldwide in 2012 and recent trends. Studies in family planning. 2014;45(3):301-14.
2. Finer LB, Zolna MR. Unintended pregnancy in the United States: incidence and disparities, 2006. Contraception. 2011;84(5):478-85.
3. Krishnan S, Dunbar MS, Minnis AM, Medlin CA, Gerdts CE, Padian NS. Poverty, gender inequities, and women's risk of human immunodeficiency virus/AIDS. Annals of the New York Academy of Sciences. 2008;1136:101-10.
4. Taylor D, Levi A, Simmonds K. Reframing unintended pregnancy prevention: a public health model. Contraception. 2010;81(5):363-6.
5. Furstenberg FF, Jr. As the Pendulum Swings: Teenage Childbearing and Social Concern. Family Relations. 1991;40(2):127-38.
6. Geronimus AT. Teenage Childbearing and Social and Reproductive Disadvantage: The Evolution of Complex Questions and the Demise of Simple Answers. Family Relations. 1991;40(4):463-71.
7. Alkema L, Kantorova V, Menozzi C, Biddlecom A. National, regional, and global rates and trends in contraceptive prevalence and unmet need for family planning between 1990 and 2015: a systematic and comprehensive analysis. Lancet. 2013;381(9878):1642-52.
8. Darroch JE, Singh S. Trends in contraceptive need and use in developing countries in 2003, 2008, and 2012: an analysis of national surveys. Lancet. 2013;381(9879):1756-62.
9. Singh S, Darroch JE, Ashford LS, Vlassoff M. Adding it up: The costs and benefits of investing in family planning and maternal and newborn health. New York: Guttmacher Institute and United Nations Population Fund, 2009.
10. Frost JJ, Sonfield A, Zolna MR, Finer LB. Return on Investment: A Fuller Assessment of the Benefits and Cost Savings of the US Publicly Funded Family Planning Program. The Milbank quarterly. 2014;92(4):696-749.
11. Polis CB, Phillips SJ, Curtis KM, Westreich DJ, Steyn PS, Raymond E, et al. Hormonal contraceptive methods and risk of HIV acquisition in women: a systematic review of epidemiological evidence. Contraception. 2014;90(4):360-90.
12. Morrison CS, Nanda K. Hormonal contraception and HIV: an unanswered question. The Lancet Infectious Diseases. 2012;12(1):2-3.
13. Phillips SJ, Curtis KM, Polis CB. Effect of hormonal contraceptive methods on HIV disease progression: a systematic review. Aids. 2013;27(5):787-94.
14. Hormonal contraception and HIV: technical statement. Geneva, Switzerland: WHO, 2012.
15. Mitchell HS, Stephens E. Contraception choice for HIV positive women. Sexually transmitted infections. 2004;80(3):167-73.
16. Klick J, Stratmann T. Abortion access and risky sex among teens: Parental involvement laws and sexually transmitted diseases. Journal of Law, Economics, and Organization. 2008;24(1):2-21.
17. Colman S, Dee TS, Joyce T. Do parental involvement laws deter risky teen sex? Journal of health economics. 2013;32(5):873-80.
18. Risking the Future. Washington, D.C.: National Academies Press; 1987.
19. Rothman KJ, Greenland S, Lash TL. Modern Epidemiology. 3 ed. Philadelphia, PA: Lippincott, Williams, & Wilkins; 2008.
20. Card JJ, Wise LL. Teenage mothers and teenage fathers: the impact of early childbearing on the parents' personal and professional lives. Family planning perspectives. 1978;10(4):199-205.
21. Hofferth SL, Moore KA. Early childbearing and later economic well-being. . American Sociological Review. 1979;44:784-815.

