ABSTRACT

Title of Thesis: EXAMINING THE ASSOCIATION BETWEEN INFERTILITY, PREGNANCY INTENTION, AND POSTPARTUM DEPRESSION

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While much research has studied postpartum depression (PPD), few studies have examined PPD in women who become pregnant through the use of fertility treatments. The process of experiencing infertility and its treatment may alter the risk of developing PPD. We utilized data from The Pregnancy Risk Assessment Monitoring System (PRAMS; unweighted N=145,036) to compare PPD symptomatology between women who had unintended pregnancies (an at-risk group for PPD), women who conceived naturally/intentionally, and women who conceived using fertility services. We show that women who used fertility treatments did not differ from women who conceived naturally in regards to PPD. The women who utilized fertility enhancing drugs in comparison to insemination or assisted reproductive technologies had higher depressive symptoms. Therefore, our results suggest that the type of fertility treatment utilized may be important for clinicians to consider when working with these women as they transition into the postpartum period.

EXAMINING THE ASSOCIATION BETWEEN INFERTILITY, PREGNANCY INTENTION, AND POSTPARTUM DEPRESSION

by

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Statement of the Problem

Postpartum depression (PPD) is commonly defined in the clinical literature as a period of major depression that occurs during the postpartum period or within one year after giving birth (O'Hara & McCabe, 2013). The symptomology of postpartum depression often includes loss of interest in pleasurable things, overwhelming concern for one's baby, disturbances in sleep, appetite changes, mood swings, recurrent thoughts of death, and irritability. Postpartum depression is more severe and less common than the "baby blues" which occur closely following the birth and often subside after a relatively short period of time, but less severe than postpartum psychosis, that is often accompanied by hallucinations and distortions of reality (Stewart & Vigod, 2013). Estimates vary widely for the prevalence of postpartum depression, with the lower end of estimates around 5.9% while the higher end are around 20% (O'Hara & McCabe, 2013). Several interventions have been shown to be effective at combating postpartum depression, including cognitive behavioral therapy, interpersonal therapy, and psychodynamic therapy (O'Hara & McCabe, 2013). Many cases of postpartum depression, if left untreated, will resolve on their own, however around 20% of women who are not treated for depression will continue to experience symptoms a year after the birth (Goodman, 2004).

There are several risk factors that have been identified in the literature in regards to postpartum depression, however the exact etiology of this disorder is not known as of yet (Beck, 2001; O'Hara & McCabe, 2013; Stewart & Vigod, 2016). Many researchers have found that there may be some genetic component to the disorder, hormones may play a role in the disorder (especially in women that are already susceptible to the

disorder), and various psychosocial factors may play a role in the development of the disorder (Beck, 2001; O'Hara & McCabe, 2013; Monti, Agostini, Fagandini, La Sala, & Blickstein, 2009; Murphy-Eberenz et al., 2006). Some of the psychosocial risk factors for developing postpartum depression that have been identified in the literature are lack of social support, stress, prenatal depression or anxiety, and having a previous history of depression (Beck, 2001; O'Hara & McCabe, 2013).

While postpartum depression in itself can have a profound effect on an individual who is experiencing the symptoms, postpartum depression also impacts the mother-child relationship during a critical period of development, through negative interactions and a decrease in engagement between mother and child (Cohn & Tronick, 1989; Field, 2010; Hart, Field, de Valle, & Palaez-Nogueras, 1998). Researchers have found that maternal depression impacts a child in a myriad of ways, such as behavioral problems during childhood and mental health disorders and substance abuse as an adolescent (Canadian Pediatric Society, 2004).

Many of the risk factors for postpartum depression and at risk groups, such as women who had an unintended pregnancy, have already been identified in the literature and extensively studied (Cheng, Schwarz, Douglas, & Horon, 2009). However, there is a lack of research examining a group of women that one would not necessarily think to examine in great depth–women who have experienced infertility and often gone to great lengths to conceive using fertility drugs and treatments. While there exists a large body of literature that examines these women's mental health during the period in which they are trying to conceive and undergoing fertility treatments, there is significantly less literature that continues to follow these women's mental health outcomes through and after pregnancy as they make their transition to parenthood (Lee, Liu, Kuo, & Lee, 2011;

Monti et al., 2009; Munk-Olsen & Agerbo, 2015; Repokari et al., 2005; Ross, McQueen, Vigod, & Dennis; 2010). While it may be simple to assume that these women who conceived through the use of fertility treatments are adjusting well to parenthood now that they have finally been able to achieve it, the road they had to take to parenthood was a unique one, filled with many more stressors than others may have encountered. Fertility treatments can be very costly, time consuming, and place an enormous burden on one's body, identity, and relationships (Anderson, Sharpe, Rattray, & Irvine, 2003; Katz et al., 2011). Consequently, there needs to be (more) research investigating the postpartum mental health outcomes of women who have conceived through the use of fertility drugs or treatments.

Due to the high expectations that women who have experienced infertility often have about parenthood, they may be a population that is less likely to ask for help if they feel depressed after birth. This may stem from feelings of guilt since they have often spent many years hoping for a child. Therefore, clinicians may need to be even more vigilant and attentive for postpartum depression in these women because they may be less likely to initiate asking for assistance or less apt to recognize the symptoms of postpartum depression. It may also be beneficial to increase services, such as support groups, that women who conceived after infertility may utilize after the birth and provide some counseling services throughout pregnancy to these women as more of a preventative measure, though there are currently mixed results as to the effectiveness of these preventative programs for postpartum depression (Munoz et al., 2010; Tandon et al., 2014). As more and more fertility treatments are created and become accessible to women, medical professionals will continue to see an increase in women who have

utilized these services to conceive making it extremely important to learn more about the mental health of this population of women.

Literature Review

What is Postpartum Depression?

Generally speaking, the symptoms of what most clinicians refer to as postpartum depression (PPD) include depressed mood, irritability, feeling overwhelmed, sleep disturbances, preoccupation with and concern for the health of one's baby, loss of interest in pleasurable things, and low energy (Stewart & Vigod, 2016). Postpartum depression impacts many women after childbirth (between 5.9% and 20%); however, research has found that with the right interventions, postpartum depression can be treated (Blazer et al., 1994; Gavin et al., 2005; O'Hara & Swain, 2009; Stewart & Vigod, 2016).

While the DSM-5 mainly discusses peripartum depression—depression in which the most recent onset is during pregnancy or in the four weeks following childbirth—this research focuses on postpartum depression, which is depression that occurs within one year after childbirth (O'Hara and McCabe, 2013). As can be seen, postpartum depression overlaps some with peripartum depression since peripartum includes the first four weeks after birth and postpartum includes the whole year after birth. In the clinical literature, there is frequently much more variability in the time frames that are used to characterize the onset of postpartum depression (O'Hara & McCabe, 2013).

The prevalence rates of postpartum depression can vary greatly, with some as low as 5.9% and some as high as close to 20% (Blazer et al., 1994; Gavin et al., 2005; Stewart & Vigod, 2016). Gavin et al. (2005) estimate that around 19.2% of women experience a minor episode of depression within three months of their child's birth, and 7.1% of women experience a major episode of depression by three months after their child's birth. There are various reasons for these differences in prevalence, such as the criteria that were used to diagnose and the time frame that was used in each study. Another factor is

who the participants were in the study; research has found ethnic and racial differences in the prevalence of postpartum depression. In one of the few studies that directly compared postpartum depression in a sample of African American, Hispanic, Native American and White women, Native Americans were found to have the highest rates of postpartum depression, followed by Whites, African Americans, and lastly Hispanics (Wei, Greaver, Marson, Herndon, Rogers, & Robeson Healthcare Corporation, 2008).

One of the best ways to monitor and intervene with postpartum depression is for medical professionals to continuously check in with expectant mothers throughout their pregnancy and after. If symptoms of postpartum depression become apparent, there are measures to further assess the prevalence and severity of postpartum depression, such as the Patient Health Questionnaire (PHQ) and the Edinburgh Postnatal Depression Scale (EPDS). Once depression has been detected, depending on the severity, various treatment options are available (Stewart & Vigod, 2016). For minimal depression, peer support can often prove extremely helpful; for more moderate cases, more formal psychotherapy may be utilized, and for severe cases medication may be administered. Cognitive behavioral therapy, interpersonal therapy, and psychodynamic therapy have been shown to be effective for the treatment of postpartum depression (O'Hara & McCabe, 2013; Stewart & Vigod, 2016), and various medications for depression have been proven to pose minimal risk to the newborn if the mother is breastfeeding. Without treatment, many cases of postpartum depression will abate on their own; however some will continue (Stewart & Vigod, 2016). Researchers have found that without treatment, approximately 20% of women who experience postpartum depression will still be experiencing these symptoms a year after the birth of their child, and 13% of women will still be experiencing symptoms after two years (Goodman, 2004).

It is important to differentiate between postpartum depression and "baby blues", which are experienced by up to 80% of women (Buttner, O'Hara, & Watson, 2012). The "baby blues" generally will abate on their own in a relatively short time period, and research has found that they peak 2-5 days after birth. Generally, the "baby blues" cause less distress to the individual experiencing them and are considered to be less severe in nature (Wisner, Parry, & Piontek, 2002). Josefsson, Berg, Nordin, and Sydsjo (2001) suggested that up to 25% of the women who are affected with "baby blues" go on to experience postpartum depression. It is also extremely important to differentiate between a depressive episode and a bipolar episode, which includes periods of mania or hypomania in addition to the periods of depression, or postpartum psychosis, which are both more severe than postpartum depression. In cases of postpartum psychosis, the mother will generally experience delusions and hallucinations, loss of touch with reality, and may in many cases pose a threat to their child's safety and their own. The prevalence rates for postpartum psychosis are generally fairly low, around 1 to 2 cases per 1,000 births (Howard et al., 2014).

What Causes Postpartum Depression?

The exact etiology of postpartum depression is unknown, and it is generally thought that a variety of factors play a role. Research has shown that hormonal changes, genetic factors, and the availability of social support may all be important factors (Stewart & Vigod, 2016). Therefore, when thinking about postpartum depression, it is essential to have an integrated understanding of this disorder, one which takes into account the biological or physiological and the psychosocial risk factors.

Biological/Physiological Risk Factors for Postpartum Depression

There is no denying that there is a rapid change in hormonal levels—particularly declines in estrogen and progesterone—that occurs after a woman gives birth. Therefore, many researchers have pointed to this change as one of the factors that might heavily contribute to the development of postpartum depression (Hendrick, Altshuler, & Suri, 1998). One study found that administering transdermal estrogen to women following birth helped to reduce their postpartum depression symptoms (Dennis, Ross, & Herxheimer, 2008). This is not surprising given that depression has been found to negatively correlate with estrogen and progesterone levels, meaning that as women experience a sharp decrease in these hormones after birth the prevalence of depression increases (Fan et al., 2009). While hormones may play a role in the development of postpartum depression, they have not been found to be the sole cause of postpartum depression. It is thought that some women may be more susceptible to the influences or impact of these hormonal changes than others (Harris et al., 1996).

More recent research has provided support to this notion that some women are more susceptible than others to the hormonal changes that occur after pregnancy. Bloch et al. (2000) found that after administering and withdrawing synthetic estrogen and progesterone (two of the hormones that are affected during pregnancy), depression symptoms were triggered in the women who took part in the study that had a history of postpartum depression, whereas the administration and withdrawal of these hormones did not trigger depressive symptoms in the women who did not have a history of postpartum depression. This experiment demonstrated that not all women are equally as susceptible to hormonal fluctuations. Researchers have hypothesized that these hormonal fluctuations for some women contribute to the development of postpartum depression through their

effects on the dopamine and serotonin systems in the brain (Byrnes et al., 2001; Gu et al., 2003).

