Trajectories of Depressive Symptoms Among Low-Income Perinatal Women: The Role of Father Involvement

TRAJECTORIES OF DEPRESSIVE SYMPTOMS AMONG LOW-INCOME PERINATAL WOMEN: THE ROLE OF FATHER INVOLVEMENT

A Dissertation Presented

By

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Submitted to the Graduate School of the
University of Massachusetts Amherst in partial fulfillment
of the requirements for the degree of

DOCTOR OF PHILOSOPHY

September 2019

Clinical Psychology

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DEDICATION

“To all the ladies havin’ babies on they own.”

-Tupac Shakur

ACKNOWLEDGMENTS

Infinite thanks to my advisor, Maureen Perry-Jenkins, for her patient and supportive guidance through the joys and struggles of work and of life. Your investment in my professional development and self-exploration will continue to grow within me and through my work for years to come. Extra special thanks to my committee member and mentor, Aline Sayer, who consistently went above and beyond the call of duty to support my anxiety-ridden journey into the world of statistics. Deepest gratitude as well to my committee members, Paula Pietromonaco, Sally Powers, and Lindiwe Sibeko for their time, encouragement, and thoughtful input throughout the many stages of this process. Many thanks are also due to my lab mates and mentors Katie Newkirk, Rachel Herman and Andrea Craft for their comradery and encouragement. My deep appreciation goes to Karin Garber and Jeff Winer for their friendship as well. To my parents, parents-in-law, and grandfather: your support has meant everything.

Most of all, to my precious family: it's been a beautiful struggle to watch us grow through this epic journey of graduate school (and I wouldn't have it any other way). To my babygirl Marlowe, who worked tirelessly alongside me on her own dissertation, and to my baby Evan, who defended with me at 30 weeks gestation: *I am because we are*. To my husband, Noah Halpern—there simply are no words to express the depths of my adoration and appreciation. Thank you for loving me, for cheering me on, for navigating this work-life puzzle with me, and for filling our family's lives with joy and comfort.

ABSTRACT

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SEPTEMBER 2019

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The present study sampled a racially diverse group of 207 women at five time points from the third trimester of pregnancy until one year postpartum. Group-based developmental trajectory modeling was used to examine unique trajectories of women's depressive symptoms (CES-D) across the perinatal period. Analyses yielded four distinct depression trajectory groups, conceptualized as the *low symptom* group, the *intermediate symptom* group, the *desist-return* group, and the *chronic* depression group. Next, fathers' roles were examined as predictors of maternal depression trajectories in resident- and non-resident father families. Specifically, aspects of *father involvement* were assessed as predictors of women's membership to depression trajectory groups, both in the full sample of women, and in separate models that examined unique components of father involvement in resident- and non-resident father families. *Mothers' relationship satisfaction* was also assessed as a predictor of trajectory group membership. Contrary to the author's expectations, family structure did not moderate the relation between either father involvement or mothers' relationship satisfaction and mothers' membership to depression trajectory groups. Instead, unique sets of predictors provided the best solution for predicting mothers' trajectory group membership based on family structure. Among

women in resident father families, low coparenting conflict was the best predictor of membership to the low symptom trajectory group. For women in non-resident father families, feeling more satisfied in their relationship with the baby's father predicted membership to the low symptom group. These findings highlight specific ways in which fathers can enhance women's mental health during a sensitive period. Implications for providers are discussed.

