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Factors Associated with Multiple Unintended Pregnancies in Fertile  
Women

by

Evelyn Angel Aztlan-James

DISSERTATION

Submitted in partial satisfaction of the requirements for the degree of

DOCTOR OF PHILOSOPHY

in

Nursing

in the

GRADUATE DIVISION

of the

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By

Evelyn Angel Aztlan-James

## **Acknowledgements**

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# Factors Associated with Multiple Unintended Pregnancies in Fertile Women

E. Angel Aztlan-James

University of California, San Francisco, 2015

## Abstract

**Background:** Fifty-one percent of pregnancies in the United States (U.S.) are unintended and 40% of these unintended pregnancies end in abortion. Seventeen percent of all U.S. women report more than one unintended pregnancy in their lifetime. While there is much literature on unintended pregnancy, less is known about factors associated with multiple unintended pregnancies. The extant literature presents mixed findings on the association between abortion and multiple unintended pregnancies.

**Objectives:** Specific aims of this dissertation were 1) to systematically assess the rate of abortion-related complications in the literature; 2) to cull from the literature a systematic view of the epidemiology of multiple unintended pregnancies for U.S. women; and 3) to investigate the association between abortion, and other factors, on the risk of multiple unintended pregnancies.

**Methods:** Empirical studies were chosen from research databases for the systematic literature reviews and meta-analysis. Secondary analysis of data from a prospective study of U.S. women, who requested abortion, was performed using survival analysis.

**Results:** A pooled abortion complication rate of 1.79% (95% CI 1.21 to 2.65) was estimated. Increasing age, being Black or Hispanic, non-voluntary first intercourse at a young age, and sex trade were associated with multiple unintended pregnancies. Analysis demonstrated neither receiving nor being denied a requested abortion were associated with an increased risk of subsequent unintended pregnancy. Women aged

35-46 years were less likely than women aged 20-24 years to have a subsequent unintended pregnancy (AHR=0.31, 95% CI=0.15-0.62). Latina women were at increased risk compared to white women (AHR=1.46, 95% CI=1.01-2.10), as were those who had two or more children at baseline compared to those who had none (AHR=1.58, 95% CI=1.06-2.34). When compared to women who did not report intimate partner violence in the past year, women who did (AHR=1.38, 95% CI=1.01-1.88) or who had a diagnosis of depression or anxiety when compared to women who did not (AHR=1.43, 95% CI=1.11, 1.85) were at increased risk.

**Conclusions:** First-trimester aspiration abortion is a safe procedure when performed legally. Abortion does not increase risk for multiple unintended pregnancies. Prevention strategies aimed at multiple unintended pregnancies should focus on factors other than abortion.

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## Introduction

More than half of all pregnancies in the United States (U.S.) are unintended (Finer & Zolna, 2014). In the first Healthy People report released in 1979, the U.S. Surgeon General noted that the high rate of unintended pregnancy was a serious public health problem for the nation (Office of the Surgeon General & Office of the Assistant Secretary for Health, 1979). More than 35 years later, the national rate of unintended pregnancy remains virtually unchanged (Finer & Zolna, 2014). Young women, poor women, cohabitating women, and women of color are at increased risk of experiencing an unintended pregnancy (Finer & Zolna, 2014). There is growing literature that supports an association between a history of child abuse or intimate partner violence and unintended pregnancy (Dietz et al., 1999; Jacoby, Gorenflo, Black, Wunderlich, & Eyler, 1999; Miller et al., 2010; Pallitto, Campbell, & O'Campo, 2005).

Women who experience an unintended pregnancy are more likely to enter prenatal care late and have fewer prenatal visits, may be more likely to smoke cigarettes, are less likely to breastfeed their infants (Kost & Lindberg, 2015), breastfeed them for shorter amounts of time (Kost & Lindberg, 2015), and may be at greater risk of maternal depression and anxiety (Lau & Keung, 2007; Najman, Morrison, Williams, Andersen, & Keeping, 1991). The association between poor maternal and infant outcomes is strongest for those unintended pregnancies that can be categorized as “unwanted,” or occurring when a woman wanted no children or no additional children (Santelli et al., 2003). The effect of pregnancy intention on more serious outcomes such as delivering a preterm or low birthweight infant are likely mediated by maternal behaviors, however they are demonstrated in a few studies (Gipson, Koenig, & Hindin,

2008; Kost & Lindberg, 2015). A positive association between unintended pregnancy and subsequent child abuse has been demonstrated by multiple studies (Goto, Yasumura, Yabe, Anazawa, & Hashimoto, 2005; Hunter, Kilstrom, Kraybill, & Loda, 1978; Sidebotham & Heron, 2003; Zuravin, 1987, 1991). While the data on effects on child development for children whose births were unintended is limited, the U.S. Department of Health and Human Services (2010) states that these children are at an increased risk of poor mental and physical health in childhood, lower educational attainment, and behavioral problems in adolescence. Additionally, an ability to prevent unintended pregnancies and control fertility is consistent with the 1994 International Conference on Population and Development (ICPD) Programme of Action (United Nations Population Fund, 1994).

Forty percent of unintended pregnancies end in abortion (Finer & Zolna, 2014). Most abortions (89%) in the U.S. are performed before 12 weeks gestation (Pazol, Creanga, Burley, Hayes, & Jamieson, 2013). The majority of first-trimester abortions are performed via vacuum aspiration (Jones & Jerman, 2014). However, of abortions performed before nine weeks gestation, more than a third (36%) were medication abortions (Jones & Jerman, 2014). Recent studies with large sample sizes have demonstrated low rates of serious complications (Upadhyay et al., 2015; Weitz et al., 2013). However, attempts to limit access to abortion are increasing (Guttmacher Institute, 2015) and currently, 89% of all U.S. counties lack a facility that provides abortions (Jones & Jerman, 2014).

Excluding pregnancies that end in miscarriage or stillbirth, it has been estimated that 17% of women experience more than one unintended pregnancy, multiple

unintended pregnancies, in their lifetime (Jones, Singh, Finer, & Frohworth, 2006). When the population of women surveyed is limited to heterosexual, sexually active women, the lifetime estimate increases to 31.6% (Magnusson, Masho, & Lapane, 2011). Estimates of incidence of multiple unintended pregnancies vary from 3.7% in six months to 30.9 per 100 person-years (Abrams, 1985; Cremer et al., 2011; Kuroki, Allsworth, Redding, Blume, & Peipert, 2008; Magnusson et al., 2011; Upadhyay, Brown, Sokoloff, & Raine, 2012). The majority of studies of multiple unintended pregnancies have used data obtained through retrospective surveys or small samples that excluded women over 25 years of age (Abrams, 1985; Cremer et al., 2011; Kuroki et al., 2008; Magnusson et al., 2011; Upadhyay et al., 2012). Estimates of rates of multiple unintended pregnancies obtained from retrospective surveys are likely underestimates as many women underreport pregnancies that end in elective termination (Jones et al., 2006).

Some sociodemographic and health history factors are associated with multiple unintended pregnancies. Increasing age, black or Hispanic ethnicity, and greater parity are associated with multiple unintended pregnancies (Jones et al., 2006; Magnusson et al., 2011). The relationship between multiple unintended pregnancies and socioeconomic status, relationship status, and education level remains unclear (Jones et al., 2006; Magnusson et al., 2011). The use of intrauterine devices as contraception has been demonstrated to decrease the risk of multiple unintended pregnancies for women, but the effect of other contraceptive methods such as contraceptive pills, patches and injections are less clear (Cremer et al., 2011; Upadhyay et al., 2012). One prospective study that followed young women (18-24 years of age) for one year,

reported that women using the contraceptive patch or ring had an increased risk of a subsequent, or multiple, unintended pregnancy during the follow-up period (Upadhyay et al., 2012).

Scant research has explored the effect of child abuse or intimate partner violence on multiple unintended pregnancies. Women who reported non-voluntary first intercourse at 15 years of age or younger were significantly more likely to report multiple unintended pregnancies (Magnusson et al., 2011). In a cross-sectional survey of women aged 16 to 29 years who presented for family planning services, those who reported recent commercial sex work were more likely to report multiple unintended pregnancies (Decker et al., 2012). No studies investigating the association between repeat unintended pregnancies and emotional or physical child abuse or chaotic events in childhood, or intimate partner violence were identified. However, an association between these events and one unintended pregnancy and multiple abortions has been reported (Bleil et al., 2011; Dietz et al., 1999; Hillis et al., 2004; Miller et al., 2010).

As noted above, more than 40% of unintended pregnancies end in elective termination of pregnancy (Finer & Zolna, 2014), but the effect of a previous abortion on the risk for a repeat unintended pregnancy is uncertain. One year-long prospective study that followed participants presenting for family planning services found no association between a history of previous abortion and repeat unintended pregnancy (Shlay, Zolot, Bell, Maravi, & Urbina, 2009). Another year-long prospective study following women younger than 24 years found that women who had a history of previous abortion were significantly more likely to experience a subsequent unintended pregnancy (Upadhyay et al., 2012). As these two studies differed in the ways in which

previous abortion was assessed and on sample characteristics, additional research is necessary to clarify the effect of a previous elective termination on subsequent unintended pregnancy, specifically if previous abortion is associated with contraceptive or sexual behaviors that affect the likelihood of conception and therefore also affect the risk of subsequent unintended pregnancies.

It has been suggested that second or higher-order unintended pregnancies are more likely to be unwanted, or at greater risk for poor outcomes (Wildsmith, Guzzo, & Hayford, 2010). Therefore, the prevention of these pregnancies may prevent the pregnancies associated with greatest risk of poor outcomes for families. In summary, there is a limited amount of data on the risk factors for multiple unintended pregnancies. Prospective studies to improve the reporting of unintended pregnancies, with samples that include all reproductively capable women and directly investigate the relationship between repeat unintended pregnancies and other factors are needed.

### **Theoretical Approach**

Ecosocial theoretical frameworks, primarily Kaplan's social epidemiology (Kaplan, 2004) and Krieger's ecosocial theory (Krieger, 2008), were used to guide this study. Ecosocial theorists posit that psychosocial adversity may directly affect physical health, through adverse behavioral, emotional, physiologic and cognitive responses, and that these psychosocial stressors are socially patterned (Krieger & Smith, 2004). These effects are not due solely to cumulative behavioral risk factors, but are also due to the differential distribution of socioeconomic resources available to social groups and the resulting cumulative stress, both psychological and physical, that results (Cox, 2009). Ecosocial theories therefore share two primary assumptions: 1) that social

determinants (e.g. social, political, and economic conditions) affect the distribution of medical conditions in a population and 2) that the effects of these social determinants are “embodied,” or experienced physically, and are cumulative over the lifecourse of an individual or community (Cox, 2009). The social determinants that affect health exist at multiple levels from the individual to the global-political, all contributing in various degrees to class, racial/ethnic, and gender inequalities in health (Krieger, 2008). An application of ecosocial theory seeks to identify connections among social determinants to understand why certain groups may experience different health outcomes (Kaplan, 2004; Krieger, 2008; Krieger & Smith, 2004). For this study, the concept of the lifecourse effect of certain factors and the gendered experience of health, was used to guide the investigation of sociodemographic, health history, and behavioral factors that likely affected women’s risk of multiple unintended pregnancy.

### **Purpose and Specific Aims**

The purpose of this dissertation is to estimate a combined complication rate for first-trimester vacuum aspiration abortion, a common outcome of unintended pregnancy, and to investigate if abortion is associated with risk of subsequent unintended pregnancies for U.S. women. The specific aims of this dissertation are 1) to systematically assess the rate of abortion-related complications reported in the literature; 2) to cull from the literature a systematic view of the epidemiology of multiple unintended pregnancies for healthy, fertile women in the U.S, and whether these factors are specific to multiple unintended pregnancy; and 3) to estimate the time to subsequent unintended pregnancy for women who had requested an abortion of an



index pregnancy and to identify factors associated with shorter time to subsequent unintended pregnancies for the participants.

### **Overview of Chapters Two through Five**

This dissertation includes the following three chapters, each an individual manuscript. Each of these chapters respectively addresses one of the specific aims above. Chapter two, titled “First-trimester, Vacuum Aspiration Abortion Complication Rates: A Systematic Review and Meta-analysis” is a systematic literature review and meta-analysis estimating an overall first-trimester abortion complication rate based on published, original research studies investigating relevant abortion complications. Chapters three and four are focused on the phenomenon of multiple unintended pregnancies. First, the extant literature was reviewed to determine which risk factors for multiple unintended pregnancies had been established. The results of this systematic literature review are reported in chapter three, titled “Multiple Unintended Pregnancies: A Systematic Review.” Chapter four, titled “Time to subsequent unintended pregnancy among United States women who are denied or receive a requested abortion” is a secondary data analysis that estimates the four-year incidence of subsequent unintended pregnancies, the time to subsequent unintended pregnancy in the study sample and identifies factors associated with shorter time to subsequent unintended pregnancies. Chapter five synthesizes the previous chapters and presents the clinical implications and suggestions for future research. In conclusion, the purpose of these three manuscripts is to offer a unique contribution to the current knowledge on unintended pregnancy in the United States.

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## **Chapter 2**

### **Paper 1: First-trimester, Vacuum Aspiration Abortion Complication Rates: A**

#### **Systematic Review and Meta-analysis**

**E. Angel Aztlan-James, BSN, MS, PhD(c)**

This paper has been submitted to *Contraception*, but is not published.



## **Abstract**

*Objectives:* Recent studies have demonstrated that first-trimester vacuum aspiration abortion is a low-risk, effective intervention for unintended pregnancy. However, a meta-analysis has not yet been conducted to estimate an abortion-related complication rate. The objective of this study is to establish a mean abortion-related complication rate for first-trimester vacuum aspiration abortions using a standardized complication assessment framework. *Study Design:* A systematic review and meta-analysis were conducted. An online search of PubMed, Web of Science, ScienceDirect, CINAHL, and POPLINE databases was performed to identify original research studies reporting complication rates of first-trimester aspiration abortion. A DerSimonian-Laird random-effects model was used to estimate the pooled overall abortion-related complication rate, major abortion-related complication rate, and diagnosis-specific complication rates. *Main results:* A total of 30 studies, published between 1970 and 2015, were included in the analysis. The meta-analysis estimated a pooled overall complication rate of 1.79% (95% CI 1.21 to 2.65), and a pooled major complication rate of 0.53% (95% CI 0.23 to 1.24). The pooled rates for specific complication diagnoses were under 1.0%. *Conclusions:* First-trimester aspiration abortion is safe. However, the variation in study complication rates found in this analysis demonstrates the lack of standardized diagnostic criteria to determine, classify, and report abortion-related complications. A standardized system may improve the precision and accuracy of reported abortion-related complication rates.