O'Keane et al. (2011) looked into whether or not there was a relationship between depressive symptomology and the magnitude of the hormonal shift following pregnancy, and they found that there was no correlation between the magnitude of the estrogen drop that women experienced from 36 weeks gestation to one week postpartum and depressive symptoms. In other words, the magnitude of the change in estrogen levels that occurs after birth did not have an association with the development of depressive symptoms. Research has not consistently found evidence that women who experience postpartum depression have lower levels of reproductive hormones after their pregnancies compared to women who are not experiencing postpartum depression or that the decrease in these hormonal concentrations happened at a different rate than with women who did not develop postpartum depression (Schiller, Meltzer-Brody, & Rubinow, 2015).

While a lot of the literature has focused on estrogen and progesterone, some research has examined oxytocin during pregnancy and after birth. Oxytocin normally plays a large role in affiliative bonding, and since researchers have found that the mother-infant relationship is often disrupted in cases of postpartum depression, this led to investigations as to what role oxytocin may have in postpartum depression (Cohn & Tronick, 1989; Hart et al., 1998; Kroll-Desrosiers et al., 2016). Several studies have now found that this hormone may play a role in the development of postpartum depression. Research has found that low levels of oxytocin during pregnancy and in the postpartum period may be a risk factor for the development of postpartum depression (Skrundz, Bolten, Nast, Hellhammer, & Meinlschmidt, 2011; Stuebe, Grewen, & Meltzer-Brody, 2013).

Given these findings, research has also examined whether there is a relationship between exposure to synthetic oxytocin in the peripartum period and the development of postpartum depressive symptoms. In medical practice today, a large portion of women receive synthetic oxytocin for a variety of reasons, such as to induce labor or to prevent postpartum hemorrhage. Initially, it was hypothesized that exposure to synthetic oxytocin may protect one against the development of postpartum depression, however this research found that women who were exposed to peripartum synthetic oxytocin were actually at a greater risk of developing postpartum depression in the one year period after the birth than women who were not exposed to synthetic oxytocin (Kroll-Desrosiers et al., 2016). This has led to some researchers pointing more toward the importance of the timing of oxytocin fluctuations on the development of postpartum depression rather than the absolute levels of oxytocin. Some research has found that while oxytocin levels increase over the course of the last trimester into the postpartum period, women who develop postpartum depression might actually experience a drop in plasma oxytocin levels right before birth, whereas this drop does not occur in women who do not develop postpartum depression (Jobst et al., 2016).

Some research has found that there may be a genetic component to the development of postpartum depression as well. These finding have come from twin and family studies, and they suggest that multiple genes may play a role in the onset of postpartum depression (Murphy-Eberenz et al., 2006).

Psychosocial Risk Factors for Postpartum Depression

In addition to the biological and physiological factors, psychosocial factors may contribute to the development of postpartum depression. The research thus far has found that there are several psychosocial risk factors for developing postpartum depression,

such as marital discord, low educational attainment, social isolation and low social support, having more time between marriage and the conception of a child, having a history of mood disorders, and the offspring being the result of an unwanted or unplanned pregnancy (O'Hara, 1986; Pariser, Nasrallah, & Gardner, 1997; Seguin, Potvin, St. Denis, & Loiselle, 1999).

A recent review that was conducted in 2015 found that having experienced severe life events, chronic strain, poor relationship quality, and lacking support from one's partner and mother were some of the strongest psychosocial risk factors for developing postpartum depression (Yim, Stapleton, Guardino, Hahn-Holbrook, & Schetter, 2015). Another meta-analysis outlined 13 significant risk factors for developing postpartum depression (Beck, 2001), which overlap significantly with the risk factors identified previously by other researchers in the field. These include: having a history of previous depression, having prenatal depression, having low self-esteem, having childcare stress or life stress, having prenatal anxiety, having low social support, having marital discord, not being married, being of low socioeconomic status, having the "baby blues", and having a child with a difficult temperament.

Low Self Esteem

In Beck's meta-analysis (2001), low self-esteem was identified as one of the strongest risk factors for the development of postpartum depression. This builds on existing literature that supports the notion that mothers who have high levels of self-esteem are able to withstand stressors better and in a way that does not allow the stressor to negatively affect their sense of self-worth. Therefore, having high self-esteem can be a protective factor against postpartum depression, whereas having low self-esteem can be a risk factor (Orozco, 1995).

Stressors

Various sources of stress such as childcare stress, marital discord, lack of social support, and general life stress are risk factors for the development of postpartum depression (Beck, 2001). Prenatal anxiety that occurs before the arrival of a baby is another risk factor for the development of postpartum depression (Beck, 2001), along with experiencing a particularly stressful life event while pregnant (Robertson, Grace, Wallington, & Stewart, 2004). Some researchers have differentiated between different stressful life events based on the magnitude of the event when looking at this relationship since some believe that the magnitude of the event plays a role in how strong of a risk factor it is for the development of postpartum depression (Ramchandani, Richter, Stein, and Norris, 2009). Several other studies have also assessed the impact that chronic strain can have on a woman developing postpartum depression, and in general, researchers have found that there is a positive correlation between experiencing chronic stress and the development of postpartum depression, whether it be chronic stress due to work demands (Dagher, McGovern, Dowd, & Lundberg, 2011) or financial stress (Dolbier, Rush, Sahadeo, Shaffer, & Thorp, 2013; Rich-Edwards et al., 2006).

Experiencing high levels of stress in regards to childcare is another one of the strongest risk factors for developing postpartum depression (Beck, 2001). Lacking social support during this transition and all the changes that come with it is another risk factor for developing postpartum depression. The First Baby Study examined first time mothers in Pennsylvania during their third trimester of pregnancy and then assessed for postpartum depression at one month postpartum. One of the variables that the researchers found was associated with the development of postpartum depression was lower reported social support (Abbasi, Chuang, Dagher, Zhu, & Kierulff, 2013). Social support can help

buffer one against the effects of stress and increases one's resources to cope with stress in many circumstances. Perceiving that one has social support has a negative correlation with postpartum depressive symptoms, meaning that the more social support one perceives that they have the lesser their postpartum depressive symptoms (Lee et al., 2011).

Many times an individual's most important source of support is from a partner. Therefore, some researchers have chosen to study in greater depth the impact of the marital relationship on the development of postpartum depression. In general, the research in this area has found that not being married can be a risk factor for the development of postpartum depression; however at the same time being in a marriage where the quality of that relationship is poor does not offer protective benefits and may increase women's risk of postpartum depression (Abbasi et al., 2013; Husain et al. 2012). Husain and colleagues (2012) found that having more difficulties in one's marriage and more discord was associated with higher depression scores at six months postpartum. The assumption is that by not having a husband, there may be less resources for mothers to rely on, which increases stress. However, being in a poor quality relationship does not provide much social support and could actually decrease one's self-esteem, and low social support and self-esteem have consistently been found to increase one's risk of postpartum depression. Further lending support to the importance of social support and healthy relationships during the transition to parenthood is the fact that positive family functioning has been found to have a negative correlation with postpartum depression (Lee et al., 2011).

One study that highlights the importance of taking both the biological and psychosocial risk factors into account when thinking of postpartum depression was

conducted by Pinheiro and colleagues (2013). They found that women who were carriers of a certain allele of a serotonin transporter gene had a greater likelihood of experiencing postpartum depression after childbirth, and they found that the association between these two variables was stronger when stressful life events during pregnancy had occurred.

History of Depression or Anxiety or Prenatal Depression or Anxiety

The First Baby Study looked at first time mothers in Pennsylvania and assessed for postpartum depression at one month postpartum. One of the variables that the researchers found was independently associated with postpartum depression was anxiety or depression before pregnancy. Women who have experienced a depressive episode are at a much greater risk for developing postpartum depression in comparison to women who have never experienced a depressive episode before pregnancy (Abbasi et al., 2013). Having an anxiety or depressive disorder that goes untreated during pregnancy is also an extremely strong risk factor for the development of postpartum depression after the birth. Therefore, it is extremely important to not only assess for mood disorders before pregnancy but also for mood disorders during pregnancy and to provide treatment for them (Milgrom et al., 2008). Once a woman gives birth, it is also important to be cognizant of any experiences she may have with the "baby blues". While in most cases, the "baby blues" resolve on their own, a subset of women who experience these will go on to develop postpartum depression (Josefsson et al., 2001).

Unintended Pregnancy

Women who become pregnant unintentionally—those that are either earlier than when the woman wanted or not wanted at all—are more likely to experience postpartum depression symptoms (Cheng et al., 2009). While births that are mistimed, meaning they occurred too soon, have been associated with an increased risk of developing postpartum

depression, it is to a lesser extent than the unwanted pregnancies that end in birth (Cheng et al., 2009). In one study, which utilized Pregnancy Risk Assessment Monitoring System (PRAMS) data from the Centers for Disease Control and Prevention (CDC), 31.3% of the women in the sample reported that their pregnancies were mistimed and 10.3% stated that their pregnancies were unwanted. While only 13.6% of the women who reported having an intended pregnancy had postpartum depression, 20.0% of the women with a mistimed pregnancy had postpartum depression and 27.4% of the women with an unwanted pregnancy had postpartum depression (Cheng et al., 2009).

While a large proportion of the literature suggests that having had an unintended pregnancy is a risk factor for developing postpartum depression, some studies have found that unintended pregnancies are not independently associated with the development of postpartum depression. For instance, Abbasi and colleagues (2013), found that women who had unintended pregnancies did have a greater likelihood of experiencing postpartum depression. However, this was not independent from other factors. In this study, 32% of the women reported that their pregnancies were unintended. The researchers found though that the only variables that were independently associated with postpartum depression were depression and anxiety during pregnancy and identifying as Asian or Hispanic.

Effects of Postpartum Depression

The reason why such a large body of literature exists on postpartum depression is because we care about individuals' mental well-being and the myriad of negative effects that this disorder has for both mother and child, as well as for society as a whole. Depression, regardless of when it occurs during the life course, is one of the leading causes of disease-related disability in females (Noble, 2005). Postpartum depression can

place an enormous burden and amount of distress on the mother if left untreated and her quality of life will be greatly diminished.

Research has found that mothers who are experiencing depression are less likely to take their baby to their well child visits, keep up to date with their vaccinations and medications, and baby proof and ensure safety around their homes (Zajicek-Farber, 2009). Having a mother with postpartum depression can interfere with the development of the parent-child relationship as well, which is essential during childhood (Cohn & Tronick, 1989; Hart et al., 1998). There is evidence that mothers who are struggling with depression have more negative interactions and exchanges with their babies (Field, 2010). Having a mother who is struggling with or has struggled with depression is related to behavioral problems during childhood and mental health disorders and substance abuse as an adolescent (Canadian Pediatric Society, 2004).

Research that has looked at the interaction between maternal postpartum depression and non-depressed father's parenting behaviors has found that mothers who are experiencing postpartum depression, even when their partner is not experiencing depression, have an effect on the father's interactions with the child. For example, father's whose partners are depressed are less likely to sing songs to their child every day (Paulson, Dauber, & Leiferman, 2006). This research suggests that not only can maternal postpartum depression impact the child and the mother's relationship with the child, but it can also have farther reaching effects, such as effecting the father-child relationship or the whole family unit.