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CHAPTER 1

INTRODUCTION

Depression is one of the most common health concerns for mothers during the perinatal period, which encompasses pregnancy through the first year after birth (Bruce et al, 2008). Suffering from depression during this time is associated with a number of physical and mental health concerns for a woman and her baby (Farr & Bish, 2013). Many women experience the "baby blues," which refers to feelings of sadness, loneliness or distress that typically pass in the first one to two weeks after birth (O'Hara & Wisner, 2014). According to the American Psychological Association (APA), however, one in seven women will experience a clinically significant depressive episode after birth (APA, 2016). Untreated perinatal depression puts women at risk for serious consequences. Among these is an increased risk of suicide; in fact, suicide is the second most common cause of death among postpartum women, accounting for approximately 20% of deaths among new mothers (Lindahl, Pearson, & Colpe, 2005). The high rates at which depression occurs during the perinatal stage, and the potential for women and families to experience severe and chronic impacts as a result, have garnered worldwide attention. In the U.S., federal and state guidelines are beginning to address the specific mental health concerns of pregnant and postpartum women (Rowan, Duckett, & Wang, 2015). Specifically, the urgent need to identify and treat perinatal depressive symptoms is reflected in the recent recommendation by the U.S. Preventative Services Taskforce that all perinatal healthcare providers screen pregnant and postpartum women for depression (O'Connor et al., 2016).

Although experts tend to agree that perinatal depression is a major public health concern, there is inconsistent agreement regarding the definition of perinatal depression. Specifically, recent research has highlighted the complexity of defining this disorder due to variations in the onset, remittance, and consistency of symptoms. Recent advances in methods and statistics have allowed researchers to model distinct developmental trajectories for women experiencing perinatal depression using a group-based modeling approach. This approach suggests that some women develop depressive symptoms during pregnancy and recover in the postpartum period, while others experience postnatal onset of depression, and still others experience high levels of depressive symptoms across the full course of pregnancy and the postnatal period (Mora et al., 2009; Sutter-Dallay et al., 2012; Vanska et al., 2011). Group-based modeling approaches offer great promise in helping to expand our conceptualization of perinatal depression. In turn, these advances can lead to more targeted and effective preventative and treatment strategies.

Much research has also focused on factors that predict perinatal depression in women. There is evidence that higher levels of perceived support from a woman's intimate partner is protective against the development of perinatal depression (Dennis & Letourneau, 2007). Furthermore, when women do experience postpartum depression, perceived partner support has been associated with better ability to cope with the experience (Letourneau et al., 2007). On the other hand, dissatisfaction with partner support during pregnancy has been associated with worse maternal mental health outcomes (Hildingsson, Tingrall, & Rubertsson, 2008). Much of this research, however, has focused on married couples; less is known about how support from the baby's father may protect against perinatal depression when the parents are not romantically involved

with one another (Reid & Taylor, 2015). Given that 40% of U.S. births occur outside the context of marriage (Hamilton, Martin, & Osterman, 2016), the overrepresentation of married women in the perinatal depression literature limits our ability to identify unique ways in which women can receive support from babies' fathers, even when the parents are not a couple. The present study addresses this gap in the literature by examining the role of fathers in shaping new mothers' mental health within diverse family structures. Fathers' *involvement* (e.g., through the time he spends with his infant; Pilkington et al., 2015) as well as mothers' *relationship satisfaction* with the baby's father (Adewuya et al., 2007; Lee, Yip, Lueng, & Chung, 2004) are assessed as predictors of the timing, course, and severity of perinatal depressive symptoms across the first year of parenthood. In addition, we consider the unique ways in which non-resident fathers' *economic support*, including formal child support, informal monetary contributions, and in-kind (non-monetary material) support, contributes to mothers' mental health across the transition to parenthood.

The present study has two primary goals. First, utilizing group-based developmental trajectory modeling, unique presentations in terms of the course and severity of women's depressive symptoms across the perinatal period are examined. Second, father involvement and mothers' relationship satisfaction are examined as predictors of mothers' trajectory group membership. The following literature review explores the state of knowledge regarding each of these issues.