22. D U, J M. The timing of a first birth and high school completion. American Sociological Review. 1990;55(2):224-34.
23. Waite L, Moore KA. The impact of an early first birth on young women's educational attainment. Social Forces. 1978;56:845-65.
24. Klepinger DH, Lundberg S, Plotnick RD. Adolescent fertility and the educational attainment of young women. Family planning perspectives. 1995;27(1):23-8.
25. Zabin LS, Hirsch MB, Emerson MR. When urban adolescents choose abortion: effects on education, psychological status and subsequent pregnancy. Family planning perspectives. 1989;21(6):248-55.
26. Geronimus AT, Korenman S. The Socioeconomic Consequences of Teen Childbearing Reconsidered. The Quarterly Journal of Economics. 1992;107(4):1187-214.
27. Hoffman SD, Foster EM, Jr FFF. Reevaluating the Costs of Teenage Childbearing. Demography. 1993;30(1):1-13.
28. Grogger J, Bronars S. The Socioeconomic Consequences of Teenage Childbearing: Findings from a Natural Experiment. Family planning perspectives. 1993;25(4):156-74.
29. Hotz VJ, McElroy SW, Sanders SG. Teenage Childbearing and Its Life Cycle Consequences: Exploiting a Natural Experiment. The Journal of Human Resources. 2005;40(3):683-715.
30. Lee D. The early socioeconomic effects of teenage childbearing: A propensity score matching approach. Demographic Research. 2010;23(25):697-736.
31. Levine D, G P. The schooling costs of teenage out of wedlock childbearing: Analysis with a within-school propensity score matching estimator. . The Review of Economics and Statistics. 2003;85:884-900.
32. Finer LB, Zolna MR. Shifts in Intended and Unintended Pregnancies in the United States, 2001–2008. American journal of public health. 2013;104(S1):S43-S8.
33. Sonfield A, Hasstedt K, Kavanaugh M, Anderson R. The social and economic benefits of women's ability to determine whether and when to have children. New York, NY: Guttmacher Institute 2013.
34. Finer LB, Frohwirth LF, Dauphinee LA, Singh S, Moore AM. Reasons U.S. women have abortions: quantitative and qualitative perspectives. Perspect Sex Reprod Health. 2005;37(3):110-8.
35. Fu H, Darroch JE, Henshaw SK, Kolb E. Measuring the extent of abortion underreporting in the 1995 National Survey of Family Growth. Family planning perspectives. 1998;30(3):128-33, 38.
36. Kane JB, Philip Morgan S, Harris KM, Guilkey DK. The educational consequences of teen childbearing. Demography. 2013;50(6):2129-50.
37. Morris M, Western B. Inequality in Earnings at the Close of the Twentieth Century. Annual Review of Sociology. 1999;25:623-57.
38. Health OoA. Promising strategies and existing gaps in supporting pregnant and parenting teens: Summary of Expert Panel Workgroup Meetings. Washington, D.C.: Department of Health and Human Services 2012.
39. Hoffman SD. Teenage childbearing is not so bad after all...or is it? A review of the new literature. Family planning perspectives. 1998;30(5):236-9, 43.
40. Roberts SC, Rocca CH, Foster DG. Receiving versus being denied an abortion and subsequent drug use. Drug and alcohol dependence. 2014;134:63-70.
41. Upadhyay UD, Weitz TA, Jones RK, Barar RE, Foster DG. Denial of Abortion Because of Provider Gestational Age Limits in the United States. American journal of public health. 2013.
42. Dobkin LM, Gould H, Barar RE, Ferrari M, Weiss EI, Foster DG. Implementing a prospective study of women seeking abortion in the United States: understanding and overcoming barriers to recruitment. Women's health issues : official publication of the Jacobs Institute of Women's Health. 2014;24(1):e115-23.