**Keywords:** first-trimester aspiration abortion, abortion complications, meta-analysis, systematic review

**Implication Statement:** Using a standardized adverse-event system, as suggested in this paper, may improve the precision and accuracy of abortion-related complication rates, allow for the comparison of rates across studies, and help distinguish true complications from concurrent conditions or variations of normal recovery.

## 1. Introduction

In the United States (U.S.), 51% of pregnancies are unintended [1]. Approximately 40% of unintended pregnancies end in abortion, with nearly 90% of abortions occurring in the first trimester of pregnancy [1]. The majority of these abortions are performed by vacuum aspiration [2].

Aspiration abortion is commonly performed using electric vacuum aspiration (EVA) or manual vacuum aspiration (MVA) [3]. In MVA, the vacuum is created by pulling back the plunger of a large syringe-like device, whereas in EVA, the vacuum is obtained via an electric aspiration machine [3]. The type of vacuum used depends primarily on weeks gestation and provider preference; the incidence of complications or experience of pain does not appear to differ between the two techniques [3].

Improving our understanding of the incidence of abortion complications is critical to interpret clinical outcomes, compare complication rates across studies and between providers, and help policy-makers determine the need for state-level restrictions regarding the safety of abortion in the U.S. Published literature suggests that vacuum aspiration abortion is a safe procedure with rare complications [4, 5]. Yet, while the Centers for Disease Control and Prevention Morbidity and Mortality Weekly Report tracks abortion-related mortality in the U.S., there is no system to track abortion-related morbidity nationally and surveillance requirements vary by state [6]. Without a standard method for classifying and monitoring abortion-related complications, or standard definitions of diagnoses and severity, published data on abortion-related complication rates and types vary widely.

While recently published, highly powered studies reinforce the low-risk nature of aspiration abortion, they do not use a standard metric to report complications [3, 7-12] and have been criticized for the same [13, 14]. Studies comparing complication rates of medication and aspiration abortion exist [15-18], however, many studies on abortion complications fail to differentiate complications from medication abortions and those from vacuum aspiration abortions. Other studies do not distinguish complication rates of patients who received general anesthesia, an independent risk factor for complications[19], from patients who received local anesthesia. Length of patient follow-up and rates of follow-up differ among studies [8, 9]. Perhaps most importantly, definitions and diagnostic criteria for complications vary widely between studies [9, 14].

Calls to establish standardized definitions of abortion complications are not new [6]. Taylor et al. recently proposed [13] and tested [5] an evidence-based, standardized framework for classifying and tracking abortion-related complications. Based on guidelines from the Agency for Healthcare Research and Quality [20] and published adverse event reporting recommendations, Taylor's framework defines abortion complications by categories such as diagnosis, timing, management, outcome, and severity. Immediate complications are those that occur at the time of procedure or before the patient is discharged from the clinical setting, and delayed complications are those that occur after discharge. Major complications are considered serious, unexpected adverse events, often requiring a blood transfusion, hospitalization, or unplanned surgery [21]. Minor complications are expected adverse events, which can usually be treated without hospitalization. The framework also defines an abortion-related complication as a diagnosis with an etiology specifically related to the abortion

procedure. These diagnoses include incomplete abortion, failed abortion, hemorrhage, infection, uterine perforation, cervical injury, and hematometra.

Employing Taylor et al.'s standardized framework (Taylor Standardized Framework), this paper attempts to systematically assess the rate of abortion-related complications reported in the literature. Specifically, performing a systematic literature review and meta-analysis, this paper aims to 1) review and present reported data from the extant literature on first-trimester abortion complications; 2) establish an overall mean complication rate for first-trimester aspiration abortion; 3) establish a mean rate for major abortion-related complications; and 4) establish mean rates for specific first-trimester vacuum aspiration abortion complication diagnoses.

## **2. Materials and methods**

This systematic review and meta-analysis was conducted according to the Meta-analysis of Observational Studies in Epidemiology (MOOSE) Guidelines. As this study was conducted using published, de-identified research, no Institutional Review Board or Ethics Committee approval was needed or obtained.

### *2.1 Search strategy*

PubMed, Web of Science, ScienceDirect, CINAHL, and POPLINE databases were searched using the following terms individually and in combination: "abortion," "complication," "complication rates," "post-abortion complications," "induced abortions," "vacuum aspiration," "early surgical abortion," "failed abortion," and "manual vacuum aspiration." The search was not restricted by country or region, publication type or study design. The search was restricted to those articles published in 1970 or later, when the transition from dilation and sharp curettage to vacuum aspiration was initially evident in

the literature [22, 23]. We included only articles in English because translation could not be performed. References from relevant articles were searched iteratively to identify any possibly missed articles.

Two members of the research team independently screened all the studies identified in the initial search. A title screen was performed, followed by an abstract screen, and finally a full-text review of studies. Full texts of articles were reviewed if the abstract discussed complications related to legal, first-trimester aspiration abortions.

## *2.2 Inclusion criteria and study selection*

Inclusion and exclusion criteria were established with the goal of identifying all relevant, original research studies reporting complication rates of first-trimester vacuum aspiration abortion. Studies reporting complications that were not clearly abortion-related were also excluded. As this study was focused on complication rates of legal abortion, inclusion was limited to studies on legal abortion performed by licensed health professionals. Studies were also excluded if they: included only second-trimester abortion; did not differentiate complications from first-trimester or second-trimester procedures; only studied medication abortion or procedures performed with a technique other than vacuum aspiration; only studied procedures performed in assisted reproductive technology situations (i.e. “fetal reductions” following in-vitro fertilization); included high risk pregnancies that could not be differentiated from low risk pregnancies or only included women with medical conditions that might increase the risk of complications (i.e. HIV, organ transplant history). Studies with the stated purpose of examining only one complication diagnosis were excluded. Studies reporting outcomes of different types of abortion procedures or gestations beyond the first-trimester (e.g.,

medication or second-trimester abortions) were included if they clearly differentiated complications from first-trimester vacuum aspiration abortion procedures. Articles reporting data from the same study sample were compared for completeness and overlap; the article with the most complete information was included and the others were excluded.

### *2.3 Data abstraction and study characteristics*

The following data were abstracted from identified full-text studies: complication rate, year of publication, country in which the research was performed, length of follow-up, follow-up rate, specifics of how the complications were defined (i.e. what conditions were considered an abortion complication and how those conditions were defined by the individual study authors), number of participants, clinician type (i.e. physician, nurse midwife, nurse practitioner, physician assistant), weeks gestation of participants' pregnancies, race/ethnicity, age, gravidity, and parity of participants. If studies reported on complications that were notably different than the other identified studies (i.e. only reporting on rates of failed abortion or major complications), this was noted during the abstraction.

### *2.4 Data Analysis*

Using data from studies that reported sufficient information, we estimated three types of complication rates:

1. Overall complication rate with Taylor Standardized Framework applied: This rate is the total number of standard abortion-related complications divided by the total number of study participants who received an aspiration abortion.

2. Major complication rate: Major complications were defined as an unexpected serious adverse event that required transfusion, hospitalization, or surgery. For studies that reported these data, a major complication rate was calculated by dividing the number of major complications by the total number of aspiration abortions.
3. Diagnosis-specific complication rates: Where possible, complication rates for the specific abortion-related complication diagnoses were calculated.

After calculating study-specific complication rates, we performed a meta-analysis on each type of complication rate to obtain pooled mean rates. Heterogeneity of the studies was explored using Cochrane's Q test of heterogeneity and the  $I^2$  statistic. To examine the heterogeneity among studies, sensitivity analyses including a cumulative meta-analysis, removal of one study at a time, and comparisons of effect estimates between subgroups categorized by time period, geographic region, and gestation were performed. Given the variation of the sample, a DerSimonian-Laird random-effects model was used to control for heterogeneity between studies. The probability of publication bias or small-study effects was assessed with a funnel plot of the included studies' standard errors and effect sizes [24]. Pooled complication rates and 95% confidence intervals are reported. Comprehensive Meta-Analysis Version 2.0 was used for all analyses.

### **3. Results**

Thirty-two studies, published between 1970 and 2015, met the inclusion criteria [5, 7, 10-12, 18, 25-55], however two [33, 35] inadequately powered studies (sample sizes under 150) were excluded from the sample. A total of 30 studies were included in



the final analyses. Figure 1 shows the study selection process and the number of studies that contributed data to each type of complication rate. Sample sizes of the included studies ranged from 251 to 100,851. Follow-up times varied with four studies reporting follow-up lengths of up to three months, 13 studies not reporting their length of follow-up, and two studies without any follow-up period. Among the 17 studies that reported follow-up rates, they ranged from 63.5% to 100%. Background information for each included study is reported in Table 1. Although high heterogeneity was found between studies ( $I^2 = 98\%$ ;  $Q\text{-value} = 1691.7$ ), sensitivity analyses suggested that no individual study influenced the heterogeneity of the sample (data not shown). Publication bias was also not indicated after funnel plot review, which is consistent with recent findings suggesting fewer than 10% of meta-analyses are significantly affected by publication bias [24].

Twenty-three studies contributed sufficient data to calculate an overall complication rate using the Taylor Standardized Framework. Figure 2 shows the distribution of complication rates across these studies and the pooled overall estimate. Major complication rates were calculated for eight studies. Incomplete abortion rates were calculated for 20 studies, failed abortion rates for 16 studies, hemorrhage rates for 24 studies, infection rates for 24 studies, uterine perforation rates for 21 studies, cervical injury rates for 17 studies, and hematometra rates for 3 studies (see Table 2).

Results from the meta-analysis estimated a mean complication rate of 1.79% (95% CI 1.21 to 2.65), and a major complication rate of 0.53% (95% CI 0.23 to 1.24). The rates for specific complication diagnoses are as follow: incomplete abortion: 0.56% (95% CI 0.38 to 0.84); failed abortion: 0.13% (95% CI: 0.07 to 0.26); hemorrhage:

0.20% (95% CI: 0.12 to 0.33); infection: 0.80% (95% CI: 0.46 to 1.39); uterine perforation: 0.07% (95% CI: 0.04 to 0.14); cervical injury: 0.08% (95% CI: 0.04 to 0.14); and hematometra: 0.16% (95% CI: 0.11 to 0.25) (Table 3).

#### **4. Discussion**

This first systematic review and meta-analysis for first-trimester aspiration abortion estimated low rates of abortion-related complications. Given our strict inclusion and exclusion criteria, we believe this study proposes reliable point estimates of complication rates for aspiration abortion when performed by trained providers. The mean total complication rate of 1.79% is consistent with recently published rates [4, 5]. The mean rate of 0.53% for major complications is slightly higher than recently reported rates of abortion-related complications requiring hospitalization [4, 5]. This may be a result of this meta-analysis' inclusion of additional treatments such as blood transfusion and surgery as indications of major complications.

Careful categorization of diagnoses and calculation of diagnosis-specific complication rates allowed for a more granular analysis of abortion-related adverse events. Future studies should consider reporting complication rates by proposed diagnoses to provide more specific and precise data that can be useful to researchers evaluating interventions and providers evaluating their own practice.

The reported rates of total and diagnosis-specific complications varied greatly between studies. This is likely related to varying definitions of complications. For example, while most studies defined "hemorrhage" as blood loss of 500cc or more, some used other definitions such as blood loss greater than 250cc [28, 32] or did not define their criteria [34, 36]. Variations in reported rates may have been related to the

year in which a study was conducted and the patient follow-up period. Use of prophylactic antibiotics became standard for first-trimester abortion in the 2000's based on research, and this practice change likely caused reductions in infection rates [56].

This study has potential limitations. Our review excluded studies earlier than 1970 and those that were not in English. Few studies were excluded based on language, and translated abstracts, when available, were reviewed. We are confident that these exclusion criteria did not result in the omission of any studies that would have otherwise met the inclusion criteria. Many studies reported an additional category of complications, often called "other," which was not included in our estimates due to inconsistent and incomplete information on these complications. This limited our ability to classify them as truly abortion-related. Thus, for seven studies that reported on "other" complications, we did not calculate a diagnosis-specific rate for this complication type or include these cases in the overall mean rate. This may have resulted in a slightly underestimated overall rate. Distinguishing abortion-related complications from concurrent or other medical conditions is an important consideration for future studies utilizing a standardized complication tracking system. This study was unable to evaluate the effect of follow-up on first-trimester aspiration abortion complication rates given the varied reporting of follow-up across studies. There is a lack of specified and agreed upon post-procedure follow-up time to capture all abortion-related complications. Finally, quality assessment of studies was not performed in this review. Studies were included based on their ability to contribute to the study aims and on the study inclusion and exclusion criteria. This is consistent with quality assessment instruments for systematic reviews conducted with studies utilizing varying designs and methodologies

[57]. Additionally, published reviews suggest there is no significant association between quality assessment scores and reported effect sizes [58, 59].

Our results support prior findings that first-trimester aspiration abortion is safe. However, the variation in study complication rates found in our analysis demonstrates the lack of standardized diagnostic criteria to determine, classify, and report abortion complications. Using a standardized adverse-event system, as suggested in this paper, may improve the precision and accuracy of abortion-related complication rates, allow for comparisons across studies, and help distinguish true complications from concurrent conditions or variations of normal recovery. With a system for identifying abortion complications, abortion providers can easily track their own performance, and researchers can improve data quality and facilitate evidence-based comparison to other common outpatient procedures. This could also result in a more complete database on abortion-related adverse events.