CHAPTER TWO

LITERATURE REVIEW

2.1 Perinatal Depression

The perinatal period represents a major life transition marked by significant changes in daily life, the assumption of new roles and responsibilities, evolving relationships, new financial demands, shifts in identity, and changes in mental and physical health (Guedeney & Tereno, 2010; O'Hara & Wisner, 2014; Walker, 2014). Poor maternal mental health is of significant concern because it impairs a woman's ability to function mentally and emotionally and challenges her ability to care for and develop a secure attachment with her infant (O'Hara & Wisner, 2014). In addition, maternal depression is associated with lower parenting competence and less supportive parenting behavior (Campbell et al., 2004; Cummings, Keller, & Davies, 2005; Dix & Meunier, 2008). New mothers affected by depression are more likely to have infants with difficult temperaments and cognitive and emotional delays (see Dennis & Ross, 2006 for an in-depth review). In addition, some studies have demonstrated long-term associations between mothers' depression early in her child's life and impairment in children's later emotional, social, and cognitive development (Muzik & Borovska, 2010).

Estimates indicate that anywhere from 7% to 51% of women meet criteria for a depressive disorder while pregnant, while one in seven new mothers suffers from postpartum depression (Wisner et al., 2013; Zayas, McKee, & Jankowski, 2004). Furthermore, The Centers for Disease Control and Prevention (CDC) estimate that 54% of women who experience postpartum depression are diagnosed before or during pregnancy (CDC, 2008). One explanation for the wide range in prevalence rates may be

due, in part, to variability in how the construct of perinatal depression is defined (i.e., as depressive symptoms versus clinically significant depression as defined by the *Diagnostic and Statistical Manual*) and the ways in which symptoms are measured. Specifically, the amount and type of information obtained from a self-report symptom checklist filled out by women compared to an in-depth clinical interview conducted by a professional is likely to yield different results. Another point of variation relates to how thoroughly symptoms are assessed. Many researchers use standardized measures containing 10-20 Likert scale items, like the Edinburgh Postpartum Depression Scale (EPDS; Cox, Holden, & Sagovsky, 1987) or the Center for Epidemiology Studies Depression scale (CES-D; Radloff, 1977), while others have based their assessment of depression on participants' responses to two or three discrete ("Yes"/ "No") items (Gavin et al., 2005; O'Hara & Wisner, 2014; Norhayati, Nik Hazlina, Asrenee, & Wan Emilin, 2015). Furthermore, variations in the timing of depressive symptom onset impacts the measurement of prevalence rates.

More recent research suggests that beyond examining levels of symptomatology at different time points, much can be learned from tracking unique trajectories of perinatal depressive symptoms over time. This approach captures the emergence of different, group-based patterns regarding onset, remittance, and consistency of symptoms. Group-based developmental trajectory modeling allows us to ask the following types of questions: Do some women develop depressive symptoms during pregnancy but recover following birth, while others experience postnatal onset of depression? How does the course and severity of these presentations vary compared to women with chronic, unrelenting depression? Longitudinal tracking of group-based changes in timing, severity

and course of perinatal depressive symptoms highlights the possibility that women follow different trajectories of depression across this critical period. As shown in Table 1, a handful of studies have examined perinatal depression using group-based modeling techniques and have identified distinct trajectories of change.

Table 1: Summary of findings regarding trajectories of perinatal depression

Authors & Year	Sample	Study Aims	Measures & Method	Time points	Trajectory Groups
Campbell et al. (2007)	U.S. (N = 1,261) White (81%) Married (68%) *M* income-to-needs ratio: 2.83	1. Identify trajectories 2. Predict maternal sensitivity & child outcomes	**Depression:** CES-D **Father involvement:** No **Analysis:** Group-based trajectory modeling	**1:** 1 mo. postpartum **2:** 6 mos. postpartum **3:** 15 mos. postpartum **4:** 24 mos. postpartum **5:** 36 mos. postpartum **6:** 54 mos. postpartum **7:** 7 years postpartum (children in 1st grade) **No prenatal assessment**	**6 groups:** High—chronic (2.5%) Moderate—increasing (6.2%) High—decreasing (5.6%) Intermittent (3.6%) Moderate—stable (score < 16; 36%) Low—stable (45.6%)
Cents et al. (2013)	Netherlands (N = 4,167) 76% Dutch or "other Western" Married (89%) Family income > 2,000 Euros (67%)	1. Identify trajectories 2. Predict child outcomes	**Depression:** BSI **Father involvement:** No **Analysis:** Group-based trajectory modeling	**1:** ~ 20 wks. pregnant **2:** 2 mos. postpartum **3:** 6 mos. postpartum **4:** 36 mos. postpartum	**4 groups:** High symptom (1.5%); Moderate symptom (11%) Low symptom (54%); No symptom (34%)