Some research has investigated in greater depth the co-occurrence of postpartum depression in mothers and fathers - finding that these two are often highly correlated (Goodman, 2003). In this meta-analysis, it was found that one of the strongest predictors

of whether a father would develop postpartum depression was whether or not their partner was either currently experiencing postpartum depression or had experienced depression during their pregnancy. While, overall, the prevalence rates of paternal postpartum depression in men usually range from 1.2% to 25.5%, when looking at the incidence of paternal postpartum depression in men whose wives are experiencing postpartum depression, the rates are between 24% and 50%. This meta- analysis also highlighted several studies that found paternal postpartum depression often begins after maternal postpartum depression (Goodman, 2003). Looking at this phenomenon from a family systems lens, which stresses that individuals within a family are not operating independently but rather they are affected by their relationships with others and the family unit as a whole, it is important for clinicians to be aware of how maternal postpartum depression symptomology interacts with paternal postpartum mental health.

Using Infertility Services to have a Child and Postpartum Depression

While there exists a significant body of literature on what are the risk factors for postpartum depression, including whether or not unintended pregnancy is a risk factor for postpartum depression, little research has focused on whether having a child as a result of medical or fertility treatments is associated with having postpartum depression (Lee et al., 2011; Monti et al., 2009; Munk-Olsen & Agerbo, 2015; Repokari et al., 2005; Ross et al.; 2010). Women using fertility services to have a child may be considered at the opposite end of the spectrum of pregnancy intention from women who experienced an unintended pregnancy and carried it to term. Women having an unintended birth are usually not trying to conceive. However, the behaviors of women seeking fertility services are overwhelmingly that they were trying to conceive but were unable to and turned to medical assistance and interventions for help with this process. Women who have

experienced infertility and conceived through medical intervention, whether it be fertility drugs or treatment, may be at a differential risk for postpartum depression, despite desiring to have a child.

Infertility

Infertility is defined as "not being able to get pregnant (conceive) after one year (or longer) of unprotected sex" (Centers for Disease Control and Prevention, 2017). Recent estimates suggest that around one in ten women in the United States are affected by infertility, either by having trouble becoming pregnant or carrying a pregnancy to term. Rates of infertility vary depending on the region of the world, with developing countries having a generally higher rate of infertility (Cousineau & Domar, 2007). With technological advances, there are now many options for individuals and couples that encounter fertility problems here in the U.S. and in other developed countries. Assisted reproductive technology (ART) has had success rates of around 37% for women that are under the age of 35 (Centers for Disease Control and Prevention, 2017). Studies have shown that infertility is associated with dysfunction in sexual relationships, anxiety, depression, difficulties in marital life, and problems with identity (Anderson, Sharpe, Rattray, & Irvine, 2003).

Research has consistently found that women who are experiencing infertility experience high levels of depression during the period in which they are trying to conceive, much higher than women who are fertile during this period (Ramezanzadeh et al., 2004; Verma & Baniya, 2016). In one study, researchers compared women who were fertile to a sample of infertile women and found that the difference in depression scores between the two groups was quite large: 57% of the women who were struggling with infertility met the criteria for depression as opposed to 11% of those in the fertile group.

This study also found that the longer a woman had been trying to conceive using fertility treatments and the older she was, the more likely she was to experience depression while trying to conceive (Verma & Baniya, 2016).

Infertility in the United States

The National Health Statistics Report (Chandra, Copen & Stephen, 2014), which tracks the use of infertility services in the United States, estimates that around 17% of women in the U.S. between the ages of 25 and 44 have used an infertility service, and 13% have used medical assistance to get pregnant. Receiving help to get pregnant is highest among several groups of women, which include older and nulliparous women, non-Hispanic white women, women who are currently experiencing infertility issues, and women with higher incomes and educational attainment (Chandra, Copen, & Stephen, 2014). Due to the high cost of receiving these treatments, there is often the perception that these treatments are reserved for women of the upper class, and it is often a reality that they are the only ones who are able to fully utilize these services. Many states have yet to institute mandated insurance policies to cover fertility services (National Conference of State Legislatures, 2014).

Current estimates suggest that despite the high cost of these treatments, which can range from $5,894 to $61,377 per successful outcome depending on which type of fertility treatment was used (Katz et al., 2011), 1.7% of women between the ages of 25-44 in the U.S. who completed the National Survey of Family Growth between 2006 and 2010 reported that they have done an artificial insemination and 0.7% of women reported that they have utilized an ART service. ART is defined as a treatment in which both the egg and the sperm are handled outside of the body in order to create a pregnancy (Chandra, Copen, & Stephen, 2014).

The various fertility treatments that are routinely conducted in the United States include, but are not limited to, controlled ovarian hyperstimulation, intrauterine insemination, and in vitro fertilization. Estrogen and progesterone are commonly affected by fertility treatments in order to achieve a pregnancy, and these are two of the hormones that have been found to relate to postpartum depression in the literature (Fan et al., 2009; Idaho Center for Reproductive Medicine, 2018). Controlled ovarian hyperstimulation is when the ovaries are stimulated to produce more than the naturally occurring amount of ovulatory follicles each month. This is accomplished through the administration of oral and injectable medications and sometimes used concurrently with intrauterine insemination. Intrauterine insemination (IUI) is where a sample of concentrated sperm is placed in the woman's uterus. In vitro fertilization (IVF) is more complex than the other procedures and is reserved for use when other methods have been tried and conception has not occurred. The process consists of many parts, beginning with ovulation stimulation, where hormonal injections are given to the woman to assist with egg production and to trigger ovulation once the eggs are mature. Then the eggs are retrieved from the woman's ovary and injected with the man's sperm in a lab setting. The last step consists of transferring a certain number of the viable embryos that were created into the woman's uterus several days later (Idaho Center for Reproductive Medicine, 2018).

Mental Health Services for Women using Fertility Services

Compared to women who do not experience fertility issues, women who experience fertility issues are more likely to have mental health issues before they conceive (Ramezanzadeh et al., 2004; Verma & Baniya, 2016). Thus having access to mental health services as one is experiencing fertility issues is important. However, most women who use fertility services receive mostly medical based services, such as meeting

with medical doctors to discuss procedures. The medical doctors provide these women with information about procedures that are available to them, such as artificial insemination, IUIs with or without drugs, or IVF, and they generally refer women to other services for psychological support. Such services include support groups and psychotherapy, which have both been found to be helpful in reducing psychological symptoms (de Liz & Strauss, 2005). In a randomized controlled clinical trial, it was actually found that both the group of depressed infertile women that received psychotherapy and the group of depressed infertile women that received an antidepressant experienced significant reductions in their depressive symptomology. While both of these groups saw improvements, greater improvements were seen in the psychotherapy group (Faramarzi et al., 2008).

Research has found that the depressive and anxiety symptoms that often accompany infertility are comparable to the psychological symptoms that accompany other medical illnesses, such as cancer, hypertension, and cardiac problems (Domar, Zuttermeister, & Friedman, 1993). Further illustrating the heavy psychological burden that can accompany fertility treatment is the fact that in a recent study, 19.1% of women stated that they needed professional help from a mental health professional during fertility treatments and 14.6% of men did (Repokari et al., 2005). Many individuals (40%) that dropped out of fertility treatment in a recent study cited that having access to a mental health professional or counselor at a fertility clinic would have been an immense help to them during treatment (Domar, Rooney, Hacker, Sakkas, & Dodge, 2018). In this study, the primary reason for discontinuation of fertility services was financial stress; however second was feeling too emotionally stressed to continue. The third reason cited for dropping out of fertility treatment was relationship issues and discord.

Researchers in one survey that was taken before women's first visit to the fertility clinic found that approximately 9.4% of the infertile women reported having suicidal thoughts (Rooney & Domar, 2018). Despite these responses from patients, only 21% of women and 11.3% of men in a study of patients seeking fertility treatments actually reported that they received mental health services during the course of this four year study. In this study, only 26.7% of women and 24.2% of men reported that they were ever provided with information about mental health services during the course of their fertility treatments, and patients that were experiencing high distress were no more likely to have received this information than patients who were experiencing less distress (Pasch et al., 2016). Given the evidence to support various treatment options for infertile individuals experiencing psychological distress, it is unfortunate that so few individuals are presented with information about these mental health services.

In qualitative interviews with women experiencing infertility, several themes have emerged, such as feeling as if one failed to fulfill the societal norm, feeling as though one's sense of personal identity has been assaulted through feelings of powerlessness, stigma, alienation, and the inability to have a genetic child, feeling as though one is mourning and passing through the stages as such, and finally feelings of transformation and restitution after a woman has experienced infertility for a substantial period of time. When women are able to reach this stage of transformation and restitution, they are able to work towards acceptance and disengaging from the fantasy of carrying a child and possibly being a parent. It is not uncommon for depression to occur alongside this transformational process (Gonzalez, 2000).

Current Research on Infertility and Postpartum Depression

While few professionals have recognized the importance of providing mental health resources to women as they go through the experience of infertility and the treatments that often accompany it (Pasch et al., 2016), even less attention is focused on continuing to follow these women as they go through pregnancy and transition to parenthood. The belief often times is that because these women have gone to great lengths to become pregnant–they have invested a lot of time, energy and money in the process–they should be beyond happy to have conceived and given birth to that long awaited child (Olshansky & Sereika, 2005). What may be overlooked is that women who give birth after utilizing fertility treatments have had to endure what can be an extremely stress inducing experience, one that is costly, can be medically invasive, and is often times far from what women anticipated their journey to pregnancy would be like. In addition to these stressors that can accompany fertility treatments, giving birth after using ARTs, even in the case of a singleton pregnancy, can be more complicated and stressful than for women who were able to conceive naturally. Women who utilized ARTs to conceive are more likely to have a baby that is born prematurely and with low birth weight in comparison to women who gave birth following natural conception. They also have a greater risk of experiencing certain complications during pregnancy in comparison to women who conceived naturally (Allen et al., 2008). These fears and stress then only add to what was often times an already long and stressful journey to achieve conception, and research has shown that stress is a risk factor for PPD (Beck, 2001) along with complications during pregnancy (Burger, Horowitz, Forsyth, Leventhal, and Leaf, 1993).

A few studies have examined the mental health effects of having conceived with IVF versus naturally on women during their pregnancy. The research has not shown a

consistent picture regarding whether women who conceive with IVF have higher or lower levels of anxiety and depressive symptoms during pregnancy. Some research has found that women who used fertility treatments to conceive have higher levels of depressive or anxiety symptoms during pregnancy compared to women who did not use such services (Hjelmstedt, Widstrom, Wramsby, Matthiesen, & Collins, 2003; Monti et al., 2009). However, research has also found that women who utilized fertility treatments to conceive do not differ in their depressive symptoms during pregnancy from women that conceived naturally (Klock & Greenfield, 2000).

Currently, there has been a very small literature investigating postpartum depression in women who used fertility services to have a child (Lee et al., 2011; Monti et al., 2009; Munk-Olsen & Agerbo, 2015; Repokari et al., 2005; Ross et al., 2010). Moreover, this literature has not shown a consistent picture regarding whether using fertility services increases women's risk of postpartum depression or is associated with higher levels of postpartum depressive symptoms. Some research suggests using fertility services is associated with higher rates or symptoms of postpartum depression (Lee et al., 2011; Monti et al., 2009); other research suggests there is no association (Munk-Olsen & Agerbo, 2015); and other research suggests using fertility services is associated with lower rates or symptoms of postpartum depression (Repokari et al., 2005).

One study found that women who conceived after utilizing ARTs had higher levels of distress during pregnancy and postpartum than women who conceived naturally. They also found these women were more emotionally vulnerable than women who conceived naturally after the birth (Monti et al., 2009). The partners of these women showed similar effects. Another study found that 25% of the women from their sample that had utilized IVF treatments to become pregnant had postpartum depression, and they

found that the more cycles of treatment with IVF, the more perceived stress associated with the treatment, and having less social support were all positively correlated with postpartum depression (Lee et al., 2011).