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**Conflict of Interest**

The authors have no conflicts of interest

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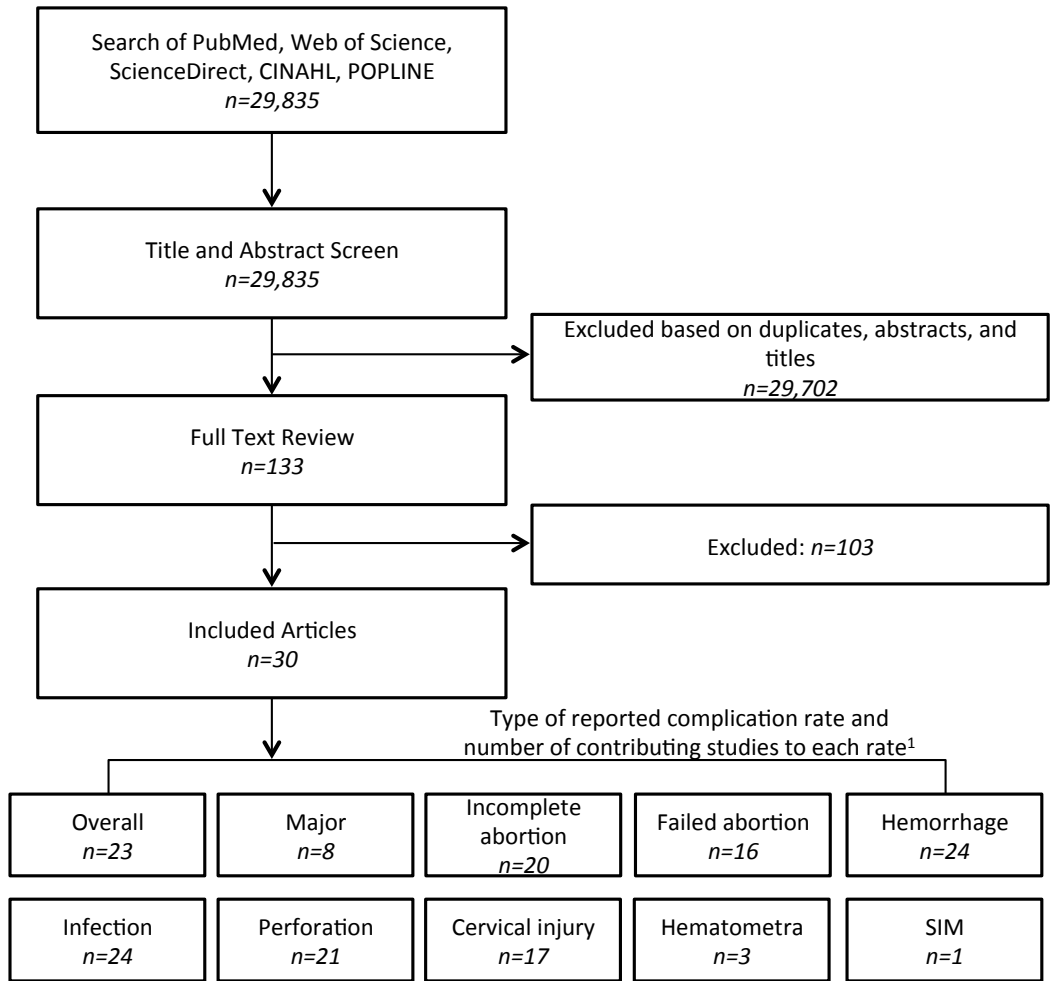
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Figure 1: Study Selection Flowchart



<sup>1</sup> Studies may have contributed data to more than one complication rate; five included articles did not contribute any data to the reported complication rates.

Table 1: General Characteristics of Studies Included in the Meta-Analysis

Author	Year	Country	Provider Type <sup>1</sup>	Total Sample Size	Follow-Up Time (days)	Follow-Up Rate
Anderson	2012	Nepal	Primarily MDs but not exclusively	7,368	14	95.0
Andolsek	1976	Yugoslavia	MDs only	1,100	90	98.5
Andolsek	1977	Yugoslavia, Singapore	MDs only	4,470	28	98.0
Baird	1976	New Zealand	MDs only	2,075	99	-
Basnett	2012	Nepal	Nurses	5,600	-	-
Bennett	2009	USA	MDs only	2,550	21	-
Borko	1975	Yugoslavia	MDs only	300	63	99.0
Bozorgi	1977	USA	MDs only	12,219	-	-
Burnhill	1978	USA	MDs only	7,272	45	63.5
Easterling	1973	USA	MDs only	661	-	-
Edwards	1997	USA	MDs only	1,530	-	-
Engbaek	2006	Denmark	MDs only	4,829	60	-
Evans	1974	USA	MDs only	536	-	-
Filshie	1977	UK	MDs only	251	42	82.8
Freedman	1986	USA	PAs & MDs	2,601	28	96.0
Goldsmith	1974	USA	MDs only	560	-	-
Hart	1986	Australia	MDs only	17,247	-	-
Hodgson	1975	USA	MDs only	4,000	-	-
Hodgson	1975	USA	MDs only	20,248	84	-
Kaunitz	1985	USA	MDs only	33,090	-	-
Lean	1976	Singapore	MDs only	420	90	-
Moller	1978	Denmark	MDs only	1,391	-	-
Pande	2005	Nepal	MDs only	160	-	-
Paul	2002	USA	MDs only	1,132	14	66.3
Schonberg	1975	USA	MDs only	23,290	21	-
Sekiguchi	2014	Japan	N/A	100,851	-	-
Upadhyay	2015	USA	MDs only	54,911	42	100.0
Warriner	2006	South Africa, Vietnam	Mid-level providers & MDs	2,894	14	SA:99.4, V:94.3
Weitz	2013	USA	NPs, NMs, PAs & MDs	11,487	28	69.5
Westfall	1998	USA	MDs only	1,769	-	-

<sup>1</sup> MD indicates medical doctor; PA indicates physician assistant; NP indicates nurse practitioner; NM indicates nurse midwife.

Table 2: Reported Complication Rates from Included Studies

Author	Sample Size <sup>1</sup>	Published Complication Rate	Complication Rates by Type										SIM <sup>2</sup>		
			Overall Complication Rate with Standard Definition Applied	Majors	Incomplete Abortion	Failed Abortion	Hemorrhage	Infection	Uterine Perforation	Cervical Injury	Hematometra				
Anderson	7,368	1.78	-	-	1.30	0.05	0.00	0.00	0.00	0.00	-	0.00	0.00	-	-
Andolsek	1,100	10.54	7.36	-	0.00	0.00	1.00	7.50	0.00	0.00	0.45	0.00	0.45	-	-
Andolsek	1,118	9.12	3.58	-	-	-	-	0.00	2.59	0.27	0.09	0.00	0.09	-	-
Baird	1,874	1.39	1.33	-	-	0.43	-	-	0.53	0.37	-	0.37	-	-	-
Basnett	4,250	1.60	1.60	-	-	0.92	0.14	0.40	0.09	-	0.05	-	0.05	-	-
Bennett	1,149	3.48	2.79	-	-	1.83	0.09	0.35	0.09	0.00	0.00	0.00	0.00	0.17	-
Borko	296	9.46	8.11	-	-	4.05	0.00	0.00	4.39	0.00	0.34	0.00	0.34	-	-
Bozorgi	10,890	0.69	0.43	-	-	0.94	0.02	0.15	-	0.02	0.18	0.02	0.18	-	-
Burnhill	7,259	3.97	2.66	-	-	-	0.15	0.07	1.12	0.11	0.26	0.11	0.26	-	-
Easterling	270	2.96	-	-	-	-	0.13	0.00	2.96	0.00	0.00	0.00	0.00	-	-
Edwards	1,530	0.33	-	-	-	0.20	0.13	0.00	0.00	0.00	0.00	0.00	0.00	-	-
Engbaek	4,829	4.97	4.41	-	-	0.00	0.00	0.00	3.11	0.00	0.00	0.00	0.00	-	-
Evans	346	11.27	-	-	-	-	-	0.03	0.05	0.02	0.00	0.00	0.00	-	-
Fishie	251	4.78	4.78	3.76	-	0.80	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-	-
Freedman	2,458	2.89	2.89	0.40	-	0.90	-	0.57	1.06	0.08	0.17	0.08	0.17	-	-
Goldsmith	560	6.40	6.40	-	-	-	1.80	1.60	3.00	-	-	-	-	-	-
Hart	17,247	1.19	0.56	-	-	-	-	0.33	0.23	-	-	-	-	-	-
Hodgson	2,000	8.95	-	1.45	-	-	-	-	-	-	-	-	-	-	-
Hodgson	20,248	0.93	0.85	0.85	-	-	0.06	0.44	0.22	0.12	0.01	0.12	0.01	-	-
Kaunitz	33,090	0.23	-	-	-	-	0.23	-	-	-	-	-	-	-	-
Lean	210	4.76	3.81	-	-	-	-	0.95	1.90	-	-	-	-	-	-
Moller	1,349	1.00	1.04	0.52	-	0.30	-	0.07	0.67	-	-	-	-	-	-
Pande	160	1.25	-	0.63	-	1.25	-	-	-	-	-	-	-	-	-
Paul	1,132	2.65	2.12	-	-	0.35	1.50	0.00	0.44	0.00	0.00	0.00	0.00	0.10	-
Schonberg	23,290	0.67	0.97	-	-	0.36	-	0.15	0.37	0.09	0.00	0.09	0.00	-	-
Sekiguchi	67,606	0.24	0.24	-	-	0.24	-	0.02	-	0.01	-	0.01	-	-	-
Upadhyay	34,755	1.26	0.78	0.16	-	0.33	0.04	0.13	0.27	0.01	-	0.01	-	-	-
Warriner	2,789	1.00	1.00	0.05	-	0.61	-	-	0.09	-	-	-	-	-	-
Weitz	11,487	1.32	1.32	0.05	-	0.29	0.16	0.03	0.15	0.04	0.03	0.04	0.03	0.17	-
Westfall	1,677	1.25	1.25	-	-	0.48	-	-	0.72	0.06	-	0.06	-	-	-

<sup>1</sup> Sample sizes only include first-trimester aspiration abortions

<sup>2</sup> SIM: Symptomatic Intra-uterine Material

Table 3: Estimated Mean Complication Rates Using Meta-Analytics

Type of complication	Number of Studies Included	Rate per 100 (95% CI)
<b>Overall with Standard Framework Applied</b>	23	1.79 (1.21 2.65)
<b>Major</b>	8	0.53 (0.23 1.24)
<b>Diagnosis-specific</b>		
Incomplete Abortion	20	0.56 (0.38 0.84)
Failed Abortion	16	0.13 (0.07 0.26)
Hemorrhage	24	0.20 (0.12 0.33)
Infection	24	0.80 (0.46 1.39)
Uterine Perforation	21	0.07 (0.04 0.14)
Cervical Injury	17	0.08 (0.04 0.14)
Hematometra	3	0.16 (0.11 0.25)

## **Chapter 3**

### **Paper 2: Multiple Unintended Pregnancies: A Systematic Review**

**E. Angel Aztlan-James, BSN, MS, PhD(c)**

## Abstract

**Context:** An estimated half or more of all U.S. women will experience an unintended pregnancy in their lifetime. Risk factors of unintended pregnancy have been researched without attention to whether the pregnancy was the woman's first unintended pregnancy or whether she had had more than one. Multiple unintended pregnancies, second or higher order unintended pregnancies, are more likely to be unwanted, i.e., occur after a woman has completed her childbearing than a first unintended pregnancy, which is more likely to be mistimed. However, little is known about the prevalence, incidence, and risk factors for multiple unintended pregnancies. The purpose of this paper is to present a systematic review of the extant literature on the risk factors for multiple unintended pregnancies in women in the U.S, and whether these factors are specific to multiple unintended pregnancies.

**Methods:** PubMed, PsychInfo, CINAHL, Web of Science and JSTOR databases were searched for empirical research studies performed after 1979, in the U.S., with a primary outcome of multiple unintended pregnancies. Articles that did not establish the intendedness of the studied pregnancies were excluded.

**Results:** Seven studies were identified. Incidence rates that ranged from 7.4 to 30.9 per 100 person-years and prevalence rates ranged from 17% to 31.6%. Increasing age, identifying as Black or Hispanic, non-voluntary first intercourse, particularly at a young age, sex trade, and previous abortion were found to be associated with multiple unintended pregnancies. Use of IUDs or combined oral contraceptives were found to decrease risk of multiple unintended pregnancies.

**Conclusions:** This review suggests a small number of modifiable factors that may be used to better predict and manage multiple unintended pregnancies.



## **Multiple Unintended Pregnancies: A Systematic Review**

An estimated more than half of all women will experience an unintended pregnancy by the time they are 45 years old (Finer & Zolna, 2014). In the literature, pregnancies are most commonly categorized into “intended” and “unintended” with unintended pregnancies sub-categorized into “mistimed” pregnancies (pregnancies that occurred earlier than desired) and “unwanted” pregnancies (pregnancies that occurred when a woman wanted no more children or no children at all) (Committee on Unintended Pregnancy, Institute of Medicine, & National Academy of Sciences, 1995; Santelli et al., 2003). Intended pregnancies are defined as pregnancies that occur at about the right time or later than desired, the latter a reflection of infertility or difficulty of conception (Santelli et al., 2003). The percentage of pregnancies that are unintended has remained virtually unchanged for more than 30 years (Finer & Zolna, 2011; Office of the Surgeon General & Office of the Assistant Secretary for Health, 1979).

Unintended pregnancies are associated with worse outcomes for women and children. Many studies have found that women who continue an unintended pregnancy are more likely to enter prenatal care late and have fewer prenatal visits, may be more likely to smoke cigarettes, are less likely to breastfeed their infants (Kost & Lindberg, 2015), breastfeed them for shorter amounts of time, attain less education during their lifetime, have lower lifetime incomes, and may be at greater risk of maternal depression and anxiety (Barber, Axinn, & Thornton, 1999; Chandra, Martinez, Abma, & Jones, 2005; Committee on Unintended Pregnancy et al., 1995; Gipson, Koenig, & Hindin, 2008; Joyce, Kaestner, & Korenman, 2000; Kost, Landry, & Darroch, 1998; Lau & Keung, 2007; Najman, Morrison, Williams, Andersen, & Keeping, 1991; U. S.

Department of Health and Human Services, 2010a, 2010b). The effect of pregnancy intention on more serious outcomes such as delivering a preterm or low birthweight infant are likely mediated by maternal behaviors, however they are demonstrated in a few studies (Gipson et al., 2008; Kost & Lindberg, 2015). These risks are increased for adolescent women who choose to continue an unintended pregnancy to birth (U. S. Department of Health and Human Services, 2010a, 2010b). A positive association between unintended pregnancy and child abuse has been demonstrated by multiple studies (Goto, Yasumura, Yabe, Anazawa, & Hashimoto, 2005; Hunter, Kilstrom, Kraybill, & Loda, 1978; Sidebotham & Heron, 2003; Zuravin, 1987, 1991). While the data on effects on child development for children whose births were unintended is limited, the U.S. Department of Health and Human Services (2010) states that these children are at an increased risk of poor mental and physical health in childhood, lower educational attainment, and behavioral problems in adolescence.

Risk factors for unintended pregnancy have been well researched.

Sociodemographically, young women, poor women, minority women and women who are cohabiting are at greatest risk of experiencing an unintended pregnancy (Finer & Zolna, 2011, 2014). Exposure to violence, such as intimate partner violence (IPV), as an adolescent or adult, a history of non-voluntary first intercourse, and adverse events in childhood have been demonstrated to increase the risk of unintended pregnancy (Dietz et al., 1999; Miller et al., 2010; Pallitto, Campbell, & O'Campo, 2005). Having a lower educational attainment, other children at home, drug and alcohol use, lacking insurance or a primary care provider, and infrequent use or nonuse of contraceptives have also been found to be associated with unintended pregnancy (D'Angelo, Gilbert, Rochat,

Santelli, & Herold, 2004; Foster et al., 2004; Postlethwaite, Armstrong, Hung, & Shaber, 2010; Rosenfeld & Everett, 1996).