43. Rocca CH, Kimport K, Gould H, Foster DG. Women's emotions one week after receiving or being denied an abortion in the United States. Perspect Sex Reprod Health. 2013;45(3):122-31.
44. Gamble SB, Strauss LT, Parker WY, Cook DA, Zane SB, Hamdan S. Abortion surveillance--United States, 2005. MMWR Surveillance summaries : Morbidity and mortality weekly report Surveillance summaries / CDC. 2008;57(13):1-32.
45. Hedeker D, Siddiqui O, Hu FB. Random-effects regression analysis of correlated grouped-time survival data. Statistical methods in medical research. 2000;9(2):161-79.
46. Rabe-Hesketh S, Skrondal A. Multilevel and Longitudinal Modeling Using Stata, 2nd edition. 2nd. ed. College Station, TX: StataCorp; 2008.
47. StataCorp. Stata Statistical Software: Release 13. College Station, TX: StataCorp LC; 2013.
48. Statistics BoL. Earnings and unemployment rates by educational attainment, 2013. United States Department of Labor; 2013.
49. Klepinger DH, Lundberg S, Plotnick RD. Teen childbearing and human capital: Does timing matter? [Working Paper]. In press 1999.
50. Biggs MA, Gould H, Foster DG. Understanding why women seek abortions in the US. BMC women's health. 2013;13:29.
51. Jones RK, Finer LB, Singh S. Characteristics of U.S. Abortion Patients, 2008. New York, NY: Guttmacher Institute 2010.
52. Gollub E, Stein Z. Living with uncertainty: acting in the best interests of women. AIDS research and treatment. 2012:524936.
53. Affairs UNDoEaS. World Contraceptive Use 2011 2011 [January 24, 2012]. Available from: http://www.un.org/esa/population/publications/contraceptive2011/wallchart_front.pdf.
54. Jain AK. Hormonal contraception and HIV acquisition risk: implications for individual users and public policies. Contraception. 2012;86(6):645-52.
55. Butler AR, Smith JA, Polis CB, Gregson S, Stanton D, Hallett TB. Modelling the global competing risks of a potential interaction between injectable hormonal contraception and HIV risk. Aids. 2013;27(1):105-13.
56. Rodriguez MI, Reeves MF, Caughey AB. Evaluating the competing risks of HIV acquisition and maternal mortality in Africa: a decision analysis. BJOG: An International Journal of Obstetrics & Gynaecology. 2012;119(9):1067-73.
57. Polis CB, Curtis KM. Use of hormonal contraceptives and HIV acquisition in women: a systematic review of the epidemiological evidence. The Lancet Infectious Diseases. 2013;13(9):797-808.
58. Morrison CS, Turner AN, Jones LB. Highly effective contraception and acquisition of HIV and other sexually transmitted infections. Best Practice & Research Clinical Obstetrics & Gynaecology. 2009;23(2):263-84.
59. Greenland S. Can meta-analysis be salvaged? American journal of epidemiology. 1994;140(9):783-7.
60. Stroup DF, Berlin JA, Morton SC, Olkin I, Williamson GD, Rennie D, et al. Meta-analysis of observational studies in epidemiology: a proposal for reporting. Meta-analysis Of Observational Studies in Epidemiology (MOOSE) group. JAMA : the journal of the American Medical Association. 2000;283(15):2008-12.
61. Moher D, Liberati A, Tetzlaff J, Altman DG, The PG. Preferred Reporting Items for Systematic Reviews and Meta-Analyses: The PRISMA Statement. PLoS Med. 2009;6(7):e1000097.
62. Systematic reviews in health care: meta-analysis in context. 2nd ed. London: BMJ Publishing Group; 2001.
63. Heffron R, Rees H, Mugo N, Baeten JM. Authors Reply. Lancet Infect Dis. 2012;12:510-1.