Munk–Olsen and Agerbo (2015) found that in a Danish population cohort of women using IVF, those who became new mothers had a higher risk of having a psychiatric episode in the first 90 days postpartum compared with women in the cohort who did not end up delivering a first child but had attempted to using IVF. In this study, the prevalence of psychiatric episodes in the postpartum period was also compared to the prevalence of postpartum psychiatric episodes in the entire Danish population, and no differences were found. While the Munk-Olsen and Agerbo (2015) study shows that women who use IVF do not have different rates of psychiatric admissions in the postpartum period compared to all women in the postpartum period, this study does not examine whether there are differences in postpartum psychiatric admission between women using IVF and those not using IVF.

On the other hand, Repokari and colleagues (2005) found that the mental health of couples that had utilized ARTs was very resistant during their progression into parenthood, more so than the individuals that conceived naturally. In fact, they found that the couples that had conceived using ARTs were not as affected by social and child care related stressors after the birth, and these couples consistently had lower depressive scores throughout the pregnancy and in the early postpartum period in comparison to the control group. They hypothesized that having experienced infertility altered these couples way of responding to stress and setbacks so that they were better prepared to handle parenthood. In a review conducted by Ross, McQueen, Vigod, and Dennis (2010), they

also found that there was little to no increased risk for postpartum depression in women who utilized ARTs.

Why Infertility Might Increase Risk of Postpartum Depression

Olshansky and Sereika (2005) developed and proposed a theoretical explanation for why women who were previously infertile may be more susceptible to postpartum depression. This theoretical explanation outlines the "divided self", which is proposed as a predictor of postpartum depression. This concept refers to the notion of being outwardly compliant while still experiencing a lot of internal anger within oneself due to one's experiences with infertility. Women who experience this "divided self" find it difficult and unsafe to show their true feelings and selves to others, and therefore often minimize the internal anger that they feel, which can lead ultimately to internalized guilt.

Olshanksy (2003) proposed the Relational Cultural Theory as well to explain previously infertile women's susceptibility to postpartum depression. This theory posits that the psychological turmoil that these women experienced during infertility is not over just because they were able to conceive and have a child, but rather they now face a sort of identity crisis. While these women were experiencing infertility, their identity revolved around their infertility, with their lives being built around this. Many women who experience infertility find it difficult to even be around women that are pregnant or have children during this period; therefore, many of them normally make changes to their social circles during this time. Many women also utilize infertility support groups, where they are surrounded by other infertile women. Infertility permeated many aspects of their lives, and there is a drastic shift when one becomes pregnant and has to shift to the identity of being fertile and a parent. These women are often left feeling as though they don't belong in either the infertile world or the fertile world anymore, which may lead to

feelings of disconnection with others, which can contribute to the development of postpartum depression.

In addition to these two theories, Dr. Hammer Burns proposes that the crisis of infertility can also be understood through the lens of boundary ambiguity. As couples experience infertility, they are confronted with a highly ambiguous situation. Lacking control, many of them remain in a state where they are unsure of whether the child they have fantasized about will ever be able to physically join their family. Research within other contexts has found that having high levels of boundary ambiguity can often lead to depressive symptoms (Boss, Caron, Horbal, & Mortimer, 1990). These infertile couples can usually very vividly picture this fantasy child. Dr. Hammer Burns describes that this fantasy child is usually envisioned as a child or toddler that can interact with the parents rather than a baby when the couple pictures them. This child is also often times perfect and ideal in almost every way. Therefore, one could imagine that once the couple passes through infertility and is able to have a baby, they may experience some adjustment as they adapt to having a new baby that does not exactly fit the expectations and fantasies that they have had throughout their experience with infertility. Dr. Hammer Burns stresses the importance of couples letting go of this fantasy child before moving into parenthood in order to accept the physical child for who he or she is rather than what they had envisioned for so long. Entering into parenthood with this fantasy child in mind can lead to an even harder transition (Hammer Burns, 1987).

Lastly, given the vast amount of research that has focused in on the hormonal shift that occurs after pregnancy and its relationship with the development of postpartum depression, it is important to take into consideration that many fertility treatments involve the administration of hormones, and some of the more common hormones that are

utilized in these treatments have been found to have side effects that are psychological in nature. For example, progesterone has potential side effects such as depression and irritability, whereas estradiol (a form of estrogen) can have antidepressant effects. Lupron, commonly used in patients with endometriosis, can cause depression, fine motor problems, and cognitive problems as well (Williams & Zappert, 2006). While many of these hormones are administered around the time of conception, some continue to be administered during the pregnancy for some time. For example, following IVF, it is common for women to continue receiving progesterone and estrogen for a significant period of time (up to 12 weeks) after the procedure (Covington & Hammer Burns, 2006). Given the side effects of these hormones that many women who have undergone fertility treatments have been exposed to, one could hypothesize that this could not only effect their mental health during the conception phase and pregnancy, but possibly continue in to the postpartum period.

Purpose of the Study

Depression is one of the leading causes of disease-related disability in females (Noble, 2005), and postpartum depression is a mental disorder that affects a number of women after childbirth. While there has been research aimed at understanding more about the contributing factors to postpartum depression and treatments for postpartum depression, little research has examined whether conceiving by fertility treatments versus naturally is associated with differential risk for postpartum depression. It is important to learn more about the mental health outcomes in women using fertility services as such services become more and more accessible to individuals. Increasing our understanding about fertility treatments and postpartum depression will be useful for developing preventative or intervention programs that can be utilized by women during pregnancy and in the postpartum period and for informing clinical practice.

Given the limited existing research on postpartum depression in women who have experienced infertility, the present quantitative study sought to investigate more about this possible relationship. The goal of this study was to determine whether the symptom levels and prevalence of postpartum depression differs between women who conceived naturally and were intending to conceive, women who conceived naturally and did not intend to conceive (a previously identified at risk group for the development of postpartum depression [Cheng, Schwarz, Douglas, & Horon, 2009]), and women who conceived using fertility treatments. Understanding more about whether postpartum depressive symptoms and postpartum depression risk varies by pregnancy intention and use of fertility treatments will have important implications for clinical practice and prevention/intervention programs designed for these women.

Objectives and Hypotheses

We used the Pregnancy Risk Assessment Monitoring System (PRAMS) data, that is collected annually by the Centers for Disease Control and Prevention (CDC), in order to study in greater depth whether the prevalence of postpartum depression and level of postpartum depressive symptoms differs by the combination of fertility treatment use and pregnancy intention. The sample was composed of women who 1) conceived naturally and unintentionally (unintended pregnancy group), 2) conceived using fertility drugs or treatment intentionally (fertility treatment group), and 3) conceived naturally and intentionally (intended, natural conception group).

We hypothesized that:

1. Women who conceived naturally and unintentionally (henceforth called unintended pregnancy group) and women who conceived using fertility treatment/drugs intentionally (henceforth called fertility treatment group) would have a higher prevalence of postpartum depression and more depressive symptoms than women who conceived naturally and intentionally (henceforth called intended, natural conception group).

Methodology

Data

This study used data from the Pregnancy Risk Assessment Monitoring System (PRAMS), a survey that is conducted annually by the CDC (Centers for Disease Control and Prevention). PRAMS serves to assess and gather information about new mother's experiences, attitudes, and behaviors before pregnancy, during pregnancy, and in the postpartum period. These data are collected annually by the CDC in conjunction with 47 states, the District of Columbia, Puerto Rico, New York City, and the Great Plains Tribal Chairmen's Health Board. This information is used to learn more about the various factors that might contribute to the health of new mothers and babies, and to reduce maternal and infant mortality and low birth weight in the United States. This survey intends to represent all US residents, with 51 areas in the United States participating in the survey (47 states and 4 territories). The study begins recruiting women 2-4 months after they have given birth through birth certificate data. Women usually respond to the survey between 2 and 8 months postpartum. Each state in the United States reaches out to approximately 100-250 new mothers that are eligible for the study per month. Women who gave birth to babies with low birth weight are often over sampled in PRAMS, and the states often stratify based upon the mother's race and ethnicity. It is left up to the states' discretion which specific groups they will chose to oversample. Exclusion criteria for the study include having had a stillborn child. Women whose babies have passed away since birth are still eligible to participate in PRAMS, but are sent slightly different materials in their questionnaire letter to express condolences for their loss.

PRAMS is a mixed-mode surveillance system. Initial contact is made through a letter that is sent to the new mother in the mail. The woman is told of PRAMS and that

she should expect to receive a questionnaire booklet in the mail soon. The questionnaire booklet is sent several days after this letter and contains information regarding PRAMS, an informed consent, the questionnaire booklet, a booklet with frequently asked questions to help answer some of the recipients questions that they may have about the study, information about any incentive that the state may be offering for the woman's participation in the study (such as a magnet or option to be entered into a raffle), and an envelope for the woman to return her completed questionnaire booklet. While an informed consent is provided to the participant, they are not required to return it to the state with their completed questionnaire packet. Consent is implied with their completion of the packet. Individuals who are under the age of 18 who are new mothers are eligible to participate in PRAMS and are able to consent without parental involvement.

Another letter is sent out to all the women approximately a week after they should have received their initial packet, which serves as both a reminder for the woman to complete her initial packet but also as a thank you for her participation.

If a mother has not responded 1-2 weeks after this thank you letter was sent, an additional questionnaire packet is sent to her followed by another one 1-2 weeks after that. As a last attempt, researchers attempt to contact the woman by phone in order to complete the questionnaire. The mail in version of the questionnaire is estimated to take approximately 20 minutes to complete, with the phone interview taking slightly longer. The surveys are available in English and Spanish, and in select areas Chinese as well.

There are three types of questions in PRAMS: those created by the CDC that all states administer to participants (called core questions), those created by the CDC but only some states administer (called standard questions), and those that are created by the state and used for only that state (called state developed questions). In addition to the

PRAMS data, when given the data one is given some information from the birth certificate for the woman and the child born. Core questions on average make up 55-60% of the total questionnaire each year. This study uses data from the core and standard questions that were created by the CDC and information that is collected through birth certificate data, all of which is included in the PRAMS dataset.

The topic areas that are covered in the core questions portion of the PRAMS questionnaire include preconception health and health care, pregnancy intention, health insurance coverage, contraception, prenatal counseling, health conditions during pregnancy, alcohol use, physical abuse, mental health, postpartum check-ups, and household income. Some of the standard topics that are in the PRAMS questionnaire relate to fertility treatment use, HIV testing, infections and chronic conditions, pregnancy complications, discrimination, social support, physical activity, reproductive history, stressful life events, family history of chronic conditions, and household characteristics. More information about PRAMS can be found online at the Centers for Disease Control and Prevention website (https://www.cdc.gov/prams/methodology.htm).

Sample

This study utilized data that was collected from 2009–2017. Overall, 265,814 women completed the PRAMS questionnaire within this time frame. The sample for our study consisted of 145,036 women - all of whom were given and answered the questions related to our variables of interest. These included information regarding maternal age, marital status, intimate partner violence (IPV), maternal education, maternal race/ethnicity, insurance status at time of birth, previous births, manner of delivery, information regarding stressful events experienced during the conception period and pregnancy, previous history of consultation or treatment for depression and anxiety,

postpartum depressive symptoms, infant's admittance into the NICU, whether the birth was a singleton or multiple, fertility treatment utilization, and pregnancy intention. Women who were not given all of these questions or did not answer all of these questions were excluded from our sample, as were women who's infant had passed away since birth (120,778 women were excluded in total). Overall, our sample consisted of women from 31 states and New York City. All women in our sample were categorized into one of our three groups: Women who had an unintended pregnancy (n=63,532), women who conceived with fertility treatments or drugs (n=5,113), and women who conceived naturally and intentionally (n=76,391).