The outcome of interest in this paper is multiple unintended pregnancies rather than multiple unintended abortions or births for specific reasons. First, experiencing more than one unintended pregnancy is a pre-requisite to the outcomes of multiple abortions and multiple unintended births. Second, as noted by Weitz and Kimport (2012), much of the research specific to multiple abortions has defined this outcome solely as a negative one. The reality is more nuanced. Abortion, a legal option in the U.S., is demonstrated to be medically safer than carrying a child to term (Upadhyay et al., 2015; Weitz et al., 2013). Framing multiple abortions as a negative outcome without research evidence supporting poor health outcomes for women further runs the risk of portraying women who experience multiple unintended pregnancies as in some way “other” than women in general. All women may be at risk of experiencing an unintended or multiple unintended pregnancies depending on putative risk factors such as the social determinants specific to their situation.

Nationally representative, cross-sectional studies have identified that 17% of women report experiencing more than one unintended pregnancy in their lifetime (Jones, Singh, Finer, & Frohwirth, 2006), however, little is known about the prevalence, incidence, and risk factors that are specific to multiple unintended pregnancies (Jones et al., 2006; Kuroki, Allsworth, Redding, Blume, & Peipert, 2008; Magnusson, Masho, & Lapane, 2011).

The purpose of this review is to cull from the literature a systematic view of the epidemiology of multiple unintended pregnancies for healthy, fertile women in the U.S, and whether these factors are specific to multiple unintended pregnancies.

**Multiple unintended pregnancy: predictor of poor maternal and neonatal outcomes or outcome itself.**

Higher-order (second or greater) unintended pregnancies are more likely to be considered unwanted at conception than a first unintended pregnancy (Wildsmith, Guzzo, & Hayford, 2010). Every additional unintended pregnancy is more likely to occur when a woman has achieved her desired family size. As women in the U.S. are less likely to abort an unintended pregnancy than women in other industrialized countries, these unwanted pregnancies are more likely to result in birth (Committee on Unintended Pregnancy et al., 1995; Singh, Sedge, & Hussain, 2010). Therefore, the prevention of multiple unintended pregnancies is a way to prevent the births most strongly associated with poor outcomes: births resulting from pregnancies that were unwanted (see Figure 1).

Whether the phenomenon of multiple unintended pregnancies is the direct cause of poor neonatal and maternal outcomes or whether it instead contributes to the likelihood of other events (i.e. violence between parents) is an ongoing question in the unintended pregnancy literature (Gipson et al., 2008). However, unintended pregnancy can also be considered a poor outcome itself regardless of its effect on health outcomes. This is consistent with the view that unintended pregnancy is a human rights issue as all people should have the ability to autonomously control their family size (United Nations Population Fund, 1994). For this review, multiple unintended

pregnancies will be the outcome of interest and the focus will be on synthesizing the current literature to determine which maternal factors have been shown to increase risk of experiencing multiple unintended pregnancies. Identifying the maternal risk factors for multiple unintended pregnancies is the first step in developing ways to assist clinicians in assessing and intervening with this understudied phenomenon.

### **Methods**

Studies published between January 1, 1979 and October 1, 2012 were identified through searches of PubMed, PsychInfo, CINAHL, Web of Science and JSTOR databases. Combinations of the following keywords were used: *multiple, repeat, higher order, unintended, unplanned, unwanted, pregnancy, abortion, birth, and childbearing*. Reference lists of relevant articles were also searched iteratively to identify additional articles for inclusion.

Inclusion criteria for studies were as follows: (1) empirical research with an outcome measure of multiple unintended pregnancy (2) research was performed in the United States; and (3) research performed during or after 1979 (appreciating the lag time to publication, we nevertheless used an early boundary date of January 1979). The earlier date boundary of January 1, 1979 was chosen as that was the year the first *Healthy People* report was published (Office of the Surgeon General & Office of the Assistant Secretary for Health, 1979). This report identified unintended pregnancy as a national health concern and established the first national goals for the reduction of unintended pregnancy (Office of the Surgeon General & Office of the Assistant Secretary for Health, 1979). Because the rate of unintended pregnancy in the U.S. is higher than that of many other developed nations (Finer & Zolna, 2011; Lakha &

Glasier, 2006; Singh et al., 2010), we limited studies to the U.S. This higher rate in the U.S. may be due to cultural and health system characteristics that are unique to the U.S. (Committee on Unintended Pregnancy et al., 1995; Trussell & Raymond, 2006; Trussell & Wynn, 2008). Articles were excluded that did not establish the intendedness of a repeat pregnancy or birth (i.e., reporting on multiple pregnancies in adolescence or repeat non-marital birth without establishing the intendedness of the births).

## Results

From this process, 1,384 studies were identified. (See Figure 2) An initial title and abstract review resulted in the exclusion of 1,333 studies. The remaining studies ( $n=51$ ) were obtained as full-text; of these, 44 did not meet the inclusion criteria. The final sample ( $n=7$ ) was abstracted and analyzed for this analysis. Studies that met inclusion criteria were then reviewed using the Quality Assessment Checklist (Power & Franck, 2010) that employs a standardized criteria to determine study quality.

Overall, the seven studies that reported on multiple unintended pregnancies were published between 1985 and 2012. (See Tables 1a and 1b.) Sample sizes ranged from 215 to 7,643 U.S. women. The ages ranged from 12 to 44 years.

**Study Designs:** Three of the studies were cross-sectional (Decker et al., 2012; Jones et al., 2006; Magnusson et al., 2011), two were prospective (Abrams, 1985; Upadhyay, Brown, Sokoloff, & Raine, 2012), one involved a retrospective chart review (Shlay, Zolot, Bell, Maravi, & Urbina, 2009), and one involved a pseudo cohort extracted from a randomized controlled trial by ignoring randomization (RCT) (Cremer et al., 2011).

**Measures of pregnancy intention** Across the studies, measures varied in defining multiple unintended pregnancies. The two cross sectional studies used data obtained from the National Survey of Family Growth (NSFG) Cycle 6 survey (Jones et al., 2006; Magnusson et al., 2011). In the NSFG, pregnancies that occur on time or later than desired (to account for infertility or sub-fertility) are currently defined as “intended” (Committee on Unintended Pregnancy et al., 1995; Mosher, Jones, & Abma, 2012; Santelli et al., 2003). Unintended pregnancies are separated into “mistimed” (earlier than desired) and “unwanted” (occurring when a woman wanted no more children) pregnancies (Committee on Unintended Pregnancy et al., 1995; Mosher et al., 2012; Santelli et al., 2003). The NSFG is an ongoing, sequential cross sectional in-person survey that is representative of women in the U.S. (Mosher et al., 2012). Two other studies did not report the questions that were used to determine pregnancy intention (Abrams, 1985; Decker et al., 2012). Two studies prospectively asked participants if they hoped to delay or avoid childbearing in the future (Cremer et al., 2011; Upadhyay et al., 2012). One study assumed that women desired to delay or avoid pregnancy based on request for contraception (Shlay et al., 2009). In these articles, the term “unplanned” was often used interchangeably with “unintended.” In a recent report of unintended births by the National Center for Health Statistics, these terms were reported to frequently be used interchangeably in the literature (Mosher et al., 2012).

Of note, none of the studies reported that they excluded women who terminated previous pregnancies for fetal anomalies. Instead, the included studies assumed a pregnancy that ended in abortion to be unintended. While the percentage of elective abortions obtained for intended pregnancies is likely low (Finer, Frohwirth, Dauphinee,

Singh, & Moore, 2005; Finer & Henshaw, 2006), at least some proportion of the previous abortions reported in these studies could have been obtained for intended pregnancies for reasons due to fetal anomalies, risks to maternal health, or changed life situations necessitating abortion.

**Prevalence.** Jones et al. (2006) and Magnusson et al. (2011) reported prevalence of 17% and 31.6%, respectively, for multiple unintended pregnancies using cycle 6 NSFG (2002) survey data. Jones and colleagues based their analysis on pregnancies reported by all surveyed women, excluding those that ended in fetal loss (miscarriage or stillbirth). Magnusson and colleagues chose to limit the pregnancies they evaluated to pregnancies reported by women who were heterosexual and recently sexually active, likely explaining the difference between these findings. Heterosexuality was defined as reporting at least two acts of intercourse with a man since menarche, and recent sexual activity was defined as having at least one sex partner in the twelve months prior to the survey (Magnusson et al., 2011).

**Incidence.** Rates of multiple unintended pregnancies were reported in three studies (Table 1b) (Abrams, 1985; Cremer et al., 2011; Upadhyay et al., 2012). Despite sample sizes and durations of follow-up which varied (for follow-up from six months (Cremer et al., 2011) to two years (Abrams, 1985), all rates were converted to person-time. Rates ranged from 7.4 to 30.9 per 100 person-years (Cremer et al., 2011; Upadhyay et al., 2012). In the study by Abrams (1985), incidence rates for new, multiple unintended pregnancies were 4.8 100 person-years respectively (Abrams, 1985).

**Sociodemographic characteristics.** Variables included age, race/ethnicity and income.



*Age:* As shown in Tables 1a and 1b, two teams, Jones and colleagues (2006) and Magnusson and colleagues (2011) reported associations between multiple unintended pregnancies and sociodemographic characteristics. Experiencing more than one unintended pregnancy was positively associated with increasing age (Jones et al., 2006), being black or Latina (Jones et al., 2006; Magnusson et al., 2011), having an income below the federal poverty level (Jones et al., 2006), having a mother who was herself younger than 18 years at her first birth (Magnusson et al., 2011), and having a history of more than one sexual partner in a woman's lifetime (Magnusson et al., 2011). As the focus of the study by Jones and colleagues was not primarily on multiple unintended pregnancies per se, but instead used multiple abortions, no analysis was considered using the multiple unintended pregnancies data. However, the percentages of women by age and race/ethnicity who reported more than one unintended pregnancy were presented. As age increased, so did the percentage of women reporting two or more unintended pregnancies in their lifetime (Jones et al., 2006). The finding that age is associated with an increased risk of experiencing more than one unintended pregnancy is not surprising as increasing age also increases the opportunity to experience more than one unintended pregnancy.

*Race/Ethnicity:* As Table 1 shows, 29.6% of black women, and 19.8% of Hispanic women reported experiencing more than one unintended pregnancy (Jones et al., 2006). Likewise, Magnusson and colleagues, using a denominator of all women with pregnancies, found that black and Hispanic women were significantly more likely than white women to report multiple unintended pregnancies (adjusted odds ratio (AOR), 3.19; and AOR, 1.75, respectively) after adjusting for number of lifetime sexual partners,

and parent's educational attainment. In this study, other sociodemographic factors significantly associated with multiple unintended pregnancies when compared to women with all intended pregnancies included having a mother who was younger than 18 years at her first birth and having a history of more than one lifetime sexual partner.

*Income:* Jones et al. (2006) reported on the poverty levels of women in the sample. Of women whose income was below 100% of the federal poverty level, 24.7% reported two or more unintended pregnancies, excluding pregnancies that ended in miscarriage or stillbirth. By comparison, 13.6% of women whose income was above 200% of the federal poverty level reported two or more unintended pregnancies. As noted above, no tests of significance for the differences between these rates were reported.

Based on prior literature supporting an association between women's childhood life factors and the overall phenomenon of unintended pregnancy, Magnusson et al. (2011) attempted to determine if childhood socioeconomic status was also associated with multiple unintended pregnancies. Magnusson and colleagues used information on the highest level of education attained by parents of the participants as a proxy for childhood socioeconomic status. In the final logistic regression model that adjusted for socio-demographic variables, women reporting multiple unintended pregnancies were no more likely to report a low educational attainment for their parents than women who reported all intended pregnancies.

**Contraception type and use.** The use of certain contraceptives was found to be associated with an increased likelihood of experiencing multiple unintended pregnancies for women. Using an as-treated analysis, intrauterine devices (IUDs), if inserted immediately after a second-trimester pregnancy termination were shown to be

effective at preventing a subsequent unintended pregnancy during the observed follow-up period ( $p=0.022$ ) (Cremer et al., 2011). Women choosing the contraceptive patch or vaginal ring were significantly more likely than women using combined oral contraceptives to report a subsequent unintended pregnancy during the one year of follow-up (Hazard Ratio - HR, 1.65; and HR, respectively) (Upadhyay et al., 2012). It is important to note that these studies do not compare IUD use to the use of contraceptive patch or vaginal ring.

**Non-voluntary first intercourse.** First intercourse before age 18 years, particularly if that intercourse was before 15 years of age and non-voluntary, was associated with an increased risk of experiencing multiple unintended pregnancies in the study by Magnusson et al. (2011) when compared to women whose first intercourse was over age 18, voluntary or non-voluntary. Magnusson and colleagues found that women who reported both a first act of intercourse prior to age 15 years and a non-voluntary first intercourse were more likely (AOR, 27.10) than women with all intended pregnancies to report multiple unintended pregnancies after adjusting for putative confounders (Table 1b). Magnusson et al. (2011) combined the voluntariness of intercourse with age to create a new variable due to the theoretical connection between the two factors. While this combining of variables limits the ability to determine if it is young age or the non-voluntary nature of the first intercourse that is most associated with multiple unintended pregnancy, the risk of multiple unintended pregnancy was highest for the combined group than either one alone (AOR = 27.10 versus 6.96, respectively).

**Sex Trade**<sup>1</sup>. Decker and colleagues (2012) considered an association of sex trade with a variety of reproductive health outcomes for young women including multiple unintended pregnancies. Among women completing the survey, 8.1% reported a history of sex trade. Women who reported a history of recent sex trade were significantly more likely than those with no history to report multiple unintended pregnancies (adjusted risk ratio (ARR), 1.52).

**Previous abortion.** Two studies examined the effect of previous abortion on the likelihood of a subsequent unintended pregnancy and the results were mixed. In the study conducted by Shlay, Zolot, Bell, Maravi, and Urbina (2009), a history of previous abortion was not found to be associated with the report of an unintended pregnancy in the interim between the initial and repeat visit when controlling for all the other factors. In the study by Upadhyay, Brown, Sokoloff, and Raine (2012), women with a history of abortion (women enrolled either on the day of their abortion or women who reported a previous abortion) were significantly more likely than those with no history of a previous abortion to report a pregnancy during the one-year follow-up period (HR, 1.63; HR, 1.66, respectively). Clearly, a previous abortion indicates fecundity. And, by definition, a pregnancy can only be considered to be a multiple pregnancy if pregnancies have preceded it. So both history of pregnancy and history of abortion will be associated with multiple unintended pregnancies by definition, It is an open question whether, among women at risk of pregnancy, having had a previous abortion is associated with sexual behavior or contraceptive use that in turn makes conception more or less likely.

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<sup>1</sup> The term “sex trade” is used in this paper for two reasons: 1) this is the term the authors of the referenced study used; and 2) “sex trade” may be better understood to include the exchange of sex for more than just money (i.e. housing, drugs, food).