Christensen et al. (2011)	U.S. (N = 215) Hispanic immigrants Cohabiting (47.4%) or married (16.7%) Low education (*M* = 8.9 years); no income measure	1. Identify trajectories 2. Predict trajectory membership based on pregnancy intention	**Depression:** BDI-II **Father involvement:** No **Analysis:** Growth mixture modeling	**1:** ~ 18 wks. pregnant **2:** 6 wks. postpartum **3:** 4 mos. postpartum **4:** 12 mos. postpartum	**3 groups:** Pregnancy high (9.8%); Postpartum high (10.2%); Perinatal low (80.0%)
Authors & Year	**Sample**	**Study Aims**	**Measures & Method**	**Time points**	**Trajectory Groups**
Fredriksen et al. (2017)	Norway (N = 1,036) 93.9% Norwegian No information about family structure 77.1% college-educated; 77.3% employed at enrollment Median personal income $36k - $55k	1. Identify trajectories 2. Predict trajectory membership based on psychosocial factors	**Depression:** EPDS **Father involvement:** No **Analysis:** Growth mixture modeling	**1:** ~ 21 wks. pregnant **2:** ~ 28 wks. pregnant **3:** ~ 32 wks. Pregnant **4:** ~ 36 wks. pregnant **5:** 6 wks. Postpartum **6:** 6 mos. Postpartum **7:** 12 mos. postpartum	**4 groups:** Moderate-persistent (10.5%); Pregnancy only (4.4%) Postpartum only (2.2%); Minimum symptoms (82.9%)

Kuo et al. (2012)	Taiwan (N = 121) Chinese ethnicity Married Income not reported	1. Identify trajectories 2. Model dual trajectories of depression & fatigue; identify predictors	**Depression:** EPDS **Father involvement:** No **Analysis:** Group-based trajectory modeling & dual-trajectory modeling	**1.** 3rd trimester **2.** 1 day postpartum **3.** 3 days postpartum **4.** 1 week postpartum	**4 groups**: Highest symptom (8.3%); Moderate symptom (25.6%); Low symptom (43%); Lowest symptom (23%)
Luoma et al. (2015)	Finland (N = 329) Racial/ethnic identity unreported Married (72%) No income measure; varied educational attainment	1. Identify trajectories 2. Identify antenatal factors predicting high-symptom trajectories	**Depression:** EPDS **Father involvement:** No, but partner relationship assessed at baseline **Analysis:** Group-based modeling	**1.** 3rd trimester **2.** 1 wk. postpartum **3.** 2 mos. postpartum **4.** 6 mos. postpartum **Follow-ups (child age):** **5.** 4-5 years **6.** 8-9 years **7.** 16-17 years	**4 groups:** Intermittent (3%); High-stable (27%); Low-stable (53%); Very low (18%)
Authors & Year	**Sample**	**Study Aims**	**Measures & Method**	**Time points**	**Trajectory Groups**
McCall-Hosenfeld et al. (2016)	U.S. (N = 2,802) White (83%) Married or cohabiting (88.5%)	1. Identify trajectories 2. Predict trajectory membership	**Depression:** EPDS **Father involvement:** No	**1.** 3rd trimester **2.** 1 mo. postpartum **3.** 6 mos. postpartum **4.** 12 mos. postpartum	**6 groups:** Lowest symptom/no symptom (6.5%) Stable low (42.2%) Low-decreasing (36.5%)