Descriptive information on our sample as a whole, as well as the three groups, is summarized in Table 1.

Measures

Dependent Variable

Postpartum depression. Our dependent variable was assessed using two or three of the core questions within the "mental health" section of PRAMS. The participants were asked several questions in regards to postpartum depression that they answered on a 5-point Likert-like scale. In phase 6, the questions related to postpartum depression were worded as such:

"Below is a list of feelings and experiences that women sometimes have after childbirth. Read each item to determine how well it describes your feelings and experiences. Then, write on the line the number of the choice that best describes how often you have felt or experienced things this way *since your new baby was born*. Use the scale when answering: 1 = never, 2 = rarely, 3 = sometimes, 4 = often, and 5 = always.

a. I felt down, depressed, or sad

b. I felt hopeless

c. I felt slowed down"

These answers were summed to create a sum score for each participant, with the lowest score possible being a 3 and the maximum a 15. These variables were entitled "PP_SAD", "PP_NHOPE", and "PP_SLOW" in the dataset.

In phase 7, there were only two questions regarding postpartum depression, and they were worded as such: "Since your new baby was born, how often have you felt down, depressed, or hopeless?" and "Since your new baby was born, how often have you had little interest or little pleasure in doing things?" Participants answered these two questions using the scale: 1 = always, 2 = often, 3 = sometimes, 4 = rarely, and 5 = never. New variables were created to recode the values of Phase 7 variables. "Never" was recoded so that the new value corresponding to it was 1, "Rarely" was recoded so that the new value corresponding to it was 2, "Often" was recoded so that the new value corresponding to it was 4, and "Always" was recoded so that the new value corresponding to it was 5. We did this to ensure that the higher levels on the depression items for both phase 6 and phase 7 indicated more depressive symptoms. These answers were summed to create a sum score for each participant, with the lowest score possible being a 2 and the maximum a 10.

Due to the different scales that are present in the two phases of data we used, we standardized the values by creating z scores separately for those who answered all three questions in phase 6 and those who answered both questions in phase 7. The continuous z-score was used as a measure of *depressive symptoms*. We also created a categorical

variable to code *depression status*. Those who were at or above a z-score of 2 (indicating two standard deviations above the mean) were considered to be depressed.

Independent Variable

We used information on pregnancy intention and fertility treatment use to create our independent variable of pregnancy group, which included three groups: 1) women who did not use fertility services and did not intend to get pregnant, 2) women who used fertility services to become pregnant, and 3) women who did not use fertility services and intended to become pregnant.

Fertility treatment use/infertility. Fertility treatment was coded using information from the standard questionnaire or the birth certificate data. In the standard questionnaire, some states gave an "Assisted Reproduction" section. If a participant received these questions and indicated in question A1 ("Did you take any fertility drugs or receive any medical procedures from a doctor, nurse, or other health care worker to help you get pregnant with your *new* baby? This may include infertility treatments such as fertility-enhancing drugs or assisted reproductive technology.") that they had utilized fertility drugs or treatments to become pregnant they were coded as having utilized fertility treatments and assumed to have experienced infertility. The states that administered this "standard question" in phase 6 were Delaware, Illinois, Maryland, Nebraska, New York, Utah, Massachusetts, Missouri, Virginia, and Michigan, and in phase 7 they were Delaware, Massachusetts, Maryland, Michigan, New York, Utah, and Vermont. Women were able to answer either yes or no to this question. This variable is denoted as "ART_HELP" in the PRAMS dataset. If they indicated that they had utilized fertility drugs or treatment, some states then prompted them with a follow up question regarding the services that they utilized. This was also a "standard question". In phase 6,

Delaware, Maryland, New York, and Massachusetts utilized this follow up question and in phase 7, Massachusetts, Maryland, New York, and Utah utilized this question. This question asked "Did you use any of the following fertility treatments during the month you got pregnant with your new baby?" Participants were able to then indicate whether they utilized:

1) Fertility enhancing drugs prescribed by a doctor (coded as ART_DRUG in the PRAMS dataset)
2) Artificial insemination or intrauterine insemination (treatments in which sperm, but NOT eggs, were collected and medically placed in the woman's body) (coded as ART_INSM in the PRAMS dataset)
3) Assisted reproductive technology (treatments in which BOTH a woman's eggs and a man's sperm were handled in a lab, such as in in vitro fertilization, gamete intrafallopian transfer, zygote intrafallopian transfer, intracytoplasmic sperm injection, frozen embryo transfer or a donor embryo transfer) (coded as ART_AST in the PRAMS dataset)

Participants were also able to indicate if they had used a different fertility treatment not listed or if they had not utilized one in the month they became pregnant. If a participant indicated that they had used one of these fertility treatments or drugs, but they had not answered previous questions, such as question A1, on whether fertility treatments were used to conceive, they were still coded as having used fertility treatments.

Fertility treatment use/infertility was also assessed through information gathered from birth certificate data. This variable is denoted as "INFER_TR" in the dataset. If a woman's birth certificate data indicated that she had utilized fertility treatments, she was coded as having utilized fertility treatments and assumed to have experienced infertility.

Pregnancy intention. Pregnancy intention was assessed by participants' answers to question 11 in the phase 6 data and question 12 in the phase 7 data from PRAMS. Both of these questions were part of the core questions within the section on "pregnancy intention" and asked the following: "Thinking back to *just before* you got pregnant with your *new* baby, how did you feel about becoming pregnant?" Participants were able to choose one of four answers to this question in phase 6: "I wanted to be pregnant sooner", "I wanted to be pregnant later", "I wanted to be pregnant then" or "I didn't want to be pregnant then or at any time in the future". If they answered that they would have liked to have been pregnant sooner or then, they were coded as intending to become pregnant. If they responded that they wanted to be pregnant later or not at any time in the future or then, they were coded as not intending to become pregnant. Participants were able to choose one of five answers to this question in phase 7: "I wanted to be pregnant sooner", "I wanted to be pregnant later", "I wanted to be pregnant then", "I didn't want to be pregnant then or at any time in the future" or "I wasn't sure what I wanted". If they answered that they would have liked to have been pregnant sooner or then, they were coded as intending to become pregnant. If they responded that they wanted to be pregnant later, not then or at any time in the future, or that they were not sure what they wanted, they were coded as not intending to become pregnant. This variable for pregnancy intention is denoted as "FEEL_PG" in phase 6 and "PG_INTENT" in phase 7.

Covariates

We selected covariates based on theory and previous research. We included sociodemographics, health related factors, relationship factors, and birth characteristics.

Sociodemographics

We included the sociodemographics of age, race/ethnicity, education, and insurance status at time of birth.

Maternal age. Maternal age was assessed using birth certificate data. Birth certificate information indicated which of the following age brackets the mother fell into at the time of the birth: less than 17 years of age, 18-19, 20-24, 25-29, 30-34, 35-39, and 40+. This variable for maternal age is denoted as "MAT_AGE_NAPHSIS" in the original dataset. We recoded this variable so that the new age brackets were: less than 17 years, 18-24, 25-29, 30-34, and 35+.

Maternal race/ethnicity. Maternal race/ethnicity was assessed using birth certificate data. Birth certificate information indicated which of the following races the mother indicated on the birth certificate: other Asian, White, Black, American Indian, Chinese, Japanese, Filipino, Hawaiian, other (non-white), Alaska native, and mixed race. This variable for maternal race is denoted as "MAT_RACE" in the original dataset. We recoded this variable by combining certain categories and adding in ethnicity, which was also gathered from birth certificate data. This left us with a race/ethnicity variable. Participants were either coded as White, Hispanic/White, non-Hispanic Black, or other.

Maternal education. Maternal education was assessed using birth certificate data. Birth certificate information indicated which of the following education brackets the mother fell into at the time of the birth: 0-8 years, 9-11 years, 12 years, 13-15 years, and more than 16 years. This variable for maternal education is denoted as "MAT_ED" in the original dataset.

Insurance status. Insurance status at the time of birth was assessed using birth certificate data. Birth certificate information indicated which of the following the mother

had at the time of the birth: Medicaid, private insurance, paid out of pocket, Indian health service, Champus/Tricare, other government provided insurance, or "other". Medicaid, Indian health service, Champus/Tricare, or other government provided insurance was coded as having public insurance. Private insurance remained coded as such, as did paying out of pocket and "other". The original variable for insurance status is denoted as "PAY" in the original dataset.

Health Related Factors

Stress and history of depression or anxiety were included as health related factors.

Stress. Stress was assessed by participants answers to question 33 in the phase 6 data and question 36 in the phase 7 data from PRAMS within the "Stress" section of the questionnaire. Both of these questions were core questions. In phase 6 and in phase 7, the participant was presented with a list of stressors and asked to indicate which of them had occurred in the 12 months prior to the baby being born. The participant was asked to indicate yes or no for each stressor. A yes for each stressor was coded as a 1, whereas an answer of no was coded as a 0. We then summed all the stressors together to create a composite score of stress. In total, 12 stressors were considered for inclusion in this sum score, and participants had to have given a response to at least 9 of the 12 questions in order to be included in our sample. We recoded the stress variable as a categorical variable, with women falling into one of five categories: having experienced no stressors, 1 stressor, 2 stressors, 3 stressors, or 4 or more stressors in the 12 months prior to the baby being born. For a complete list of the 12 stressors see Appendix 1.

History of being checked or treated for depression or anxiety. History of depression or anxiety was assessed using participants answers to question 1 in the phase 6 data and question 7 in the phase 7 data from PRAMS within the "Pre-Conception

Readiness" section of the questionnaire. Both of these questions were core questions. Participants were asked "at any time during the 12 months before you got pregnant with your new baby, did you do any of the following things? For each item, check No if you did not do it or Yes if you did it." If they answered yes to having been to a health care worker to be checked or treated for depression or anxiety, they were coded as having a history of depression or anxiety. These variables were originally denoted as "PRE_MH" in phase 6 and "PRE_DEPR" in phase 7 in the dataset.

Relationship Factors

We included marital status and IPV either during the pregnancy or in the year before the pregnancy as relationship factors.

Marital status. Marital status was assessed using birth certificate data. Birth certificate information indicated whether the participant was married or "other". This variable for marital status is denoted as "MARRIED" in the original dataset.

IPV. Two variables were included as our measures of IPV, "PAB6HUS" and "PAD6HUS". These were questions 34 and 35 on phase 6 and questions 37 and 38 on phase 7 under the "Abuse" subsection of the PRAMS questionnaire. These were all core questions. One assessed for abuse before the pregnancy and the other assessed for abuse during the pregnancy. Abuse was defined as your partner "pushing, hitting, slapping, kicking, choking, or physically hurting you in any other way." Participants either indicated yes or no to these two questions.

Birth Characteristics

We included infant's admittance into the NICU, manner of delivery, plurality, and previous births as birth characteristics.

Infant's admittance to the NICU. Admittance into the NICU was assessed using participants answers to question 41 within the "Morbidity" section of the questionnaire. This was a core question. Participants were asked if their child was placed in the NICU after birth. They were able to indicate yes, no, or that they did not know. Individuals who indicated that they did not know were coded as missing this data point in the system. This variable is denoted as "INF_ICU" in the original dataset.