## Discussion

Despite limited data to date, the major finding is that risk factors specific to multiple unintended pregnancy can be identified and some such as previous abortion, non-voluntary first intercourse, sex trade, and contraceptive type and use, are likely modifiable. Additionally, the sociodemographic characteristics that were associated with multiple unintended pregnancies were consistent with those identified for the umbrella phenomenon of unintended pregnancy. Age, identifying as black or Latina, and being poor were all found to be associated with an increased risk of experiencing a multiple unintended pregnancy (Jones et al., 2006; Magnusson et al., 2011). However, as suggested by Prager et al. (2007), age may be better described as a confounder as the older a woman is the more opportunity she has had to experience acts of intercourse, contraceptive method failure, and unintended pregnancy. That more black women experience multiple unintended pregnancies than women of other races and ethnicities seems well-supported in both large, nationally representative samples of women and smaller, convenience samples (Jones et al., 2006; Magnusson et al., 2011). Hispanic women also seem to be at increased risk when compared to white women (Jones et al., 2006; Magnusson et al.).

Non-voluntary first intercourse at a young age and sex trade both demonstrated significant increase in risk for women of multiple unintended pregnancies (Decker et al., 2012; Magnusson et al., 2011). The association between non-voluntary first intercourse and multiple unintended pregnancies is consistent with previous research demonstrating an association between child sexual abuse and an unintended first pregnancy (Dietz et al., 1999). The association between contraception use and multiple

unintended pregnancies is also consistent with the published literature on the larger phenomenon of unintended pregnancy in the U.S. (Cremer et al., 2011; Upadhyay et al., 2012). As expected, IUD use was found to effectively prevent another unintended pregnancy during a one-year follow-up period (Cremer et al., 2011). Interestingly, when compared to the contraceptive patch and vaginal ring, the pill was also more effective at preventing a subsequent unintended pregnancy during a one-year follow-up (Upadhyay et al., 2012).

Caveats should be acknowledged. First, measurement of events and putative risk factors remain a concern. Unintended pregnancies and prior abortions are frequently underreported (Jones et al., 2006). Some studies used NSFG data or defined intendedness in ways that were similar to the definitions used by the NSFG. Concerns have been raised regarding the ability of this definition and its associated measures to capture the actual intendedness of any conception and account for the inherent complexity associated with this issue (Committee on Unintended Pregnancy et al., 1995; Santelli et al., 2003). Additionally, NSFG data are from sequential cross-sections and while this design is efficient, it suffers from potential recall bias and inability to establish temporality (Menard, 2008). Another concern is around unmeasured variables, some of which may be important such as drug and alcohol abuse. For example, two studies using a different, but related outcome from those studied here, multiple abortions, noted that a history of drug use was associated with reporting multiple abortions (Jones et al., 2006; Prager, Steinauer, Foster, Darney, & Drey, 2007). Whether there is an association, independent or possibly confounded, between drug

and/or alcohol use and the larger phenomenon of multiple unintended pregnancies is an open question.

A deeper understanding of the role of fecundity, frequency of intercourse, access to contraception, and attitudes toward contraception are necessary to better understand multiple unintended pregnancies. Future research aiming to identify risk factors for multiple unintended pregnancies should work to clarify the many questions that remain regarding the association between non-voluntary first intercourse and multiple unintended pregnancies. Previous research using the Adverse Childhood Experiences Study data demonstrated that women who reported childhood abuse or household dysfunction demonstrate associations between these childhood experiences and first intercourse before age 15 years and having greater than 30 lifetime partners (Hillis et al., 2004). Additional research to clarify if there is an effect from childhood adverse experiences other than non-voluntary first intercourse on the risk of multiple unintended pregnancies and to determine if this effect is exerted through risky sexual behaviors is needed. How long does the effect from these experiences last? How does exposure to violence as a child or adolescent versus as an adult affect the risk of multiple unintended pregnancies? Does childhood abuse events combine with abusive events such as intimate partner violence experienced as an adult to exert a stronger effect on the risk of multiple unintended pregnancies?

Subsequent studies will provide stronger inferences if they utilize a prospective design that also include multiple measures of pregnancy intention. While cross sectional data tend to capture cumulative exposure data, the longitudinal design provides an opportunity to measure variation in exposures in calendar time which improves the

ability to examine proximal and distal influences. For example, many of the associated factors identified in this review (i.e. stressful life events) tend to vary in frequency or severity of occurrence over time. Differentiating intendedness and abortion history will distinguish women who had a previous abortion of an intended pregnancy from women who have previously aborted unintended pregnancies. Additionally, as the effect of previous abortion remains uncertain (Shlay et al, 2009; Upadhyay, 2012), attempts should be made to obtain the most accurate pregnancy history possible over the longest amount of time possible. Earlier cycles of the NSFG have limited the pregnancy history obtained to the previous five years (Committee on Unintended Pregnancy et al., 1995)

### **Conclusions**

Overall, these seven studies provide intriguing information on factors associated with multiple unintended pregnancies. As reported above, a woman's risk of an unwanted pregnancy increases with each she pregnancy she has experienced (Wildsmith et al., 2010). Unwanted pregnancies carried to term are the births associated with worse perinatal outcomes. To address these issues, what is needed is a standardized measurement of pregnancy intendedness, investment in use of prospective study designs, and powering for analyses that can detect possible interactions between sociodemographic characteristics such as race/ethnicity and nativity and social factors such as exposure to child abuse and drug and alcohol abuse.

Much of the research on multiple unintended pregnancies has been driven by concerns regarding multiple abortions, specifically concerns that women use abortions as their main method of birth control (Abrams, 1985; Weitz & Kimport, 2012; Westfall & Kallail, 1995). However, unintended pregnancies can end in miscarriage, abortion or



birth. Limited research suggests a small number of modifiable factors that may be used to better predict and manage multiple unintended pregnancies. To date, the variability of measures, limited variables considered and the predominant use of cross sectional designs all limited confidence in the inferences that can be generated. Subsequent investigation can build on these studies and extend our ability to provide better care for women at risk of experiencing multiple unintended pregnancies.

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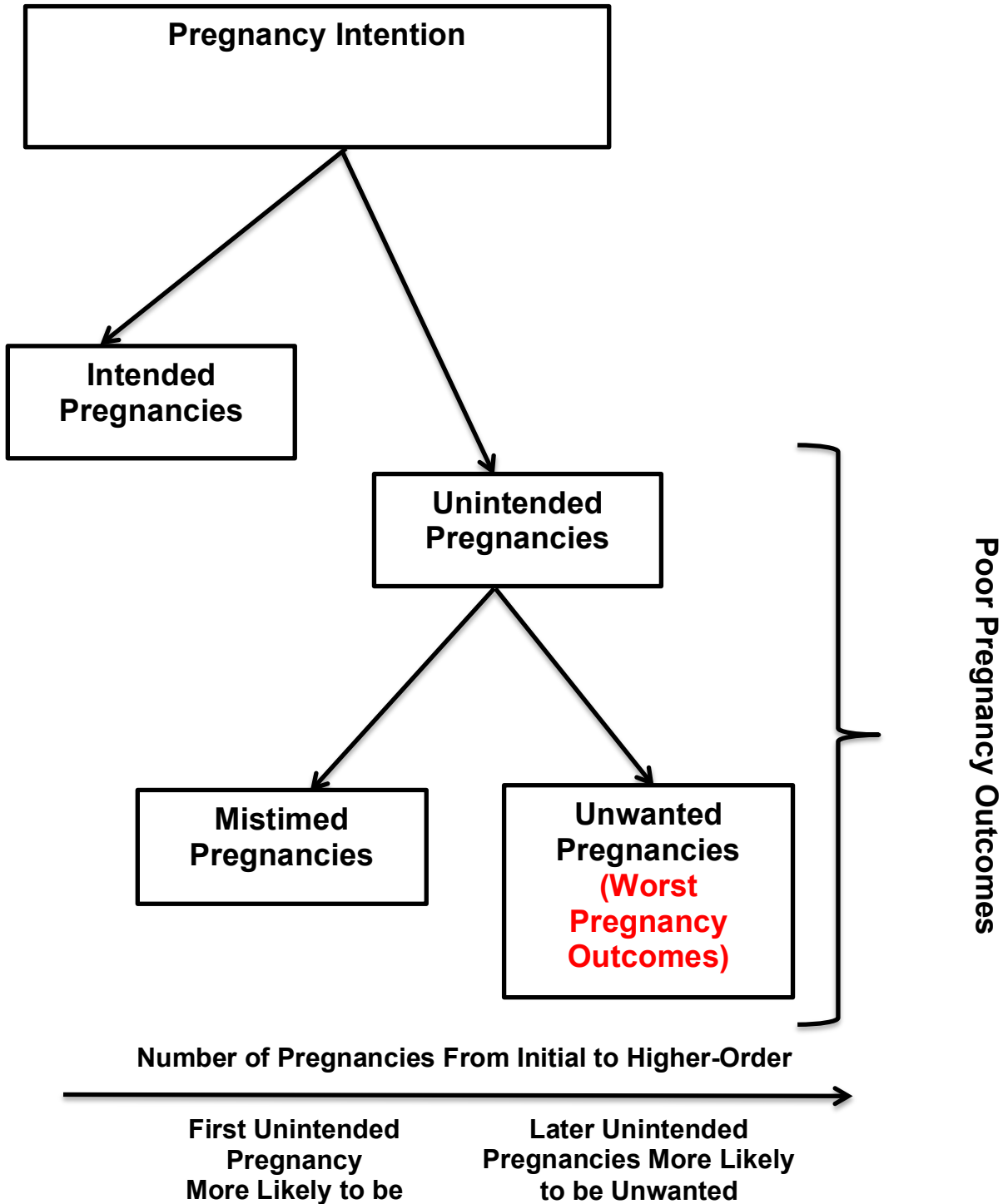


Figure 1: Pregnancy Intention and Associated Pregnancy Outcomes

Figure 2: Selection of articles for inclusion in review

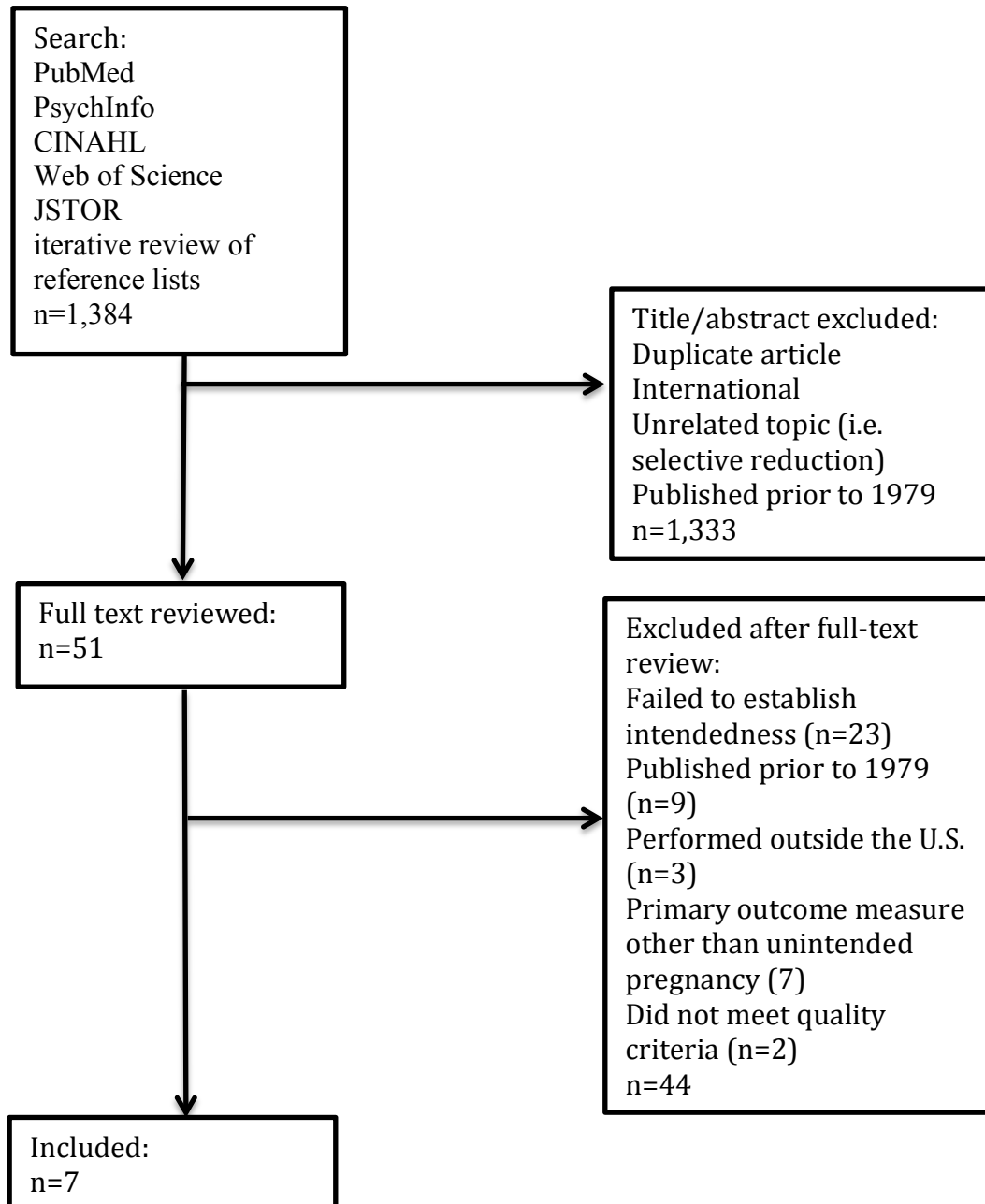


Table 1a: Prevalence Estimates from Included Studies (listed in order of prevalence magnitude)

First Author, Year	Sample/Setting • Design • Age	Number of Participants	Prevalence	Correlates	Risk	95% Confidence Interval	Covariates*
Magnusson, 2011	<ul style="list-style-type: none"> <li>• NSFG Cycle 6</li> <li>• Cross-Sectional</li> <li>• 18-44 years</li> </ul>	4,521	31.6%	Race/ethnicity: Black Hispanic White  Mother < 18 years at her first birth: Yes No  Age and voluntary nature of first intercourse: 15-17 years, voluntary 15-17 years, non-voluntary <15 years, voluntary <15 years, non-voluntary ≥18 years, voluntary or non-voluntary  Number of lifetime sex partners: 1-4 5-9 10+ 1	(AOR) 3.19 1.75 1.00  1.44 1.00  2.41 5.62 6.96 27.10 1.00  3.42 6.47 12.14 1.00 (ARR) 1.52 1.00	2.27-4.48 1.30-2.34  1.10-1.90  1.90-3.29 3.29-9.59 4.26-11.39 11.03-66.57  2.46-4.67 4.59-9.12 8.14-19.12	1-2  1,3-4  1-2, 5-7  6,8
Decker, 2012	<ul style="list-style-type: none"> <li>• Recruited from 5 northern Planned Parenthood Clinics</li> <li>• Cross-sectional</li> <li>• 16-29 years</li> </ul>	1,277	17.4%	Sex trade: Yes No	(ARR) 1.52 1.00	1.11-2.07	5,9,10-11
Jones, 2006	<ul style="list-style-type: none"> <li>• NSFG Cycle 6</li> <li>• Cross-sectional</li> <li>• 15-44 years</li> </ul>	7,643	17%	N/A	N/A	N/A	N/A