64. Heffron R, Donnell D, Rees H, Celum C, Mugo N, Were E, et al. Use of hormonal contraceptives and risk of HIV-1 transmission: a prospective cohort study. The Lancet Infectious Diseases. 2012;12(1):19-26.
65. Morrison CS, Chen P-L, Kwok C, Richardson BA, Chipato T, Mugerwa R, et al. Hormonal contraception and HIV acquisition: reanalysis using marginal structural modeling. Aids. 2010;24(11):1778-81.
66. Morrison CS, Skoler-Karpoff S, Kwok C, Chen P-L, van de Wijgert J, Gehret-Plagianos M, et al. Hormonal contraception and the risk of HIV acquisition among women in South Africa. Aids. 2012;26(4):497-504.
67. McCoy SI, Zheng W, Montgomery ET, Blanchard K, van der Straten A, de Bruyn G, et al. Oral and injectable contraception use and risk of HIV acquisition among women in sub-Saharan Africa. Aids. 2013;27(6):1001-9.
68. Robins JM, Hernan MA, Brumback B. Marginal structural models and causal inference in epidemiology. Epidemiology (Cambridge, Mass). 2000;11(5):550-60.
69. Higgins JP, Thompson SG, Deeks JJ, Altman DG. Measuring inconsistency in meta-analyses. BMJ (Clinical research ed). 2003;327(7414):557-60.
70. DerSimonian R, Laird N. Meta-analysis in clinical trials. Controlled clinical trials. 1986;7(3):177-88.
71. Gray RH. Use of hormonal contraceptives and risk of HIV-1 transmission. Lancet Infect Dis. 2012;12(7):507; author reply 10-1.
72. Kiddugavu M, Makumbi F, Wawer MJ, Serwadda D, Sewankambo NK, Wabwire-Mangen F, et al. Hormonal contraceptive use and HIV-1 infection in a population based cohort in Rakai, Uganda. Aids. 2003;17(233-240).
73. Hernan MA. The hazards of hazard ratios. Epidemiology (Cambridge, Mass). 2010;21(1):13-5.
74. Plummer FA, Simonsen JN, Cameron DW, Ndinya-Achola JO, Kreiss J, Gakinya MN, et al. Cofactors in male-female sexual transmission of human immunodeficiency virus type 1. Journal of Infectious Diseases. 1991;162(2):233-9.
75. Saracco A, Musicco M, Nicolosi A, Angarano G, Arici C, Gavezzeni G, et al. Man-to-woman sexual transmission of HIV: Longitudinal study of 343 steady partners of infected men. JAIDS 1993;6:497-502.
76. Laga M, Manoka A, Kivuvu M, Malele B, Tuliza M, Nzila N, et al. Non-ulcerative sexually transmitted diseases as risk factors for HIV-1 transmission in women: results from a cohort study. Aids. 1993;7(95-102).
77. Bulterys M, Chao A, Habimana P, Dushimimana A, Nawrocki P, Saah A. Incident HIV-1 infection in a cohort of young women in Butare, Rwanda. Aids. 1994;8:1585-91.
78. Sinei SK, Fortney JA, Kigondu CS, Feldblum PJ, Kuyoh M, Allen MY, et al. Contraceptive use and HIV infection in Kenyan family planning clinic attenders. International Journal of STD & AIDS. 1996;7:65-70.
79. Ungchusak K, Rehle T, Thammapornpilap P, Spiegelman D, Brinkmann U, Siraprapasiri T. Determinants of HIV infection among female commercial sex workers in northeastern Thailand: results from a longitudinal study. Journal of acquired immune deficiency syndromes and human retrovirology : official publication of the International Retrovirology Association. 1996;12(5):500-7.
80. Kilmarx PH, Limpakarnjanarat K, Mastro TD, Saisorn S, Kaewkungwal J, Korattana S, et al. HIV-1 seroconversion in a prospective study of female sex workers in northern Thailand: continued high incidence among brothel-based women. Aids. 1998;1998(12):1889-98.
81. Martin HL, Nyange PM, Richardson BA, Lavreys L, Mandaliya K, Jackson DJ, et al. Hormonal contraception, sexually transmitted diseases, and risk of heterosexual transmission of human immunodeficiency virus type 1. The Journal of Infectious Diseases. 1998;178(1053-1059).