	"Nonpoverty" status (81%)	based on psychosocial factors	**Analysis:** Semi-parametric mixture modeling		Moderate-decreasing (11.9%) Moderate-increasing (1.7%) Stable high (1.3%)
Mora et al. (2009)	U.S. (N = 1,735) Black (70%), Hispanic (17%), & White (13%) Unmarried (75%) *M* income $8,131	1. Identify trajectories 2. Identify demographic predictors	**Depression:** CES-D **Father involvement:** No **Analysis:** Growth mixture modeling	**1.** ~ 15 wks. Pregnant **2.** 3 mos. postpartum **3.** 11 mos. postpartum **4.** 25 mos. postpartum	**5 groups**: Chronic (7%) Antepartum only (6%); Postpartum (9%); Late (7%); Never (71%)
Ramos-Marcuse et al. (2010)	U.S. (N = 181) Low-income, first-time African American adolescent mothers Majority (66%) in relationship with father at 1st interview Low-income (defined by WIC requirements)	1. Identify trajectories	**Depression:** BDI **Father involvement:** No **Analysis:** Group-based trajectory modeling	**1:** Within 3 weeks after birth **2:** 6 mos. postpartum **3:** 24 mos. postpartum **No prenatal assessment**	**3 groups:** High (14%); Medium (45%); Low (41%)

Authors & Year	Sample	Study Aims	Measures & Method	Time points	Trajectory Groups
Sutter-Dallay et al. (2012)	France (N = 579) Race/ethnicity unreported Married (53%) Monthly income > 1,500 Euros (71%)	1. Identify trajectories	**Depression:** CES-D **Father involvement:** No **Analysis:** Semi-parametric mixture modeling	**1:** 3rd trimester **2:** 3 days postpartum **3:** 6 wks. postpartum **4:** 3 mos. postpartum **5:** 6 mos. postpartum **6:** 12 mos. postpartum **7:** 18 mos. postpartum **8:** 24 mos. postpartum	**4 groups:** Chronic (3%); Antepartum (21%); Postpartum (4%); Never depressed (72%)
Van der Warden et al. (2015)	France (N = 1,807) French ethnicity (93%) Married/cohabiting (93%) No financial difficulties (87%)	1. Identify trajectories 2. Determine predictors of group membership	**Depression:** CES-D (pregnancy; 3- & 5-year follow-ups); EPDS (postpartum year) **Father involvement:** No **Analysis:** Semi-parametric group-based modeling	**1.** < 24 wks. pregnant **2.** birth **3.** 4 mos. postpartum **4.** 8 mos. postpartum **5.** 12 mos. postpartum **6.** 24 mos. postpartum **7.** 3 years **8.** 4 years **9.** 5 years	**5 groups:** Persistent high (5%); High symptoms—preschool only (4.9%); High symptoms—pregnancy only (4.7%); Persistent intermediate-level (25.2%); No symptoms (60.2%)
Vanska et al. (2011)	Finland (N = 805)	1.Identify trajectories	**Depression:** General Health	**1.** 18-20 wks. pregnant **2.** 2 mos. postpartum	**5 group:** Chronic high (4%) Prenatal onset (6%);

	Race/ethnicity unreported Married (72%) or cohabiting (28%) High professional (31%); low professional (41%)	2. Predict child outcomes	Questionnaire (GHQ-36) & BDI **Father involvement:** No **Analysis:** Mixture modeling	**3.** 12 mos. postpartum	Early postpartum (9%); Late postpartum; (6%); Stable low (75%)