Table 1b: Incidence Estimates from Included Studies (listed in order of incidence magnitude)

First Author, Year	Sample/Setting Design Age	Number of Participants	Incidence	Length of Follow-Up	Risk Factors	Risk	95% Confidence Interval	Covariates*
Upadhyay, 2012	<ul style="list-style-type: none"> <li>Recruited from 4 northern Planned Parenthood Clinics</li> <li>Prospective survey</li> <li>15-24 year</li> </ul>	1,316	30.9 per 100 PYAR	1 year	Contraceptive type: Patch Ring Pill  Enrolled on day of abortion: Yes No  Prior abortion: Yes No	(AHR)  1.65 1.80 1.00  1.63 1.00  1.66 1.00	1.21-2.26 1.26-2.57  1.21-2.20  1.18-2.33	12-15  5,9,11,13-16  5,9,11,13-17
Abrams, 1985	<ul style="list-style-type: none"> <li>Presenting for abortion at a clinic in Boston</li> <li>Prospective observational</li> <li>18 years and younger</li> </ul>	345	Yr 1: 8.8% Yr 2: 16%	2 years	N/A	N/A	N/A	N/A
Cremer, 2011	<ul style="list-style-type: none"> <li>Presenting for abortion at a clinic in New York City</li> <li>RCT</li> <li>16-43 years</li> </ul>	215	With IUD: 0 No IUD: 8.4%	1 year	N/A	N/A	N/A	N/A
Shlay, 2009	<ul style="list-style-type: none"> <li>Women who had more than one visit to a Denver STI clinic</li> <li>Retrospective chart review</li> <li>12-44 years</li> </ul>	710	Unable to determine from published report	1.2 years mean f/u time	Previous abortion: Yes No	(AOR)  1.17 1.00	0.64-4.04  5,9	5,9

\* 1=number of sex partners, 2=parent's educational attainment, 3=younger than 18 at first intercourse, 4=non-voluntary first intercourse, 5=race/ethnicity, 6=parental living situation at age 14, 7=mother's age at first birth, 8=mother's educational attainment, 9=age, 10= nativity, 11=recruitment site, 12=previous abortion, 13=previous birth, 14=certainty of continuation of birth control method, 15=plans if pregnant in the next 3 months, 16=educational attainment, 17=hormonal use at baseline

## **Chapter 4**

**Paper 3: Time to subsequent unintended pregnancy among United States women  
who are denied or receive a requested abortion**

**E. Angel Aztlan-James, BSN, MS, PhD(c)**

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## **Abstract**

**Background:** An estimated 17% of U.S. women experience more than one unintended pregnancy in their lifetime. However, little is known about factors that are associated with multiple unintended pregnancies. Research is limited on how the outcome of unintended pregnancy (e.g., abortion or birth) affects risk of subsequent unintended pregnancy in the U.S.

**Methods:** Data from the Turnaway Study, a five-year, prospective study of U.S. women who requested abortion between 2008 and 2010 at one of 30 abortion facilities were analyzed for 801 study participants using Cox proportional hazards modeling. The association between receiving or being denied a requested abortion and subsequent unintended pregnancy as well as other factors that might influence time-to-subsequent unintended pregnancy were investigated.

**Results:** Neither receiving nor being denied a requested abortion were associated with an increased risk of subsequent unintended pregnancy. Women aged 35-46 years were less likely than women aged 20-24 years to have a subsequent unintended pregnancy during the follow-up period (AHR=0.31, 95% CI=0.15-0.62). Latina women were at increased risk compared to white women (AHR=1.46, 95% CI=1.01-2.10), as were those who had two or more children at baseline compared to those who had none (AHR=1.58, 95% CI=1.06-2.34). When compared to women who did not report intimate partner violence, women who did report such violence in the past year (AHR=1.38, 95% CI=1.01-1.88) or who had a diagnosis of depression or anxiety when compared to women who did not (AHR=1.43, 95% CI=1.11, 1.85) were also at increased risk of a subsequent unintended pregnancy.



Conclusion: Neither receiving nor being denied abortion affects subsequent unintended pregnancy risk. Other structural factors such as IPV and mental health are more associated with multiple unintended pregnancies.

## Introduction

An estimated 51% of pregnancies in the US are unintended.<sup>1</sup> One of the primary sources for unintended pregnancy rates and trends in the US is the National Survey of Family Growth (NSFG),<sup>2</sup> which separates unintended pregnancies into two categories: mistimed and unwanted.<sup>3</sup> A mistimed pregnancy is a pregnancy that is reported to have occurred earlier than desired.<sup>2</sup> An unwanted pregnancy is a pregnancy that occurs when a woman did not want any (more) children.<sup>2</sup>

Unintended pregnancies are associated with negative health behaviors during pregnancy. Women who continue an unintended pregnancy are more likely to enter prenatal care late and have fewer prenatal visits,<sup>4-6</sup> are more likely to smoke cigarettes,<sup>6</sup> are less likely to breastfeed their infants,<sup>4,5</sup> breastfeed them for shorter lengths of time,<sup>4</sup> and may be at greater risk of maternal depression and anxiety<sup>7,8</sup> than women who continue intended pregnancies. While less evidence on the consequences of unintended pregnancy exists for other health outcomes such as delivering a preterm or low birthweight infant, these outcomes have been demonstrated in a few studies.<sup>4,9</sup> Additionally, a positive association between unintended pregnancy and child abuse has been demonstrated in a few studies.<sup>10-12</sup>

**Multiple Unintended Pregnancies.** Excluding pregnancies that end in miscarriage or stillbirth, an estimated 17% of women nationally experience more than one unintended pregnancy in their lifetime.<sup>13</sup> With each birth, a woman's likelihood of having attained her desired family size increases, meaning that each additional pregnancy is more likely to be unwanted rather than mistimed.<sup>14</sup> Repeat, or multiple

unintended pregnancies, are by definition higher-order pregnancies, and therefore, are more likely to be unwanted than first unintended pregnancies.

In the United States (U.S.), an increase in risk of multiple unintended pregnancies has been observed among black and Hispanic women,<sup>15</sup> and women with greater parity,<sup>14</sup> however the effects of other sociodemographic factors are less certain.<sup>8-13</sup> The association between intimate partner violence (IPV) and unintended pregnancy<sup>16</sup> and the association between child abuse and unintended pregnancy have both been demonstrated.<sup>17</sup> Only one study was found to have investigated an association between child abuse and multiple unintended pregnancies.<sup>15</sup> A strong, positive association between the type of investigated child abuse, non-voluntary first intercourse among adolescent girls, and multiple unintended pregnancies was found.<sup>15</sup> No studies were found which examined the association between IPV and multiple unintended pregnancies.

Forty percent of unintended pregnancies, and 21% of all pregnancies, end in induced abortion in the United States.<sup>1,18</sup> Upadhyay et al. (2012) found that previous abortion was associated with an increase in risk of experiencing a subsequent unintended pregnancy during a one-year follow-up period compared to women who never had an abortion.<sup>19</sup> One other U.S. study, however, found no association between previous abortion and subsequent unintended pregnancy.<sup>20</sup>

This analysis was undertaken to investigate the effect of abortion on the risk and timing of subsequent unintended pregnancies. Utilizing data from a large five-year study on women presenting for abortion, this study aims to: 1) estimate the four-year incidence of subsequent unintended pregnancy; 2) investigate the association between

receiving or not receiving a requested abortion on the risk of subsequent unintended pregnancy; and 3) identify other factors that may be associated with shorter time-to-subsequent unintended pregnancies.

## **Methods**

This analysis used data from a large prospective study, the Turnaway Study, conducted at the University of California, San Francisco. The Turnaway Study is a prospective study designed to investigate the psychosocial health effects of an unwanted birth on women. More detailed information regarding Turnaway Study design and recruitment have been previously published.<sup>21</sup> Briefly, participants were recruited at 30 abortion clinics across the U.S. between January 2008 and December 2010. Participants were recruited from clinics providing abortions at the latest gestations within a 150-mile radius; the gestational limits of these clinics were between 10 weeks and the end of the second trimester.

Women, aged 15 years or older, presenting for an elective termination of pregnancy were eligible to participate if they spoke English or Spanish and had no known fetal anomalies or fetal demise. To recruit women who carried an unwanted pregnancy to birth, it was necessary to seek women who had been denied an elective termination as they were beyond a clinic site's gestational age limit. Because women having later abortions are not typical – over 90% of abortions occur in the first trimester<sup>22</sup> – a first trimester sample was collected to represent a more typical abortion patient. Therefore, three study groups were recruited: “First trimester abortion group” - women presenting for elective termination in the first trimester; “Near-limit abortion group” - women who presented for an elective termination and were under the clinic's

gestational age limit by as much as two weeks; and the “Turnaway group” - women who presented to a clinic up to three weeks over the clinic’s gestational age limit (and were therefore denied their requested termination).

The ratio of recruitment into these groups was 1:2:1 and in total 956 women were recruited. As some of the Turnaway participants had outcomes other than birth (miscarriage, stillbirth, abortion obtained at alternate facilities) and some sought adoptive parents for their children, Turnaway participants were further divided into “Turnaway-parenting” and “Turnaway-non-parenting” groups. This analysis utilized data from 801 of the 956 recruited women. Participants (n=76) recruited at the clinic with the lowest gestational limit, 10 weeks, were excluded as 90% of them obtained an abortion elsewhere and therefore did not provide a sufficient sample of women carrying the pregnancy to term. Women who did not complete any follow up surveys after the baseline survey were excluded as there was no way to determine an amount of time-at-risk for them (n=72). An additional seven participants were excluded as they did not provide any information to determine the pregnancy intention of their subsequent pregnancies.

Participants were interviewed by phone. The initial interview occurred eight days after recruitment and subsequent interviews occurred every 6 months after. Follow-up will be for five years and is ongoing. This analysis used the data from the initial interview performed at eight days and from the next eight interviews after recruitment.

## Measures

### *Outcome*

For this analysis, the outcome of interest was a subsequent unintended pregnancy experienced during the four-year follow-up period. All subsequent pregnancies were first identified and then categorized based on their intention status. Pregnancy intention was determined using the *London Measure of Unplanned Pregnancy* (LMUP), which was administered when a participant first reported a subsequent pregnancy.

The LMUP is a 6-item tool that was specifically developed to address concerns regarding validity of previous pregnancy intention measures.<sup>23</sup> It assumes that a woman's pregnancy intentions determine her actions to prevent or become pregnant.<sup>23</sup> Each of the six items is scored 0, 1, or 2, and scores range from zero to twelve. A participant must have answered at least three of the six items to have a score calculated, and missing values were imputed as recommended by the measure's developers. The LMUP developers recommend scores of 0-3 be considered to indicate an unplanned pregnancy; scores of 4-9 to indicate an ambivalent pregnancy; and scores of 10-12 to indicate a planned pregnancy.<sup>23</sup>

Similarly to the NSFG, the LMUP measure queries women about the timing of their pregnancies.<sup>23</sup> However, the LMUP scores intention based on a woman's actions including contraceptive use, intention to become pregnant, desire to have a baby, discussions with the man involved in the pregnancy, and healthy preconception behaviors.<sup>23</sup> While "unintended" and "unplanned" are often used interchangeably in the literature, the LMUP measure differentiates the two on the basis of actions. Using the

LMUP, pregnancies identified as “unplanned” in this dataset are a subset of “unintended” pregnancies as timing is included in the assessment.

For this analysis, pregnancies that were not scored as planned (a score of 10-12) were considered to be unplanned, and therefore unintended. The LMUP has been tested in U.S. women whose primary language is English or Spanish, demonstrating both reliability and validity as a measure of unplanned pregnancy.<sup>24</sup>

### *Independent Variables*

The primary independent variable for this analysis is study group: First trimester, Near-limit, Turnaway-parenting, and Turnaway-non-parenting. The Near-limit abortion group was chosen as the reference group to assess how other groups compared to those who received their requested abortion.

Categorical variables for age, race, highest level of completed education, federal poverty level, cohabitation, previous abortion (at recruitment), and number of children (at recruitment), were included in the analysis. These baseline demographic variables were chosen based on their theoretical association with the outcome of interest or if they had been demonstrated in the literature to be associated with multiple unintended pregnancies.<sup>13,15</sup>

A variable reflecting a history of depression or anxiety, defined as a clinical diagnosis of either depression or anxiety, was included as research has demonstrated that depressive symptoms predict contraceptive behaviors that can lead to unintended pregnancy.<sup>25</sup> It is plausible that anxiety may also affect a woman’s ability to access or use contraception effectively.

IPV was assessed for the previous year using the questions, “In the last year, were you ever frightened for your safety as a result of anger or threats made by another person?” and “In the last year, were you ever pushed, hit slapped, kicked, choked, or physically hurt in any way by another person?” If the participant answered in the affirmative, a further question was asked to determine who had frightened or hurt her. Participants reporting either psychological or physical violence by the man involved in her index pregnancy during the previous year were considered to have experienced IPV.

A history of child abuse was assessed at baseline by asking three questions, “In childhood, were you ever (physically/sexually) abused?” and, “In childhood, were you ever seriously neglected?” Sexual assault prior to age 18 years was also assessed in a similar manner. Two variables based on these questions were created: one dichotomous variable to indicate the experience of childhood sexual abuse and/or sexual assault prior to age 18 years; and one dichotomous variable that indicated whether a participant had experienced physical abuse and/or severe neglect during childhood. Both IPV and child abuse were investigated based on their prior demonstrated association with unintended pregnancy,<sup>16,17</sup> but limited published research on its association with multiple unintended pregnancies specifically.

### **Statistical Analysis**

Data analyses were performed using STATA 13, (College Station, TX). Sociodemographic and baseline values of all the analyzed participants and the women who experienced a subsequent unintended pregnancy were described. Kaplan-Meier



estimates that account for differential durations of follow-up were used to graph survival rates for each group.

The association between the independent variables and subsequent unintended pregnancy was investigated using the log-rank test and bivariate Cox regression. However, variables were not included based solely on statistical significance. Instead, variables were included in analyses based both on findings from bivariate analyses and theoretical or demonstrated associations in the extant literature.