82. Kapiga S, Lyamuya EF, Lwihula GK, Hunter DJ. The incidence of HIV infection among women using family planning methods in Dar es Salaam, Tanzania. Aids. 1998;12:75-84.
83. Lavreys L, Baeten JM, Martin HL, Jr., Overbaugh J, Mandaliya K, Ndinya-Achola J, et al. Hormonal contraception and risk of HIV-1 acquisition: results of a 10-year prospective study. Aids. 2004;18(4):695-7.
84. Baeten JM, Benki S, Chohan V, Lavreys L, McClelland RS, Mandaliya K, et al. Hormonal contraceptive use, herpes simplex virus infection, and risk of HIV-1 acquisition among Kenyan women Aids. 2007;21:1771-7.
85. Myer L, Denny L, Wright TC, Kuhn L. Prospective study of hormonal contraception and women's risk of HIV infection in South Africa. International Journal of Epidemiology. 2006;36(1):166-74.
86. Kleinschmidt I, Rees H, Delany-Moretlwe S, Smith D, Dinat N, Nkala B, et al. Injectable progestin contraceptive use and risk of HIV infection in a South African family planning cohort. Contraception. 2007;75:461-7.
87. Morrison CS, Richardson BA, Mmiro F, Chipato T, Celentano DD, Luoto J, et al. Hormonal contraception and the risk of HIV acquisition. Aids. 2007;21(1):85-95.
88. Kumwenda NI, Kumwenda J, Kafulafula G, Makanani B, Taulo F, Nkhoma C, et al. HIV-1 incidence among women of reproductive age in Malawi. International Journal of STD & AIDS. 2008;19(5):339-41.
89. Watson-Jones D, Baisley K, Weiss HA, Tanton C, Changalucha J, Everett D, et al. Risk factors for HIV incidence in women participating in an HSV suppressive treatment trial in Tanzania. Aids. 2009;23(3):415-22.
90. Feldblum PJ, Lie C-C, Weaver MA, Van Damme L, Halpern V, Adeiga A, et al. Baseline Factors Associated With Incident HIV and STI in Four Microbicide Trials. Sexually Transmitted Diseases. 2010:1.
91. Reid SE, Dai JY, Wang J, Sichalwe BN, Akpomiemie G, Cowan FM, et al. Pregnancy, Contraceptive Use, and HIV Acquisition in HPTN 039: Relevance for HIV Prevention Trials Among African Women. JAIDS Journal of Acquired Immune Deficiency Syndromes. 2009:1.
92. Wand H, Ramjee G. The effects of injectable hormonal contraceptives on HIV seroconversion and on sexually transmitted infections. Aids. 2012;26(3):375-80.
93. Lutalo T, Musoke R, Kong X, Makumbi F, Serwadda D, Nalugoda F, et al. Effects of hormonal contraceptive use on HIV acquisition and transmission among HIV-discordant couples. Aids. 2013;27 Suppl 1:S27-34.
94. Crook AM, Ford D, Gafos M, Hayes R, Kamali A, Kapiga S, et al. Injectable and oral contraceptives and risk of HIV acquisition in women: an analysis of data from the MDP301 trial. Human Reproduction. 2014.
95. Wang CC, Reilly M, Kreiss JK. Risk of HIV infection in oral contraceptive pill users: a meta-analysis. Journal of acquired immune deficiency syndromes (1999). 1999;21(1):51-8.
96. Higgins J, (editors) GS. Cochrane Handbook for Systematic Reviews of Interventions The Cochrane Collaboration 2011.
97. Cates W. Research on hormonal contraception and HIV. Lancet. 2014;383(9914):303-4.
98. Polis CB, Westreich D, Balkus JE, Heffron R. Assessing the effect of hormonal contraception on HIV acquisition in observational data: challenges and recommended analytic approaches. Aids. 2013;27 Suppl 1:S35-43.
99. Schwartz SR, Pettifor A, Stuart GS, Cohen MS. Hormonal contraception and HIV: the methods have confused the message. Aids. 2013;27 Suppl 1:S45-53.
100. Gallo MF, Behets FM, Steiner MJ, Thomsen SC, Ombidi W, Luchters S, et al. Validity of self-reported 'safe sex' among female sex workers in Mombasa, Kenya--PSA analysis. Int J STD AIDS. 2007;18(1):33-8.