2.2 The Course of Perinatal Depression

The major strength of a group-based approach to modeling depressive symptoms lies in the ability to identify subgroups within a population for whom the level and course of symptoms hang together, thereby creating distinctive trajectories (Nagin, 2005). In this approach, trajectory paths are identified using unconditional models, meaning that the emergence of groups is not dependent upon predictors such as age or marital status. To date, 12 studies using a group-based modeling approach to studying perinatal depression have been identified. All studies met the following criteria: (a) maternal depressive symptoms were measured longitudinally; (b) symptoms were assessed across the perinatal period; (c) studies employed a group-based statistical approach to developmental modeling of depressive symptoms. Of these 12 studies, eight included follow-up analyses that explored predictors of trajectory group membership. Three studies used maternal depression trajectories to predict child outcomes. Samples varied widely in terms of demographic factors including women's country of origin, racial and ethnic background, socioeconomic status, and marital status. In addition, the scope of assessment ranged from very narrow and focused (e.g., four time points from the third trimester until one week postpartum in a study by Kuo, Yang, Kuo, Tseng, & Tzeng, 2012) to broader (e.g., a second trimester assessment with follow-ups at two- and 12-months postpartum in a study by Vanska et al., 2011). Notably, the majority of studies included follow-up time points beyond the perinatal period (Campbell et al., 2007; Cents et al., 2013; Luoma et al., 2015; Mora et al., 2009; Ramos-Marcuse et al., 2010; Sutter-

Dallay et al., 2012; Van der Warden et al., 2015). Findings regarding women's depression after babies turned one year old fall outside the scope of the current review.

Across these studies, several predominant themes emerged with regard to women's depressive symptoms over time. First, the majority of women (at least 70% of a given sample, and upwards of 80% in some samples) *never* endorsed clinically significant depressive symptoms during the perinatal period (Campbell et al., 2007; Cents et al., 2013; Christensen, Stuart, Perry, & Le, 2011; Fredriksen, von Soest, Smith, & Moe, 2017; Kuo et al., 2012; Luoma et al., 2015; McCall-Hosenfeld et al., 2016; Mora et al., 2009; Ramos-Marcuse et al., 2010; Sutter-Dallay et al., 2012; Van der Warden et al., 2015; Vanska et al., 2011). In fact, in one study, none of the participants endorsed clinically significant depressive symptoms at any time point across the transition to parenthood (Luoma et al., 2015).

The second pattern, represented in six studies, identified women who endorsed clinically significant depressive symptoms during pregnancy (*antepartum depression*), then recovered within the first 12 months after giving birth (Christensen et al., 2011; Fredriksen et al., 2017; Mora et al., 2009; Sutter-Dallay et al., 2012; Van der Warden et al., 2015; Vanska et al., 2011). The timing of postnatal depressive symptom measurement varied widely across these studies, with the first postnatal assessment occurring sometime between three days after birth (Sutter-Dallay et al., 2012) and four months postpartum (Mora et al., 2009; Van der Warden at al., 2015). In addition, there was considerable variability in the relative proportion of women in a given sample who followed the *antepartum depression* trajectory. In four large-scale studies (N = 805 – 1,807), 4-6% of samples followed the *antepartum depression* trajectory (Fredriksen et al., 2017; Mora et

al., 2009; Van der Warden et al., 2015; Vanska et al., 2011). Regardless of ethnic background, family structure, or socioeconomic status, women in this group appeared to recover from clinically significant depressive symptoms within the four months following birth. Social and emotional stressors, including history of childhood adversity, history of mental health problems, prenatal anxiety, ambivalence about pregnancy and lack of social support, predicted membership in the *antepartum* groups in these studies.

The incidence of *antepartum depression* was slightly higher (~10%) in a study that followed 215 Hispanic immigrants in the U.S (Christensen et al., 2011). In this sample, women suffering from *antepartum depression* were less likely to be married compared to their non-depressed peers. Finally, the highest incidence of *antepartum depression* (21%) was observed in a sample of 579 French women who were followed more consistently over time (i.e., third trimester, then postpartum at 3 days, 6 weeks, 3 months, 6 months, and 12 months). In this study, lower incomes and higher levels of trait anxiety predicted membership to the *antepartum depression* group. Together, these findings suggest that tracking women at more time points in the early postpartum period, as Christensen and colleagues did, may reveal that more women experience clinically significant depression during pregnancy and recover gradually during the first year than the broader literature on antenatal depression would suggest.