Data were encoded to allow for the inclusion of participants who might be missing values on one independent variable for their other non-missing variables in the analyses. Hazard ratios for these encoded missing values are not reported. Time to subsequent pregnancy was defined as the period between the participant's entry date, an estimate of the beginning of exposure to the risk of a subsequent pregnancy and the first day of her last normal menstrual period, the first day of the medically standard 40-week pregnancy, before the subsequent unintended pregnancy. Entry date was defined for women who obtained abortions or had miscarriages of the index pregnancy as two weeks after that abortion or miscarriage. For Turnaway patients who received an abortion after recruitment at another abortion provider with a later gestational age limit, it was assumed that they would obtain an abortion quickly. Their entry date was estimated as four weeks after recruitment (two weeks to find an abortion at another facility and two weeks to return to fecundity). For women reporting miscarriage, entry date was estimated as the mid-point between the survey at six-months and their recruitment date. For women who gave birth to either a live or stillborn infant, entry was defined as six weeks after their delivery. For participants who did not report a delivery

date of the index pregnancy, a delivery date was estimated based on their weeks gestation at recruitment.

The first subsequent unintended pregnancy was the outcome of interest; participants were censored from the analysis at the time of their first event. Additionally, if a participant who had not experienced a subsequent pregnancy reported sterilization, in the absence of a date of sterilization, they were censored at the mid-point between their previous survey and the survey they reported sterilization. Finally, participants who were lost to follow-up were censored at the date of their last completed survey.

Cox proportional hazards regression analyses were used to estimate hazard ratios for the association of the variables described above with time to subsequent unintended pregnancy. The proportional hazard assumption was tested using STATA's global and detailed tests based on Schoenfeld residuals as described by Grambsch and Therneau,<sup>26</sup> and by visually examining Schoenfeld residuals for each variable. Variables that were significant at 0.05 level of significance (indicating a potential violation of proportionality) or appeared visually to violate proportionality were further investigated by creating and testing an interaction with time. This included the variable for study group. As none of these interactions with time were significant, and for the sake of parsimony, they were not included in the final model and are not reported. Tied failures were handled using the Breslow approximation.<sup>26</sup> Results were reported as hazard ratios with 95% confidence intervals (CI).

To determine whether differences in contraceptive use explains any difference in risk of subsequent unintended pregnancies among the groups, contraceptive use by

study group was compared, excluding women who were not sexually active. Pearson's chi-squared test was used to evaluate differences.

## Results

Of eligible women, 38% participated in the Turnaway Study. There was no significant difference in participation between women who were turned away and women who received abortions near the gestation age limit of the clinic to which they presented.<sup>21</sup> Of the 801 included in the analysis, 294 women (37%) experienced at least one subsequent pregnancy over the four years. Of these 294 women, 252 (86% of the pregnancies and 31% of the total sample) pregnancies were not planned (LMUP score  $\leq 9$ ). Table 1 describes the baseline characteristics of the 801 women who requested an abortion for their index pregnancy and who were included in this analysis, and the baseline characteristics of the subset, 252 women, who reported a subsequent unplanned pregnancy during the follow-up period.

Figure 1 presents the graphed Kaplan-Meier survival estimates by group. Of women at risk (not censored), 84% at 12 months; 74% at 24 months; 67% at 36 months; and 63% at 48 months had not experienced a subsequent unintended pregnancy. Table 2 presents the bivariate and multivariable results of the Cox proportional hazard models to assess factors associated with a subsequent unintended pregnancy during the four-year follow-up period. The multivariable Cox regression provided adjusted estimates of subsequent unintended pregnancy events during the four-year follow-up period. During the follow-up period, there was no difference among the study groups in the risk of experiencing a subsequent unplanned pregnancy. Women in the oldest age category (35-46 years) when compared to women aged 20-24

years had a significantly reduced risk of experiencing a subsequent unplanned pregnancy (AHR=0.31, 95% CI=0.15-0.62). Latina women when compared to non-Hispanic white women and women with two or more children at baseline when compared to women with no children had an increased risk of experiencing a subsequent unplanned pregnancy (AHR=1.46, 95% CI=1.01-2.10 and AHR=1.58, 95% CI=1.06-2.34, respectively). When compared to women who had no history of IPV in the past year, women who reported psychological or physical IPV in the year prior to recruitment were more likely to experience an unplanned pregnancy (AHR=1.38, 95% CI=1.01-1.88). Women who reported a history of depression and/or anxiety when compared to women who did not were at a significantly increased risk of an unplanned pregnancy during follow-up (AHR=1.43, 95% CI=1.11, 1.85). Testing for theoretically important interactions was performed, but none were found to be significant in the model.

As reported in Table 3, differences in contraceptive use at six months by study group were also assessed. Among participants who reported sexual activity in the past month, there was no statistically significant difference among the groups in the use of contraception at last intercourse (Pearson  $\chi^2(3)=1.72$ ;  $P=0.63$ ).

## **Discussion**

This study found that neither receiving nor being denied an abortion affected the risk of a subsequent unplanned pregnancy during the four-year follow-up period. This finding is consistent with the separate analysis that demonstrated no statistically significant difference in contraceptive use at last intercourse among the sexually active participants at the second survey. Previous research using the Turnaway Study data

had also found that there was no difference among the groups in the likelihood of being in a romantic relationship with the man involved in their pregnancy at two years after recruitment.<sup>27</sup> Further supporting that abortion has little effect on risk of subsequent unintended pregnancy, there was no difference in the risk of an event between women who had a history of obtaining a previous abortion and those who did not at recruitment.

Thirty-one percent of participants reported a subsequent (and, therefore, multiple) unplanned pregnancy in four years of follow-up. To our knowledge, there are no other prospective studies of multiple unintended pregnancies among women in the U.S. which followed women for longer than two years. As we used the LMUP to define pregnancies as unplanned, the incidence rates found here should be compared to rates from previously published studies<sup>19,28,29</sup> with caution as they use other measures of pregnancy intention.

Aspects of the Turnaway Study design add support for the incidence findings from this study. Women were surveyed frequently; every six months, and many reported pregnancies were ongoing at the time women were surveyed. The participants were recruited at abortion clinics and were aware that this was a study of abortion. Because of these design strengths, reports of subsequent pregnancies that ended in abortion are less likely to be underreported – a common source of response bias in research on unintended pregnancy.<sup>30</sup>

Both Jones et al. (2006) and Magnusson et al. (2011) found that being older increased the likelihood of reporting multiple unintended pregnancies. Our finding that women in the highest age category were at decreased risk of an unplanned pregnancy during the follow-up when compared to the youngest women does not conflict with

those findings. Instead, it may be that while cumulative risk of experiencing multiple unintended pregnancies increases with time, older women are at lower incidental risk due to decreasing fertility, increasing experience with contraception, or some combination of both. In this study, Latina women, when compared to white women, were at increased risk of subsequent unplanned pregnancy. This is consistent with previous findings regarding multiple unintended pregnancy.<sup>13,15,31</sup> These findings could be a reflection of a lack of health care access for Latina women. In the U.S., it is estimated that 28-60% of Hispanics, depending on legal residence, are uninsured which may impede their access to contraception.<sup>32</sup> Beyond issues of access, these findings may also reflect a different cultural view of pregnancy and pregnancy desire or happiness about a pregnancy regardless of intention.<sup>33</sup> As of 2013, Hispanics, a category that usually includes Latinos, were the largest minority population in the U.S., and their health outcomes exert a substantial effect on the national healthcare system.<sup>34,35</sup> However, as noted in a Guttmacher Institute Special Report from 2005, information on unintended pregnancy in adult Hispanic women is limited.<sup>34</sup> The unique reproductive health needs of Latina and Hispanic women deserve additional investigation. It is interesting to note, however, that previously published research has found that black women are also at increased risk of multiple unintended pregnancies when compared to white women.<sup>13,15</sup> This study, however, demonstrated no significant difference in risk of subsequent unplanned pregnancy between black and white women.

This study found that women who had two or more children at recruitment were at increased risk of experiencing a subsequent unintended pregnancy when compared to women with no children at recruitment. Previous research using NSFG data has

found that higher-order births are more likely to be unwanted,<sup>14</sup> a category of unintended as defined by the NSFG.<sup>2</sup> While this study looked at pregnancies and not just births, it is likely that this is due to women with children having already attained their desired family size when the subsequent pregnancy occurred.

A history of having been diagnosed with depression or anxiety at baseline was significantly associated with an increased risk of subsequent unplanned pregnancy when compared to women with no history of depression or anxiety. While the research regarding depression's effect on contraceptive use demonstrates mixed findings, Steinberg and Rubin<sup>25</sup> have suggested that as depression affects memory, information-processing, motivation, and self-efficacy, it is likely a predictor of lack of contraceptive behaviors that lead to unintended pregnancy. Our findings support this hypothesis and suggest that anxiety may also affect a woman's ability to prevent unintended pregnancy. In addition, our study is the only study identified that presents evidence of an association between depression or anxiety and multiple unintended pregnancies in U.S. women.

Though child abuse was not found to be significantly associated with a subsequent unplanned pregnancy in our study, psychological or physical IPV in the last year was associated with an increased risk of an unplanned pregnancy. IPV has been posited to increase risk of unintended pregnancy by multiple mechanisms including birth control sabotage and pregnancy coercion.<sup>16</sup> These same mechanisms may influence continued risk of unintended pregnancy beyond an initial conception.

Any extension of these findings to all women or even all women experiencing an unintended pregnancy should be done with caution. As noted in previously published

findings from the Turnaway Study, three of the four study groups (all but the first trimester group) presented for their abortion at later gestations than the average American woman.<sup>27</sup> Additionally, women who were not able to present at an abortion facility and be recruited, perhaps due to limited financial limitations or limitations in regional access, are not present in this sample.

Neither receiving nor being denied a requested abortion affects subsequent unintended pregnancy risk. However, other factors such as Latina ethnicity, IPV, and mental health concerns are associated with multiple unintended pregnancies. Findings from this study suggest that interventions aimed at preventing multiple unintended pregnancies should focus on helping all women, including women of color, achieve healthier, safer lives overall.



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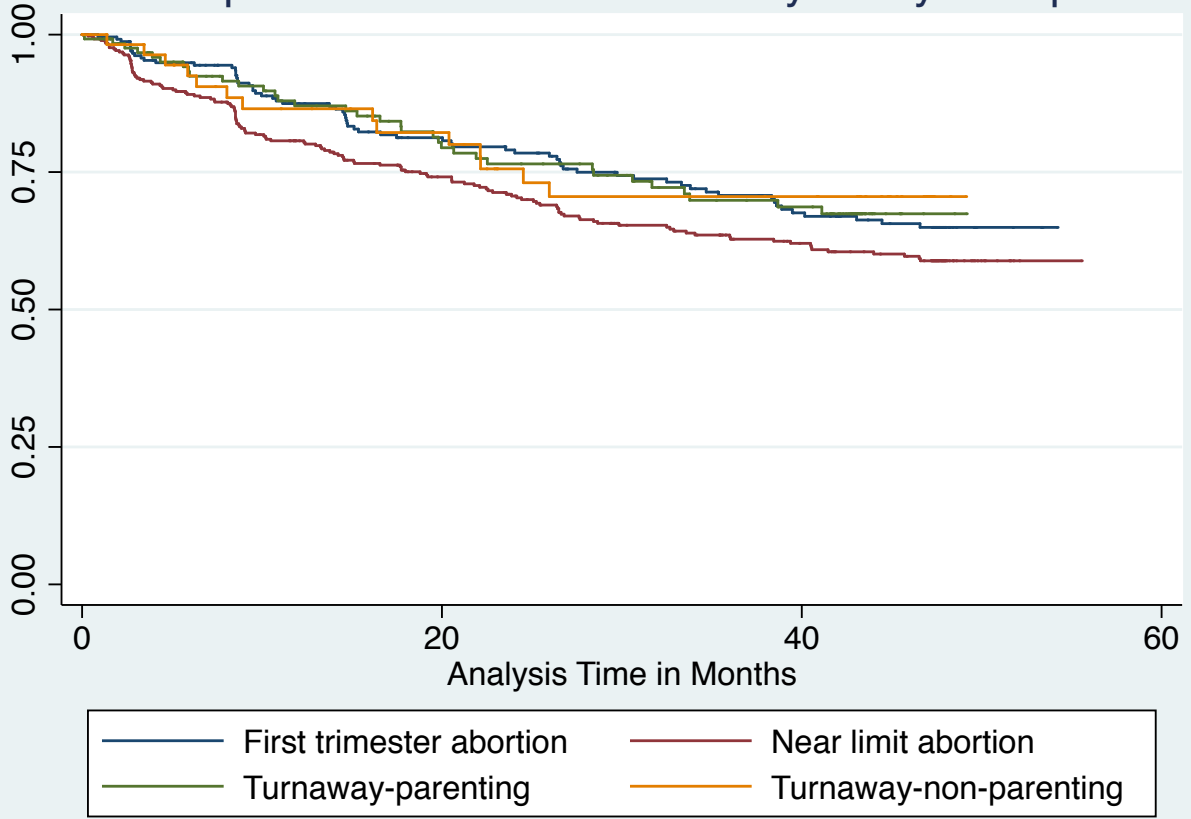
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<b>Table 1 - Baseline characteristics of women who experienced a subsequent unplanned pregnancy within four years after seeking an abortion for an index pregnancy in the United States</b>				
	<b>Total sample (n=801)</b>		<b>Subset of women who experienced a subsequent unplanned pregnancy within four years (n=252)</b>	
	<b>N</b>	<b>%</b>	<b>N</b>	<b>%</b>
<b>Baseline Characteristics</b>				
<b>Group</b>				
First-trimester abortion	237	29.6	67	26.6
Near-limit abortion	380	47.4	137	54.4
Turnaway-Parenting	127	15.9	34	13.5
Turnaway-Non-parenting	57	7.1	14	5.5
<b>Age</b>				
15-19*	149	18.6	53	21.0
20-24	284	35.5	94	37.3
25-34	311	38.8	98	38.9
35-46	57	7.1	7	2.8
<b>Race/Ethnicity</b>				
Non-Hispanic white	271	33.8	74	29.4
Non-Hispanic black	261	32.6	80	31.7
Latina	170	21.2	71	28.2
Multi/Other	99	12.4	27	10.7
<b>Education</b>				
Less than high school	148	18.5	55	21.8
High school or GED	261	32.6	94	37.3
AA, Technical degree, Some college	327	40.8	92	36.5
College degree	65	8.1	11	4.4
<b>Poverty Status</b>				
Below 100% FPL	460	57.5	161	63.9
100-200% FPL	193	24.1	53	21.0

Above 200% FPL	110	13.7	30	11.9
Missing	38	4.7	8	3.2
Union status				
Not Cohabiting	586	73.2	181	71.8
Cohabiting	215	26.8	71	28.2
Previous Children				
None	329	41.4	86	34.1
1	214	26.7	79	31.4
2 or more	256	32.0	87	34.5
Missing	2	0.2	0	0.0
Previous Abortion (prior to index pregnancy)				
None	436	54.4	130	51.6
1 or more	364	45.4	122	48.4
Missing	1	0.1	0	0.0
History of depression and/or anxiety				
No	596	74.4	175	69.4
Yes	205	25.6	77	30.6
Combined psychological and/or physical violence in past year by man involved in pregnancy				
No	703	87.8	209	82.9
Yes	81	10.1	35	13.9
Missing	17	2.1	8	3.2
History of childhood physical abuse or severe neglect				
No	669	83.5	200	79.4
Yes	120	15.0	47	18.7
Missing	12	1.5	5	2.0
History of childhood sexual abuse or sexual assault <18yo				
No	643	80.3	196	77.8
Yes	145	18.1	51	20.2
Missing	13	1.6	5	2.0

\* This age category includes one participant aged 14 years, who was recruited early in the study before the minimum enrollment age was changed to 15.