101. Warner P. Concerns regarding design, analysis, and interpretation of the morrison study on hormonal contraceptive use and acquisition of cervical infections. Sex Transm Dis. 2005;32(10):644; author reply 5.
102. Smith JA, Butler AR, Polis CB, Gregson S, Stanton D, Hallett T. Programmatic implications: balancing maternal mortality and HIV risk. 20th Conference on Retroviruses and Opportunistic Infections; March 3-6, 2013; Altanta, GA, USA2013.
103. McCoy SI, Ralph LJ, Padian NS, Minnis AM. Are Hormonal Contraceptive Users More Likely to Misreport Unprotected Sex? Evidence From a Biomarker Validation Study in Zimbabwe. AIDS and behavior. 2014.
104. Ralph LJ, McCoy SI, Hallett T, Padian N. Next steps for research on hormonal contraception and HIV. Lancet. 2013;382(9903):1467-9.
105. Jones HE. Time to focus on improving the contraceptive method mix in high HIV prevalence settings and let go of unanswerable questions. Contraception. 2014;90(4):357-9.
106. Murphy K, Irvin SC, Herold BC. Research gaps in defining the biological link between HIV risk and hormonal contraception. American journal of reproductive immunology (New York, NY : 1989). 2014;72(2):228-35.
107. Ventura SJ, Abma JC, Wosher WD, Henshaw SK. Estimated pregnancy rates by outocme for the United States, 1990-2004. . In: Statistics NCfH, editor. Hyattsville, Maryland: National Vital Statistics Reports 2008.
108. Kost K, Henshaw SK. U.S. teenage pregnancies, births, and abortions, 2008: National trends by age, race, and ethnicity. New York, NY: Guttmacher Institute 2012.
109. Rosen RH. Adolescent pregnancy decision-making: are parents important? Adolescence. 1980;15(57):43-54.
110. Henshaw SK, Kost K. Parental involvement in minors' abortion decisions. Family planning perspectives. 1992;24(5):196-207, 13.
111. Griffin-Carlson MS, Mackin KJ. Parental consent: factors influencing adolescent disclosure regarding abortion. Adolescence. 1993;28(109):1-11.
112. Resnick MD, Bearinger LH, Stark P, Blum RW. Patterns of consultation among adolescent minors obtaining an abortion. The American journal of orthopsychiatry. 1994;64(2):310-6.
113. Zabin LS, Hirsch MB, Emerson MR, Raymond E. To whom do inner-city minors talk about their pregnancies? Adolescents' communication with parents and parent surrogates. Family planning perspectives. 1992;24(4):148-54, 73.
114. Frost JJ, Oslak S. Teenagers' pregnancy intentions and decisions: A study of young women in California choosing to give birth. New York, NY: Guttmacher Institute 1999.
115. Blum RW, Resnick MD, Stark TA. The impact of a parental notification law on adolescent abortion decision-making. American journal of public health. 1987;77(5):619-20.
116. Major B, Cozzarelli C, Sciacchitano AM, Cooper ML, Testa M, Mueller PM. Perceived social support, self-efficacy, and adjustment to abortion. Journal of personality and social psychology. 1990;59(3):452-63.
117. Pope LM, Adler NE, Tschann JM. Postabortion psychological adjustment: are minors at increased risk? The Journal of adolescent health : official publication of the Society for Adolescent Medicine. 2001;29(1):2-11.
118. Major B, Cozzarelli C, Cooper ML, Zubek J, Richards C, Wilhite M, et al. Psychological responses of women after first-trimester abortion. Archives of general psychiatry. 2000;57(8):777-84.
119. Foster DG, Gould H, Taylor J, Weitz TA. Attitudes and decision making among women seeking abortions at one U.S. clinic. Perspect Sex Reprod Health. 2012;44(2):117-24.
120. Foster DG, Gould H, Kimport K. How women anticipate coping after an abortion. Contraception. 2012;86(1):84-90.