Manner of delivery. Manner of delivery was assessed using birth certificate data. Birth certificate information indicated whether the participant delivered vaginally or not. This variable was denoted as "DEL_VAG" in the original dataset.

Plurality. Plurality was assessed using birth certificate data. Birth certificate information indicated whether the participant delivered a singleton, twins, or other multiple. This variable was denoted as "PLURAL" in the original dataset.

Previous births. Previous births were assessed using participants' answers to question 8 in phase 6 and question 4 in phase 7 within the "Reproductive History" section of the questionnaire. These were core questions. Participants were asked if before this birth they had given birth to another baby who was born alive. They were able to indicate yes or no. This variable is denoted as "PREV_LB" in the original dataset.

Analysis

We conducted unadjusted and adjusted linear (depressive symptoms) and binomial logistic (depression status) regression analyses. Our first models examined the association between pregnancy group and depressive symptoms and depression status without controlling for any covariates. We then examined the association between pregnancy group and depressive symptoms and depression status controlling for all of our covariates.

All our analyses were conducted using SPSS, and we took the complex sample design into account. We used SUD_NEST for strata variable, WTANAL for sample weight, and TOTCNT for population size according to PRAMS documentation.

Results

Descriptive and Bivariate Statistics

Descriptive information on our sample as a whole, as well as by the three groups, is summarized in Table 1.

We examined whether there were differences between our three pregnancy groups in the study variables. Women who had used fertility treatments were more likely to be older, be married, have more education, be using private insurance for the birth, have had multiple babies born during the most recent pregnancy, have given birth via a Cesarean-section for the most recent birth, were more likely to identify as White and were more likely to have had a their new infant admitted to the NICU after birth than women who had unintended pregnancies and women who had intended, natural pregnancies, *ps* < .05. Women who had unintended pregnancies were more likely to have experienced IPV before and during pregnancy, be younger, not be married, and have had lower educational attainment than the fertility treatment group and the intended, natural pregnancy group, *ps* < .05. Mean depressive symptoms for each group can be found in Table 1 along with information regarding prevalence of postpartum depression by group.

Table 1

Descriptive Statistics on Sample (Unweighted N=145,036, Weighted N=7,965,820)

	Entire Sample (Unweighted)	Unintentional Pregnancy (unweighted n=63,532)	Fertility Tx (unweighted n=5,113)	Natural, Intentional Conc. (unweighted n=76,391)	Chi Square P Value
Age					
<17	1.2%	2.4%	0.0%	0.3%	0.000**
18-24 years	25.8%	37.9%	3.7%	17.4%	
25-29 years	30.0%	28.3%	20.9%	31.9%	
30-34 years	27.6%	20.0%	37.3%	33.1%	
35+ years	15.3%	11.4%	38.0%	17.2%	
Education					
0-8 years	2.6%	3.0%	0.3%	2.5%	0.000**
9-11 years	9.8%	13.8%	1.5%	7.1%	
12 years	23.4%	29.9%	8.3%	19.0%	
13-15 years	29.2%	32.7%	22.5%	26.7%	
>16 years	35.0%	20.6%	67.4%	44.7%	
Race/Ethnicity					
White	64.7%	56.4%	81.4%	70.3%	0.000**
White/Hispanic	13.3%	14.8%	4.3%	12.6%	
Non-Hispanic/Black	13.7%	20.8%	4.2%	8.7%	
Other	8.3%	7.9%	10.1%	8.4%	

Insurance					
Private	54.0%	38.7%	89.6%	64.2%	0.000**
Public	41.4%	56.4%	8.5%	31.3%	
Self-Pay (no insurance)	2.8%	2.9%	1.2%	2.7%	
Other	1.8%	2.0%	0.7%	1.8%	
Relationship Context					
Marital Status					
Married	63.6%	43.4%	92.0%	77.9%	0.000**
Other	36.4%	56.6%	8.0%	22.1%	
IPV					
Year before Pregnancy					
Yes	2.8%	4.4%	1.0%	1.6%	0.000**
No	97.2%	95.6%	99.0%	98.4%	
During pregnancy					
Yes	2.4%	3.9%	0.8%	1.4%	0.000**
No	97.6%	96.1%	99.2%	98.6%	
Birth Context					
Previous Births					
Yes	59.1%	59.8%	40.7%	59.5%	0.000**
No	40.9%	40.2%	59.3%	40.5%	
NICU					
Yes	12.1%	12.7%	19.6%	11.3%	0.000**
No	87.9%	87.3%	80.4%	88.7%	
Plurality					
Singleton	98.1%	98.6%	83.3%	98.4%	0.000**
Twins	1.9%	1.3%	15.8%	1.6%	
Other	0.0%	0.0%	0.9%	0.0%	

Vaginal Birth					
Yes	67.3%	68.7%	49.8%	67.0%	0.000**
No	32.7%	31.3%	50.2%	33.0%	
Psychological Health					
Stress					
0	31.1%	21.5%	45.4%	37.8%	0.000**
1	25.7%	22.5%	28.5%	28.0%	
2	17.4%	18.4%	15.5%	16.8%	
3	10.8%	13.8%	6.9%	8.7%	
4+	15.0%	23.7%	3.8%	8.7%	
History of Depression or Anxiety					
Yes	16.0%	18.5%	17.2%	14.1%	0.000**
No	84.0%	81.5%	82.8%	85.9%	
Depressive Symptoms	M = -0.05 SE = 0.00	M = 0.09[a] SE = 0.01	M = -0.12[b] SE = 0.02	M = -0.16[c] SE = 0.01	
Depression Status					
Yes	4.1%	5.9%	2.5%	2.7%	0.000**
No	95.9%	94.1%	97.5%	97.3%	

Note: All variables were categorical except depressive symptoms which was continuous and ranged from -1.2 to 3.32.
Note: Different superscripts on depressive symptoms signify a statistically significant difference between the two means at the 0.05 level in an unadjusted analysis.

We also examined whether depressive symptom levels or depression status varied by study variables, such as maternal age, marital status, history of IPV, maternal education, maternal race/ethnicity, insurance status at time of birth, previous births, manner of delivery, stress during conception period and pregnancy, previous history of consultation or treatment for depression and anxiety, infant's admittance into the NICU, and whether the birth was a singleton or multiple (see Table 2).

Table 2

Bivariate relationship between study variables and depressive symptoms and depression status (Unweighted N=145,036, Weighted N = 7,965,820)

	Depressive Symptoms – Mean (Standard Error)	Depression Status		P Value
		Yes	No	
Age				
<17	M = 0.07[a] (0.03)	1.5%	1.2%	0.000**
18-24 years	M = 0.03[a] (0.01)	36.9%	25.3%	
25-29 years	M = -0.07[b] (0.01)	29.3%	30.1%	
30-34 years	M = -0.09[c] (0.01)	20.8%	27.9%	
35+ years	M = -0.10[c] (0.01)	11.5%	15.5%	
Education				
0-8 years	M = -0.15[a] (0.03)	2.4%	2.6%	0.000**
9-11 years	M = 0.00[b] (0.02)	15.8%	9.6%	
12 years	M = -0.03[b] (0.01)	30.9%	23.1%	
13-15 years	M = -0.01[b] (0.01)	32.6%	29.0%	
>16 years	M = -0.12[a] (0.01)	18.3%	35.7%	
Race/Ethnicity				
White	M = -0.04[a] (0.01)	60.2%	64.9%	0.000**
White/Hispanic	M = -0.19[b] (0.02)	13.0%	13.3%	
Non-Hispanic/Black	M = -0.05[a] (0.01)	18.4%	13.5%	
Other	M = 0.01[c] (0.01)	8.4%	8.3%	
Insurance				
Private	M = -0.10[a] (0.00)	36.5%	54.8%	0.000**
Public	M = 0.00[b] (0.01)	59.1%	40.6%	
Self Pay (no insurance)	M = -0.03[b] (0.03)	2.7%	2.8%	
Other	M = -0.15[a] (0.04)	1.8%	1.8%	

Relationship Context				
Marital Status				
Married	M = -0.11[a] (0.00)	45.6%	64.3%	0.000**
Other	M = 0.04[b] (0.01)	54.4%	35.7%	
IPV				
Year before Pregnancy				
Yes	M = 0.66[a] (0.03)	11.7%	2.4%	0.000**
No	M= -0.07[b] (0.00)	88.3%	97.6%	
During pregnancy				
Yes	M = 0.68[a] (0.03)	9.7%	2.1%	0.000**
No	M = -0.07[b] (0.00)	90.3%	97.9%	
Birth Context				
Previous Births				
Yes	M = -0.06[a] (0.01)	63.1%	58.9%	0.000**
No	M = -0.05[a] (0.01)	36.9%	41.1%	
Plurality				
Singleton	M = -0.05[a] (0.00)	98.3%	98.1%	0.182
Twins	M = -0.02[a] (0.02)	1.6%	1.9%	
Other	M = -0.04[a] (0.07)	0.0%	0.0%	
NICU				
Yes	M = 0.06[a] (0.01)	17.9%	11.9%	0.000**
No	M = -0.07[b] (0.00)	82.1%	88.1%	
Vaginal Birth				
Yes	M = -0.07[a] (0.00)	64.0%	67.4%	0.001**
No	M = -0.03[b] (0.01)	36.0%	32.6%	
Psychological Health				
Stress				
0	M = -0.31[a] (0.01)	11.1%	31.9%	0.000**
1	M = -0.16[b] (0.01)	14.4%	26.2%	
2	M = -0.02[c] (0.01)	16.7%	17.5%	
3	M = 0.13[d] (0.01)	14.2%	10.7%	
4+	M = 0.48[e] (0.01)	43.6%	13.8%	
History of Depression or Anxiety				
Yes	M = 0.30[a] (0.01)	33.5%	15.3%	0.000**
No	M = -0.12[b] (0.00)	66.5%	84.7%	

Note: Within a variable, different superscripts on depressive scores signify a statistically significant difference between the two means at the 0.05 level.

Linear Regression

We examined whether the three pregnancy groups differed on depressive symptoms in a linear regression analysis. The unadjusted mean depressive symptoms in the fertility treatment group was (M = -0.12, SE = 0.02) significantly different from the mean depressive symptoms in the natural, intended conception group (M = -0.16, SE = 0.01), p = .035. Women who had an unintended pregnancy had mean depressive symptoms significantly higher (M = 0.09 SE = 0.01), than women who conceived naturally and intentionally and the women who had utilized fertility treatments, ps < 0.01 (see Table 1, Table 3, and Figure 1).

We also conducted linear regression analyses adjusting for maternal age, maternal education, maternal race/ethnicity, insurance status at time of birth, marital status, IPV, previous births, manner of delivery, infant's admittance into the NICU, whether the birth was a singleton or multiple, information regarding stressful events experienced during conception period and pregnancy, and previous history of consultation or treatment for depression and anxiety. Once adjusted means were considered, women who used fertility treatments no longer differed from the natural, intentioned conception women in depressive symptoms. Women who had unintended pregnancies had higher adjusted means (adjusted M = 0.10, SE = 0.03) compared to women who had intended, natural conceptions (adjusted M = -0.05, SE = 0.03) and to women who had used fertility services (adjusted M = -0.03, SE = 0.03) ps < 0.01. Women who used fertility services had comparable adjusted means to women who had a natural and intentional conception (p=0.221). A graphical display is presented in Figure 1. Other significant predictors of postpartum depressive symptoms in the linear regression included IPV both during and before the pregnancy, marital status, manner of birth (vaginal vs. Caesarean-section),

maternal race/ethnicity, overall stress experienced during the conception period and pregnancy, history of depression or anxiety, infant's admittance to the NICU after birth, and insurance status (see Table 3). Women who had experienced IPV either during or before their pregnancy had more depressive symptoms as did the women who were married and those who gave birth via Caesarean-section. Women who identified as Hispanic or Non-Hispanic/Black had less symptoms of depression than women who identified as White, whereas women who identified as "Other" had higher depressive symptoms. Women who had a history of being checked or treated for depression or anxiety, those whose infant spent time in the NICU after birth, those who had experienced more stressful events, and those who had private insurance or no insurance had more depressive symptoms as well.