### Kaplan-Meier Survival Curve by Study Group



<b>Table 2 – Unadjusted and adjusted risk of subsequent unplanned pregnancy within 4 years of requesting an abortion (n=801)</b>		
	Unadjusted HR (95% CI)	Adjusted HR (95% CI)
<b>Baseline Sociodemographic Characteristics</b>		
<b>Group</b>		
Near-limit abortion	1.00	1.00
First trimester abortion	0.76 (0.57, 1.01)	0.81 (0.62, 1.06)
Turnaway-Parenting	0.74 (0.51, 1.08)	0.74 (0.53, 1.04)
Turnaway-Non-parenting	0.68 (0.39, 1.19)	0.67 (0.44, 1.03)
<b>Age, y</b>		
20-24	1.00	1.00
14-19	1.09 (0.78, 1.52)	1.31 (0.93, 1.82)
25-34	0.95 (0.72, 1.26)	0.90 (0.64, 1.25)
35-46	0.33** (0.15, 0.70)	0.31** (0.15, 0.62)
<b>Race/Ethnicity</b>		
Non-Hispanic White	1.00	1.00
Non-Hispanic Black	1.14 (0.83, 1.56)	1.06 (0.79, 1.42)
Latina	1.66** (1.20, 2.30)	1.46* (1.01, 2.10)
Multi/Other	1.06 (0.68, 1.65)	0.93 (0.63, 1.37)
<b>Education</b>		
< high school	1.00	1.00
High school diploma or GED	0.90 (0.65, 1.26)	1.10 (0.70, 1.73)
Some/grad tech, or college	0.66* (0.48, 0.93)	0.85 (0.54, 1.32)
College degree	0.36** (0.19, 0.68)	0.58 (0.32, 1.04)
<b>Poverty Status</b>		
< 100% FPL	1.00	1.00
100-200% FPL	0.74 (0.55, 1.01)	0.86 (0.64, 1.22)
> 200% FPL	0.70 (0.47, 1.03)	1.07 (0.69, 1.64)
<b>Union status</b>		
Not cohabitating	1.00	1.00
Cohabitating	1.09 (0.83, 1.43)	1.17 (0.91, 1.51)
<b>Reproductive History</b>		
<b>Previous children</b>		
None	1.00	1.00
1	1.64** (1.21, 2.23)	1.54 (0.93, 2.54)
2 or more	1.46* (1.08, 1.97)	1.58* (1.06, 2.34)
<b>Previous abortion</b>		
None	1.00	1.00
1 or more	1.16 (0.90, 1.48)	1.18 (0.84, 1.65)
<b>Psychosocial Factors</b>		
History of anxiety and/or depression		

No	1.00	1.00
Yes	1.41* (1.07, 1.84)	1.43**(1.11, 1.85)
Psychological and/or physical violence in past year by father of pregnancy (n=784)		
No	1.00	1.00
Yes	1.54* (1.08, 2.21)	1.38* (1.01, 1.88)
History of childhood physical abuse or severe neglect		
No	1.00	1.00
Yes	1.41* (1.03, 1.94)	1.15 (0.79, 1.66)
History of childhood sexual abuse or sexual assault <18yo		
No	1.00	1.00
Yes	1.22 (0.90, 1.66)	0.99 (0.70, 1.39)

\*p<0.05; \*\*p<0.01



**Table 3 –Contraceptive Use at Last Intercourse Among Sexually Active Women by Group** (n=622); Pearson  $\chi^2(3)=1.72$  , P=0.63

<b>Group</b>		<b>Used Contraception</b>	<b>Did Not Use Contraception</b>
	Group Total	N(% of group total)	N(% of group total)
Near limit abortion	308	265(86.0)	43(14.0)
First trimester abortion	198	166(84.0)	32(16.0)
Turnaway-parenting	61	49(80.3)	12(19.7)
Turnaway-non-parenting	55	48(87.3)	7(12.7)

## **Chapter 5**

### **Dissertation Summary**

**E. Angel Aztlan-James, BSN, MS, PhD(c)**

## **Summary of Research**

As presented in the introduction, the purposes of this dissertation were to estimate an overall, combined complication rate for first-trimester vacuum aspiration abortion, a common outcome of unintended pregnancy, and to investigate if abortion is associated with risk of subsequent unintended pregnancies for United States (U.S.) women. The specific aims of this dissertation were 1) to systematically assess the rate of abortion-related complications reported in the literature; 2) to cull from the literature a systematic view of the epidemiology of multiple unintended pregnancies for healthy, fertile women in the U.S, and whether these factors are specific to multiple unintended pregnancy; and 3) to estimate the time to subsequent unintended pregnancy for women who had requested an abortion of an index pregnancy and to identify factors associated with shorter time to subsequent unintended pregnancies for the participants.

## **Review of Chapter 2**

The first manuscript entitled “First-trimester, Vacuum Aspiration Abortion Complication Rates: A Systematic Review and Meta-analysis” presented the findings of a systematic literature review and meta-analysis of first-trimester vacuum aspiration complication rates. While recently published, highly powered studies have demonstrated low rates of abortion complications, the definitions and diagnostic criteria of complications employed by these studies vary widely (Hakim-Elahi, Tovell, & Burnhill, 1990; Paul, Mitchell, Rogers, Fox, & Lackie, 2002; Upadhyay et al., 2015; Warriner et al., 2006; Weitz et al., 2013). In addition, no meta-analysis had yet been conducted to estimate a first-trimester abortion-related complication rate. To address these gaps in

the extant literature, the Taylor Standardized Framework was utilized to systematically assess the rate of abortion-related complications reported in the published literature.

The findings of the review highlighted the lack of consistency in defining and categorizing first-trimester vacuum aspiration abortion complications. Among the studies that met the inclusion criteria and were included in the review and meta-analysis, consensus was missing in not just how complications were defined (i.e. the definition of hemorrhage varied among the studies), but also in aspects of each study's design such as length of follow-up time during which complications were counted.

A total of 30 studies were included in the analysis. The meta-analysis estimated a pooled overall complication rate of 1.79% (95% CI 1.21 to 2.65), and a pooled major complication rate of 0.53% (95% CI 0.23 to 1.24). The pooled rates for specific complication diagnoses were under 1.0%. These findings demonstrate that first-trimester aspiration abortion is safe. However, the variation in study complication rates found in this analysis demonstrates the lack of standardized diagnostic criteria to determine, classify, and report abortion-related complications. A standardized system, such as the Taylor Standardized Framework, may improve the precision and accuracy of reported abortion-related complication rates.

### **Review of Chapter 3**

“First-trimester, Vacuum Aspiration Abortion Complication Rates: A Systematic Review and Meta-analysis” presents the synthesized findings of a systematic review of the published literature on multiple unintended pregnancies in U. S. women. While nationally representative cross-sectional studies have reported that 17% of all U.S. women will experience more than one unintended pregnancy in their lifetime (Jones,

Singh, Finer, & Frohworth, 2006), relatively little research exists about the risk factors associated with multiple unintended pregnancies.

Seven studies that met the inclusion criteria were identified. Incidence rates that ranged from 7.4 to 30.9 per 100 person-years (Abrams, 1985; Cremer et al., 2011; Upadhyay, Brown, Sokoloff, & Raine, 2012) and prevalence rates ranged from 17% to 31.6% (Jones et al., 2006; Magnusson, Masho, & Lapane, 2011). Increasing age (Jones et al., 2006; Magnusson et al., 2011), identifying as Black or Hispanic (Jones et al., 2006; Magnusson et al., 2011), non-voluntary first intercourse, particularly at a young age (Magnusson et al., 2011), and sex trade (Decker et al., 2012) were found to be associated with multiple unintended pregnancies. The use of IUDs or combined oral contraceptives decreased risk of multiple unintended pregnancies (Cremer et al., 2011; Upadhyay et al., 2012). Findings regarding the effect of previous abortion on risk of multiple unintended pregnancies was mixed with one study demonstrating an increase in risk (Upadhyay et al., 2012), and another demonstrating no increase in risk (Shlay, Zolot, Bell, Maravi, & Urbina, 2009). This systematic review offered insight into which factors may put women at particular risk of experiencing multiple unintended pregnancies.

#### **Review of Chapter 4**

The third manuscript, “Time to subsequent unintended pregnancy among United States women who are denied or receive a requested abortion”, presented the main findings from this dissertation study. The primary goal of the manuscript presented in this chapter was to investigate the association between receiving or being denied a requested abortion. Additionally, other factors that might influence time-to-subsequent

unintended pregnancy in a sample of women who presented for abortion were investigated.

A secondary data analysis using data from the Turnaway Study (PI: Dr. Diana Greene Foster) was performed to answer the research questions. Of the 956 participants recruited for the Turnaway Study, data from 801 of the participants were analyzed. Neither receiving nor being denied a requested abortion were associated with an increased risk of subsequent unintended pregnancy. When compared to women aged 20-24 years, women aged 35-46 years were less likely to have a subsequent unintended pregnancy during the follow-up period (AHR=0.31, 95% CI=0.15-0.62). Latina women were at increased risk compared to white women (AHR=1.46, 95% CI=1.01-2.10), as were those who had two or more children at baseline compared to those who had none (AHR=1.58, 95% CI=1.06-2.34). Women who reported intimate partner violence (IPV) in the past year were at increased risk of subsequent unintended pregnancies (AHR=1.38, 95% CI=1.01-1.88) when compared to women who did not report IPV. Women who reported a diagnosis of depression or anxiety were also at increased risk (AHR=1.43, 95% CI=1.11, 1.85) of a subsequent unintended pregnancy when compared to women who did not. Neither receiving nor being denied abortion affects subsequent unintended pregnancy risk. Other structural factors such as IPV and mental health are more associated with multiple unintended pregnancies.

### **Implications**

The main findings of this dissertation are that 1) first-trimester vacuum aspiration abortion is safe; and 2) abortion does not affect the likelihood of experiencing a subsequent unintended pregnancy in U.S. women. Additionally, this dissertation

highlighted the issues with how abortion complications are identified, defined, and categorized in the extant literature and identified several factors that put women at increased risk of multiple unintended pregnancies including potentially modifiable factors such as experiencing intimate partner violence.

These findings have both clinical and policy implications. Clinically, women can be reassured that first-trimester vacuum aspiration abortion is a safe procedure when performed by competent, legal providers. However, clinicians and facilities offering abortion services may be limited in their ability to assess and compare their rates of complications without nationally reported abortion complication rates based on standardized definitions and categories of abortion complications. Abortion morbidity data, if compiled using a system of defining and categorizing abortion complications, has the potential to improve clinical care at the facility level. For researchers, data such as this would enable better evaluation of novel abortion interventions (i.e. does the use of a new device, technique, or patient intervention improve complication rates when compared to national rates). Additionally, as attempts to limit access to abortion through legal barriers, such as those that cite patient safety as a reason to place burdensome facility requirements on abortion providers (Guttmacher Institute, 2015), continue, systematically collected data on abortion morbidity could offer evidence to policy-makers that such limits are unnecessary.

Second or higher-order unintended pregnancies are more likely to be unwanted (Wildsmith, Guzzo, & Hayford, 2010), and therefore may be more likely to be associated with the poorest health outcomes for mothers and infants. This study demonstrates that clinicians, researchers, and policy-makers should focus attempts to prevent multiple

unintended pregnancies not on preventing women from obtaining abortions, but instead on empirically identified risk factors such as IPV, mental health diagnoses, and the role race and ethnicity play in women's reproductive health.

### **Future Research**

While there is a great deal of literature on unintended pregnancy, relatively little of that literature has focused on multiple unintended pregnancies. The findings from this dissertation contribute to the existing body of knowledge on unintended pregnancy, and add to what is known regarding multiple unintended pregnancies. Additionally, the data presented here offer direction for future research.

When compared to white women, Latina women were found in this study to be at increased risk of experiencing a subsequent unintended pregnancy in the follow-up period. This finding is consistent with findings from other studies on multiple unintended pregnancies (Jones et al., 2006; Magnusson et al., 2011). However, why Latina women are at increased risk is not clear. Limited access is one possibility as Hispanics, a category that includes Latinos, are more likely than most adult Americans (28-60% depending on legal residency status vs. 17%) to be uninsured (Livingston, 2009). There are alternate possibilities. Recent research has posited that for Latina women, pregnancy intention and pregnancy happiness are distinct concepts and that an unintended pregnancy is not necessarily a pregnancy with which they are unhappy (Aiken & Potter, 2013). This finding may present a difference in pregnancy desire for Latina women. However, it has been recognized that there is limited research on Latina women's reproductive health needs and experiences (Foulkes, Donoso, Fredrick, Frost, & Singh, 2005), and without additional research focused on Latina women, the cause(s)



of the increase in risk for multiple unintended pregnancies will remain undiscovered. Latina women should be included in all research on reproductive health topics in numbers sufficient to draw accurate conclusions.

The issue of race and ethnicity as it relates to reproductive health outcomes more generally deserves additional attention. In this study, Black women were not found to be at increased risk of experiencing a subsequent, or multiple, unintended pregnancy during the follow-up period. This finding is not consistent with previously published research on unintended pregnancy and multiple unintended pregnancies. Stress, including the stress of racial bias (Collins, David, Handler, Wall, & Andres, 2004; Dominguez, 2008), is implicated in other reproductive health outcomes such as preterm birth, but the mechanism for this increased risk is not fully understood (Gennaro, Shults, & Garry, 2008). For both Latina and Black women, culturally appropriate, effective interventions cannot be designed and implemented without additional research that focuses on their unique experiences.

No other studies were identified that investigated an association between IPV and multiple unintended pregnancies, making the findings of this dissertation particularly interesting. Further research is needed to better understand the effect IPV has on the risk of multiple unintended pregnancies. How does IPV increase risk? How long does the risk following exposure to IPV last? As this is a new finding, qualitative research may be of particular use in understanding the association between IPV and multiple unintended pregnancies. Finally, the finding that women who reported diagnoses of depression or anxiety were at increased risk when compared to women who did not report such diagnoses also warrants further study. For example, can this risk be

explained by contraceptive use behaviors that might be associated with depression or anxiety symptoms? Increasing knowledge and understanding of these risk factors for multiple unintended pregnancies is a critical step in designing effective interventions to decrease rates of multiple unintended pregnancies for U.S. women.

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