121. Paul M. ea. Management of unintended and abnormal pregnancy: Comprehensive abortion care. . West Sussex, UK: Blackwell Publishing Ltd.; 2009.
122. Abortion APATFoMHa. Report of the task force on mental health and abortion. Washington DC: 2008.
123. Kumar A, Hessini L, Mitchell EM. Conceptualising abortion stigma. Culture, health & sexuality. 2009;11(6):625-39.
124. Major B, L.T. OB. The social psychology of stigma. Annual Review of Psychology 2005;56:393-421.
125. Miller E, Decker MR, McCauley HL, Tancredi DJ, Levenson RR, Waldman J, et al. Pregnancy coercion, intimate partner violence and unintended pregnancy. Contraception. 2010;81(4):316-22.
126. Akers AY, Schwarz EB, Borrero S, Corbie-Smith G. Family discussions about contraception and family planning: a qualitative exploration of black parent and adolescent perspectives. Perspect Sex Reprod Health. 2010;42(3):160-7.
127. Kendall C, Afable-Munsuz A, Speizer I, Avery A, Schmidt N, Santelli J. Understanding pregnancy in a population of inner-city women in New Orleans--results of qualitative research. Social science & medicine (1982). 2005;60(2):297-311.
128. Boonstra H, Nash E. A surge of state abortion restrictions puts providers - and the women they serve - in the crosshairs. Guttmacher Policy Review. 2014;17(1):9-15.
129. Jones RK, Jerman J. Abortion incidence and service availability in the United States, 2011. Perspect Sex Reprod Health. 2014;46(1):3-14.

APPENDIX

A. Survey question wording used to construct outcome measures; Chapter 1

1. Are you currently in school, either full-time or part-time?
a. Full time → Q2 → CODED AS GRADUATE/DROPOUT==0
b. Part time → Q2 → CODED AS GRADUATE/DROPOUT==0
c. Not at all → Q4
d. Don't know → Q4
e. Refused → Q4

2. What degree are you seeking? [*Read options only if necessary*]
a. High school diploma
b. Technical school
c. Community college
d. Certificate
e. College
f. Graduate school
g. Don't know
h. Refused

3. What month and year do you expect to graduate?
a. (Specify Month/Year of Graduation): _____
b. Don't Know
c. Refused

[If they report that they were in school in last interview and are not in school now, ask them Q4]

4. Last interview you said you were in school. Have you graduated or finished since we last spoke?
a. Graduated degree → **CODED AS GRADUATE==1**
b. Quit/dropped out → **CODED AS DROPOUT==1**
c. Don't Know → *INTERVIEWERS WERE ENCOURAGED TO PROBE TO DETERMINE IF STILL IN SCHOOL OR COMPLETED A DEGREE/DROPPED OUT, THIS RESPONSE WAS NEVER SELECTED.*
d. Refused → *INTERVIEWERS WERE ENCOURAGED TO PROBE TO DETERMINE IF STILL IN SCHOOL OR COMPLETED A DEGREE/DROPPED OUT, THIS RESPONSE WAS NEVER SELECTED*.