Table 3

Linear Regression of Depression Symptoms by Group without and with Covariates

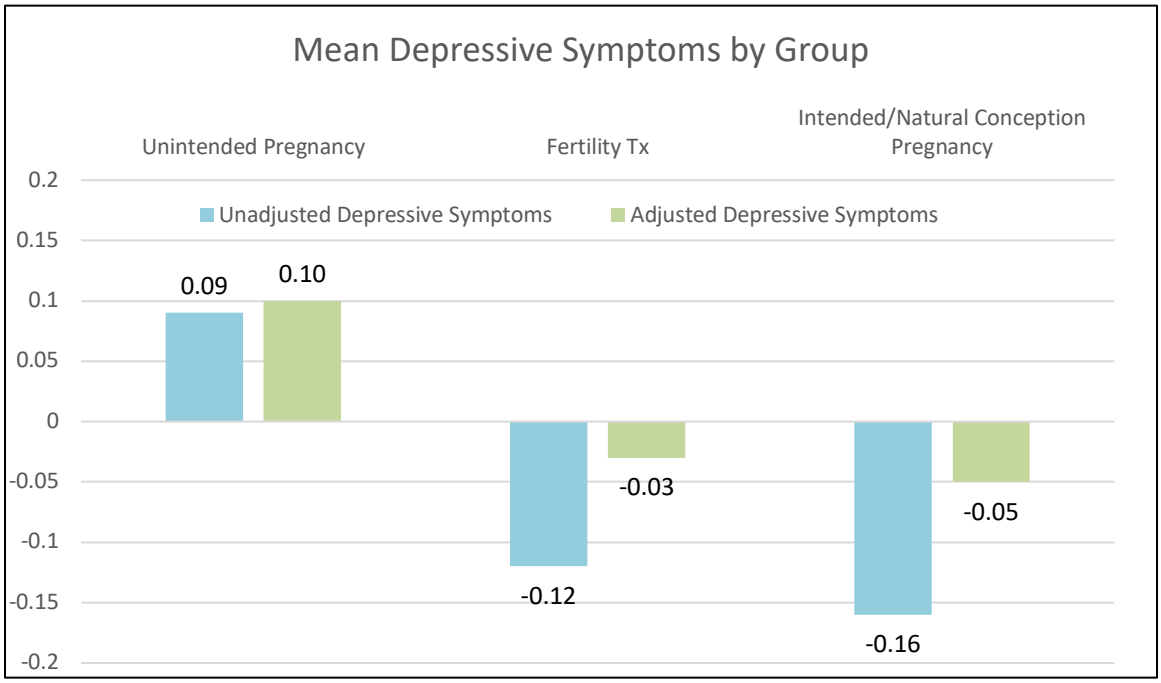
(Unweighted N = 145,036, Weighted N= 7,965,820)

	Model 1 (Unadjusted)		Model 2 (Adjusted)	
	B (95% CI)	p-value	*B* (95% CI)	p-value
Pregnancy Group				
Unintended Pregnancy	0.25 (0.23-0.27)	0.000**	0.15 (0.13-0.17)	0.000**
Fertility Treatment	0.04 (0.00 - 0.08)	0.035**	0.02 (-0.01-0.06)	0.221
Natural, Intended Conception	Reference		Reference group	
Covariates				
Maternal Age				
<17 years old			Reference group	
18-24 years old			-0.03 (-0.10–0.04)	0.378
25-29 years old			-0.04 (-0.11-0.04)	0.339
30 – 34 years old			-0.02 (-0.09-0.06)	0.622
40+ years old			-0.03 (-0.10-0.05)	0.511
Maternal Education				
0-8 years			Reference group	
9-11 years			-0.02 (-0.09-0.05)	0.549
12 years			-0.03 (-0.10-0.03)	0.323
13-15 years			0.00 (-0.06-0.06)	0.974
>16 years			0.02 (-0.05-0.08)	0.614
Maternal Race/Ethnicity				
White			Reference group	
Hispanic			-0.15 (-0.18 - -0.12)	0.000**
Non-Hispanic/Black			-0.13 (-0.15 - -0.10)	0.000**
Other			0.07 (0.04-0.09)	0.000**
Insurance Status				
Public Insurance			Reference group	
Private Insurance			0.02 (0.00-0.04)	0.035**
Other			-0.05 (-0.12-0.02)	0.162
Self Pay			0.11 (0.05-0.17)	0.000**

Relationship Context				
Married				
Other			Reference group	
Yes			0.03 (0.01-0.05)	0.005**
IPV Before Conception				
No			Reference group	
Yes			0.24 (0.16-0.31)	0.000**
IPV During Pregnancy				
No			Reference group	
Yes			0.26 (0.19-0.34)	0.000**
Birth Context				
Had Previous Births				
No			Reference group	
Yes			-0.00 (-0.02-0.01)	0.668
Plurality				
Singleton			-0.01 (-0.16-0.14)	0.935
Twins			0.01 (-0.14 – 0.17)	0.861
Other multiple			Reference group	
Admitted into the NICU				
No			Reference group	
Yes			0.08 (0.06 – 0.10)	0.000**
Had Vaginal Birth				
No			Reference group	
Yes			-0.03 (-0.05- -0.01)	0.001**
Psychological Health				
Stress				
0			Reference group	
1			0.14 (0.12 – 0.16)	0.000**
2			0.27 (0.25 – 0.29)	0.000**
3			0.40 (0.37 – 0.43)	0.000**
4+			0.68 (0.65 – 0.71)	0.000**
History of being treated or checked for depression or anxiety				
No			Reference group	
Yes			0.30 (0.28 – 0.33)	0.000**

Figure 1

Mean Depressive Symptoms by Pregnancy Group within Unadjusted and Adjusted Models



Logistic Regression

Using a binomial logistic regression model, we examined whether depression status differed by the three pregnancy groups, using the intended, natural conception group as our reference group. In the unadjusted model, we found that women who conceived using fertility treatments did not differ from women who conceived naturally and intentionally in depression status (OR = 0.93, 95% CI: 0.73 – 1.18, p=0.559). Women who had an unintended pregnancy had higher odds (OR = 2.23, 95% CI: 2.04 – 2.44, p=0.000) of scoring above our depression cut-off than women who conceived naturally and had an intended pregnancy (see Table 4).

Table 4

Logistic Regression of Depression Status by Group (Unweighted N = 145,036, Weighted N= 7,965,820)

	Unadjusted OR	95% CI	P Value
Pregnancy Group			
Unintended Pregnancy	2.23	2.04 – 2.44	0.000**
Fertility Treatment	0.93	0.73 – 1.18	0.559
Intended, Natural Conception	Reference		

In our adjusted logistic regression model, we found that women who had used fertility treatments had similar odds of having depression relative to women who had a natural, intended conception (OR = 1.22, 95 % CI: 0.95 – 1.57, p=0.117). Women who had unintended pregnancies were more likely to have depression than women who had a natural, intended conception (OR = 1.36, 95 % CI: 1.24 – 1.51, p=0.000).

Significant predictors of postpartum depression status included history of depression or anxiety, stress during pregnancy or in the pre conception period, IPV in the year prior to pregnancy or during pregnancy, previous births, manner of delivery, and whether the infant was in the NICU. Women who had either been checked or treated for depression or anxiety in the past, experienced more stressful events during pregnancy or in the period leading up to pregnancy, experienced IPV in the year before pregnancy or during pregnancy, had had a previous birth, gave birth via Caesarean-section, or had an infant that was admitted to the NICU after birth had higher rates of depression (see Table 5).

Table 5

Logistic Regression of Depression Status by Group with and without Covariates

(Unweighted N = 145,036, Weighted N= 7,965,820)

	Model 1 (Unadjusted)		Model 2 (Adjusted)	
	Unadjusted OR (95% CI)	p-value	Adjusted OR (95% CI)	p-value
Pregnancy Group				
Unintended Pregnancy	2.23 (2.04 – 2.44)	0.000**	1.36 (1.24 – 1.51)	0.000**
Fertility Treatment	0.93 (0.73 – 1.18)	0.559	1.22 (0.95 – 1.57)	0.117
Intended, Natural Conception	Reference group		Reference group	
Covariates				
Maternal Age				
<17 years			Reference group	
18-24 years			1.28 (0.92 – 1.78)	0.137
25-29 years			1.23 (0.88 – 1.72)	0.231
30 – 34 years			1.18 (0.83 – 1.68)	0.354
40+ years			1.17 (0.82 – 1.68)	0.398
Maternal Education				
0-8 years			Reference group	
9-11 years			1.18 (0.82 – 1.69)	0.372
12 years			1.04 (0.73 – 1.48)	0.821
13-15 years			0.97 (0.68 – 1.38)	0.860
>16 years			0.78 (0.54 – 1.14)	0.197
Maternal Race/Ethnicity				
White			Reference group	
White/Hispanic			0.91 (0.76 – 1.09)	0.292
Black			0.96 (0.86 – 1.08)	0.494
Other			1.16 (1.01 – 1.32)	0.038

Insurance Status				
Public Insurance			Reference group	
Private Insur.			0.91 (0.81 – 1.01)	0.077
Other			0.89 (0.59 – 1.33)	0.560
Self Pay			1.05 (0.73 – 1.50)	0.804
<u>Relationship Context</u>				
Married				
Other			Reference group	
Yes			1.00 (0.90 – 1.12)	0.962
IPV Before Pregnancy				
No			Reference group	
Yes			1.72 (1.37 – 2.16)	0.000**
IPV During Pregnancy				
No			Reference group	
Yes			1.39 (1.09 – 1.77)	0.009**
<u>Birth Context</u>				
Had Previous Births				
No			Reference group	
Yes			1.20 (1.09 – 1.32)	0.000**
Plurality				
Single			0.87 (0.44 – 1.71)	0.679
Twin			0.73 (0.36 – 1.47)	0.378
Other Multiple			Reference group	
Vaginal Birth				
No			Reference group	
Yes			0.87 (0.79 – 0.96)	0.004**
Infant Admitted into NICU				
No			Reference group	
Yes			1.38 (1.23 – 1.54)	0.000**

Psychological Health				
Stress				
0			Reference group	
1			1.49 (1.27 – 1.75)	0.000**
2			2.38 (2.02 – 2.79)	0.000**
3			2.95 (2.49 – 3.48)	0.000**
4+			5.50 (4.72 – 6.42)	0.000**
Had history of Depression or Anxiety				
No			Reference group	
Yes			1.98 (1.80 – 2.17)	0.000**

Additional Analyses

Lastly, we divided the group of women who reported using fertility treatments on the PRAMS standard questionnaire into three smaller groups based on what fertility treatment they used. We did not have this information available for all participants since this was a "standard question" that not all states chose to ask their participants. Given this fact, only 1,638 women were included in this additional analysis. These women had the option of indicating whether they had received fertility drugs, utilized insemination services, or underwent ART to conceive this baby. If women indicated that they had used more than one of these services in the month in which they conceived, they were coded into the fertility treatment group that was more medically invasive to avoid overlap in participants between the groups. We ran an unadjusted linear regression and found that the women who had utilized fertility drugs had significantly higher depressive symptoms (M = 0.04, SE = 0.06) than the women who utilized either insemination services (M = -0.18, SE = 0.07), p= 0.024, or assisted reproductive technologies (M = -0.17, SE = 0.05), p= 0.008.

We then examined using a linear regression analysis whether the depressive symptoms for the three fertility treatment groups differed from women with unintended pregnancies and women who had natural, intentional conceptions. The unadjusted mean depressive symptoms in the fertility enhancing drug treatment group was (M = 0.04, SE = 0.06) significantly different from the mean depressive symptoms in the natural, intended conception group (M = -0.16, SE = 0.01), p = 0.001. Women who had used fertility enhancing drugs to conceive had mean depressive symptoms comparable to women with an unintended pregnancy (M = 0.09, SE = 0.01), p = 0.383 (see Table 6).

Table 6

Mean Depressive Symptoms Broken Down by Fertility Treatment Utilized (Unweighted N=141,561, Weighted N=7,804,965)

	Mean	Std. Error
Unintended Pregnancy (Unweighted n=63,532)	0.09[a]	0.01
Natural, Intended Conception (Unweighted n=76,391)	-0.16[b]	0.01
Fertility Drugs (Unweighted n=439)	0.04[a]	0.06
Insemination (Unweighted n=304)	-0.18[b]	0.07
ART (Unweighted n=895)	-0.17[b]	0.05

Note: Different superscripts on depressive scores signify a statistically significant difference between the two means at the 0.05 level.

Discussion

Given the existing research on postpartum depression and the risk factors that are associated with it, we sought in this study to examine whether a specific population of women who had underwent fertility treatment in order to conceive would be at a differential risk of postpartum depression (PPD) in comparison to women who had conceived naturally and to women who had unintended pregnancies, a previously identified at risk group for postpartum depression in the literature (Cheng, Schwarz, Douglas, & Horon, 2009). We hypothesized that in our study we would find that women who utilized fertility treatments would have higher rates of PPD and more depressive symptoms compared with women who were able to conceive naturally and intentionally and that women who had unintended pregnancies would also have higher rates of PPD and more depressive symptoms than women who conceived naturally and intentionally.

Our hypothesis was partially supported. Women using fertility services did differ in terms of postpartum depressive symptoms from women who conceived naturally and intentionally in our unadjusted linear model, however once our covariates were accounted for this difference became non significant. Women using fertility services did not differ in terms of prevalence of postpartum depression in comparison to women who conceived naturally and intentionally in either our unadjusted or adjusted logistic analyses. Women who conceived unintentionally did have higher depressive symptoms and were more likely to be above the depression cut-off than women whose natural conception was intentional in all our analyses. While we did not find that overall women who had used fertility services had more depressive symptoms than women who conceived naturally,

we did find that if the type of fertility treatment used was taken into account, one particular type of fertility service had poorer postpartum depression outcomes than the rest. Women who conceived using fertility enhancing drugs, as opposed to insemination or ART, had more depressive symptoms, and they were comparable to the women in the unintended pregnancy group.

Several variables emerged as statistically significant covariates within our analyses including, history of IPV within the couple relationship, delivery method (vaginal vs. via Caesarean-section), stress during pregnancy and in the pre conception period, history of depression or anxiety, and infant's admittance into the NICU. The literature has traditionally shown that social support is an important buffer against the development of postpartum depression (Abbasi, Chuang, Dagher, Zhu, & Kierulff, 2013; Husain et al. 2012; Lee et al., 2011), therefore one could assume that if one were involved in a relationship that was exhibiting IPV, there may be less social support than normal between partners and less satisfaction in the relationship as one is approaching this important and often times stressful enough transition point - parenthood. Therefore, it is not surprising that IPV would be an important factor in postpartum outcomes for women.

An unexpected finding in our study was that women who were married were found to have more depressive symptoms than the women who reported "Other" for their marital status in our adjusted linear regression analysis. Given our use of a pre-existing data set, we did not have much information as to the quality of the marital relationship, which would be important to consider in future work. Marital quality and satisfaction may help explain why despite these women being married and theoretically having more of a support system in place than women who are not they are still experiencing more

depressive symptoms. We were also unable to precisely determine with this data set the nature of one's partnership. There was no question that assessed for cohabitation or committed partnership. Marital status was a dichotomous variable with the only two options being married or "other". Therefore, it is possible that within the "Other" category there could be individuals who are in committed partnerships that provide that same social support as a legal marriage could.

Research Contributions and Recommendations for Future Research

While our results were not completely in the direction that we hypothesized, we believe that this study adds to the existing literature on the topic of mental health outcomes for women who have utilized fertility services and have gone on to conceive and give birth. While a substantial amount of research exists examining mental health outcomes for these women while they are going through fertility treatments, significantly less research has continued to follow these women to investigate their long term mental health outcomes after having gone through what many would consider an extremely stressful time. Our study is therefore one of the few that looks at postpartum mental health in these women and showed that those who utilized fertility treatments had comparable mental health outcomes to the general population of women who conceived naturally and intentionally, when taking various covariates into account. Another strength of the current study is that since we used data from a nationally representative dataset, our sample was a representative sample of women's postpartum outcomes in the United States.

Our study also contributed new knowledge in terms of whether the type of fertility treatment utilized has an association with postpartum depression. The few studies that have looked at postpartum depression outcomes for women after fertility treatment,

typically choose to focus on one population. For example, they may choose to examine women who utilized only IVF or only intracytoplasmic sperm injection (ICSI). Our study is unique in that we were able to analyze data from women who used a variety of fertility treatment services. While we did not have information regarding what services were utilized for all the women in our sample, we were able to examine a subset of our data. We found that among those who had used fertility services, women who used fertility drugs had more depressive symptoms than women who used insemination or ART. Women who used fertility drugs also had more depressive symptoms than women who had an intended, natural conception and had depressive symptoms comparable to women who had unintended pregnancies. Future research should continue to examine differences in mental health outcomes by fertility treatment type, as this appears to play an important role. This would require a shift in the way researchers collect data to ensure that various treatment modalities are represented within samples.

It is interesting to note that while much of the research on the effects of fertility treatments uses women who have conceived using ART as a sample, this is not the group that our data suggests has the most depressive symptoms. Future research should continue to explore this relationship to hopefully determine what are some of the factors that contribute to this. Given the more invasive nature of ARTs and inseminations as opposed to fertility drugs, it would be interesting to explore further why the utilization of solely fertility drugs may be most associated with poorer mental health outcomes.

Limitations

As mentioned previously, while we were able to gather information from some participants in regards to the fertility treatments they utilized, this information was not available for all participants. Of course in using a pre-existing data set we were limited to

the information that was already included in the dataset. As a result of this, we operated with some assumptions as well. While we used the presence or absence of fertility treatments as a marker for infertility, there was no question that directly asked participants if they experienced infertility. While it is reasonable to assume that many of the women who utilized fertility treatments probably did so due to infertility, there are other reasons why a woman may utilize these services, such as women in same sex partnerships only have this method of conceiving available to them. Our analyses could have also been helped by more subjective reports from the women as to their experiences with the utilization of fertility treatments and the length of time that they used fertility treatments, since these may vary greatly amongst this group, and more measures of social support, both within and in addition to the couple relationship.

The measurement of postpartum depression was not optimal in this study. Their measure varied between phases 6 and 7 and neither used a validated psychological instrument such as the Edinburgh Postpartum Depression Scale (EPDS) or the Patient Health Questionnaire (PHQ). Furthermore, respondents answered the survey anywhere between approximately 2 and 8 months after giving birth, and it has been found that postpartum depression often peaks around 3 months after birth (Canadian Pediatric Society, 2004). Therefore, some symptoms of postpartum depression may have diminished or been resolved by the time of data collection for many women. It would be beneficial in future studies to collect data from women earlier in the postpartum period when postpartum depressive symptoms are more likely to be present. We were also unable to determine using our data set whether women were currently being treated for postpartum depression. While some states did ask questions related to medication and counseling, very few states chose to develop questions such as these.

Another limitation to our study is its narrow focus. The majority of postpartum outcome studies and studies on infertility focus on women. Future research should broaden the focus to examine the mental health effects of infertility and the postpartum outcomes after these methods of conception on the partners of women undergoing these treatments. Effects on the couple relationship are also an area that could use more research.

Clinical Implications

With medical advances occurring continually, we are able to do more and more to help women conceive. However, with more women utilizing fertility treatments and services, it is important for us to have a better understanding of how the experience of infertility shape both the woman's individual world and all her relationships. As clinicians, it is extremely important for us to learn in greater depth about these women's mental health outcomes both during infertility, throughout pregnancy if they are able to conceive, and in the transition to parenthood. Recent research highlighted that despite the fact that the period during which one is trying to conceive using fertility services is a time when women experience substantially higher levels of depression than the general population when they are trying to conceive (Ramezanzadeh et al., 2004; Verma & Baniya, 2016), only 26.7% of women and 24.2% of men reported that they were provided with information about mental health services during the course of their fertility treatments. Patients that were experiencing high distress were also found to be no more likely to have received this information than patients who were experiencing less distress (Pasch et al., 2016). It is our job as clinicians to not only inform ourselves in regards to the research in this area but to also find ways in which to make mental health services

more available and utilized within the highly medically based model that is typically used at fertility clinics.

While our results do not show that these women on average are at a higher risk of developing postpartum depression than women who conceived naturally, our results do highlight the importance of the couple relationship, stress, and the type of fertility treatment used to outcomes of mental health. As clinicians, we are in unique position where we are able to address factors, such as stress and the couple dynamic, that the medical team is not as well suited for.

The stressors assessed for in this study varied, with some of the stressors being situational while many were interpersonal in nature. As clinicians, we are better suited than the medical team to work with clients and assess for these stressors throughout fertility treatments. We know that as individuals and families face a stressor a variety of factors affect whether this stressor becomes a crisis that overloads their resources. These factors include, the nature of the stressor in itself, the resources available to the individual or family, and the perception of the stressor, according to the ABC-X theory of family stress (Hill, 1949). As clinicians, we can work with clients to build their resources and modify perceptions and cognitions around the stressor. We can also address couple dynamics. As we continue to conduct research in this topic area, it will be important to continue to assess how a family's resources affect their mental health outcomes after utilizing fertility treatments, and it will also be important to assess how perceptions of the experience affect their mental health outcomes. We were unfortunately unable to do these things with this dataset.

Conclusion

While the viewpoint that many hold is that seeking fertility services and treatments are primarily a medical intervention, these services and the process of experiencing infertility can be a stressful psychological experience. Our study examined postpartum psychological outcomes for women who had utilized fertility services, and our results showed that overall women who have utilized fertility services do not differ in a statistically significant manner from women who conceived naturally in depressive symptoms. In a supplemental analysis, our data showed that women who used fertility drugs, as opposed to insemination or ARTs, had higher depressive symptoms than those who had intended, natural conceptions. This suggests more research is needed to understand whether fertility services and which types are associated with more postpartum depressive symptoms. It is important for clinicians to be aware of this research and to use it to inform work with individuals and couples seeking fertility treatments.

Appendix 1: Stressors Assessed

A close family member was very sick and had to go into the hospital

I got separated or divorced from my husband or partner

I moved to a new address

I was homeless

My husband or partner lost his job

I lost my job even though I wanted to go on working

I argued with my husband or partner more than usual

My husband or partner said he didn't want me to be pregnant

I had a lot of bills I couldn't pay

I or my husband or partner went to jail

Someone very close to me had a problem with drinking or drugs

Someone very close to me died

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