B. Table summarizing the descriptive characteristics of studies reviewed, and, when applicable, reasons for exclusion from pooled analyses; Chapter 2

First author	Year of publication	Original study design	Study population	Contraceptive exposures assessed	Reason(s) for exclusion from pooled analyses				
		PC = prospective cohort; RCT = secondary analysis of other trial; CC = case-control	GCP = general or clinic population; CSW = commercial sex workers; SD = women in serodiscordant partnerships	OCP = oral contraceptive pills, type not specified; COC = combined oral contraceptive pills; POP = progestin only pills; DMPA = injectable depomedroxyprogesterone acetate; Net-En = injectable norethisterone enanthate; INJ = injectable, type not specified; HC= hormonal contraception, type not specified	No specificity in exposure group*	Reference group includes HC users#	Did not adjust for age^	Did not adjust for condom use^	≥30% lost to follow up%%
Crook	**2014**	**RCT**	**GCP^^**	**OCP, DMPA, Net-En**					
Lutalo	2013	PC	SD	OCP, DMPA, Implant				X**	
McCoy	**2012**	**RCT**	**GCP**	**COC, POP, OCP, DMPA, Net-En**					
Morrison	**2012**	**RCT**	**GCP**	**COC, DMPA, Net-En**					
Heffron	**2012**	**RCT**	**SD**	**OCP, DMPA, Net-En**					
Wand	**2012**	**RCT**	**GCP**	**OCP, DMPA**					
Reid	**2010**	**RCT**	**GCP**	**OCP, INJ**					
Feldblum	2010	RCT	GCP	OCP, INJ			X	X	
Morrison	**2010**	**PC**	**GCP**	**COC, DMPA**					
Watson-Jones	2009	RCT	GCP	HC	X			X	
Kumwenda	2008	RCT	GCP	DMPA				X	
Morrison@	2007	PC	GCP	COC, DMPA					
Kleinschmidt	**2007**	**PC**	**GCP**	**DMPA, Net-En**					
Myer	**2007**	**RCT**	**GCP**	**COC, DMPA, Net-En**					X
Baeten	**2007**	**PC**	**CSW**	**OCP, DMPA**					
Lavreys%	2004	PC	CSW	OCP, DMPA					
Kiddugavu	**2003**	**PC**	**GCP**	**OCP, DMPA**					
Kapiga	1998	PC	GCP	OCP, DMPA		X		X	X
Martin%	1998	PC	CSW	Low-dose OCP, High-dose OCP, DMPA			X		
Kilmarx	1998	PC	CSW	OCP, DMPA		X	X	X	X
Ungchusak	1996	PC	CSW	OCP, INJ			X	X	X
Sinei	1996	CC	GCP	OCPs		X	X		X
Bulterys	1994	PC	GCP	HC	X		X		
Laga	1993	CC	CSW	OCP		X	X	X	Unclear
Saracco #	1993	PC	SD	OCP		X	X		
Plummer	1991	PC	CSW	OCP			X		X

Bolded studies are those meeting all inclusion criteria and contributing to pooled analyses; * Studies that did not present disaggregated categories of exposure for injectables (e.g., DMPA, NetEn), or for which we could not ascertain this information, were excluded from pooled analyses; # Early studies on the relationship between hormonal contraception and risk of HIV acquisition were focused primarily on oral contraceptive pills (OCPs). Thus, some of these studies included women using other types of HC (notably injectables) in the reference group, which would result in biased effect estimates. These studies are excluded; ** Participants who reported condom use in the observation period were excluded in this analysis; thus, the parameters estimated in this study are not directly comparable to others and we exclude it from pooled analyses; @ Same study population as Morrison et al., 2010; % Same study population as Baeten et al., 2007; ^ Includes scenarios where only unadjusted estimates of the hormonal contraception-HIV relationship were presented. # Although included in the WHO technical review, this study's setting (Italy) made it ineligible for inclusion in our analysis.^^ A subset (9%) of participants in this study were in serodiscordant partnerships, however the vast majority (91%) were women in the general population. %% We could not obtain an estimate of loss to follow up for one study (Bulterys et al., 1994); the authors only describe compliance with visits as "satisfactory." However, the median number of visits is high (4, with 4 visits planned), suggesting minimal loss to follow up.