Additionally, between 1.7% and 15% of women in five studies developed clinically significant symptoms of *postpartum depression* within the first six months after giving birth (Christensen et al., 2011; Fredriksen et al., 2017; McCall-Hosenfeld et al., 2016; Mora et al., 2009; Vanska et al., 2011). Within these *postpartum depression* groups, women tended to remain in the clinical range for depression at the end of the first

year. The exception was in a study by Fredriksen and colleagues (2017), in which women developed clinically significant *postpartum depression* symptoms within the first six weeks after birth, and recovered by six months postpartum. Risk factors for membership in *postpartum depression* trajectory group included experiences with marginalization (e.g., low educational attainment; immigrant status), high levels of objective stress, single motherhood, low social support, unintended pregnancy, pregnancy-related anxiety and previous mental health issues (Christensen et al., 2011; Fredriksen et al., 2017; McCall-Hosenfeld et al., 2016; Mora et al., 2009).

Finally, eight studies identified a small subsample of women (1.3% - 7% of a given sample) who reported unrelenting high levels of depression across the perinatal period (Campbell et al., 2007; Cents et al., 2013; Kuo et al., 2012; McCall-Hosenfeld et al., 2016; Mora et al., 2009; Sutter-Dallay et al., 2012; Van der Warden et al., 2015; Vanska et al., 2011). Women who followed these *chronic depression* trajectories tended to be burdened by a number of psychosocial stressors, including having low income and low educational attainment and feeling overinvested in work (Campbell et al., 2007; Cents et al., 2013; Sutter-Dallay et al., 2012; Van der Warden, 2015); being unmarried, living alone and experiencing high family stress or low social support (Campbell et al., 2007; McCall-Hosenfeld et al., 2016; Sutter-Dallay et al., 2012), having more children, experiencing low parenting satisfaction, and feeling ambivalent about the current pregnancy (Mora et al., 2009; Sutter-Dallay et al., 2012), and history of mental illness (McCall-Hosenfeld et al., 2016; Sutter-Dallay et al., 2012; Van der Warden, et al., 2015).

Together, these findings suggest that among women who endorse clinically significant depressive symptoms in the perinatal period, some are worse off during pregnancy and

recover after giving birth, while others fare well during pregnancy but become depressed after birth. A third group of women experience chronically high depressive symptoms. In light of differences across previous studies in terms of measurement timing, the present study utilizes measures of depression at five time points from the third trimester of pregnancy until one year postpartum. This timeframe has been widely referred to as the transition to parenthood, and strikes a balance between the shortest- and longest-term studies reviewed above. In addition, the present study builds upon previous findings to conduct an assessment of within-group variability among an understudied group: low-income, employed women in the U.S.

2.3 Predicting Trajectories of Perinatal Depression

Given that the course of perinatal depression varies greatly, predictors of trajectory group membership may differ as a function of the timing of symptom onset, decline and recovery. Research has identified several key factors that differentially predict the probability of belonging to one trajectory group versus another. These factors include: (a) *current and previous stressors* (i.e., childhood adversity; presence of acute or chronic stressors; Mora et al., 2009; Ramos-Marcuse et al., 2010, van der Waerden et al., 2015); (b) *support from family and broader social networks* (Luoma et al., 2015; McCall-Hosenfeld et al., 2016); (c) *partner relationship quality* (Luoma et al., 2015); (d) *physical health* (Mora et al., 2009; Sutter-Dallay et al., 2012); (e) *pregnancy characteristics*, including parity, pregnancy planning and feelings about one's pregnancy (Christensen et al., 2011; Luoma et al., 2015; Mora et al., 2009; Sutter-Dallay et al., 2012), and (f) *parenting experiences*, including post-birth fatigue and parenting satisfaction (Kuo et al., 2012; Ramos-Marcuse et al., 2010). In addition, previous mental

health history and heightened symptoms of depression and anxiety during pregnancy have predicted worse mental health outcomes across the first year of parenthood (Luomo et al., 2015; McCall-Hosenfeld et al., 2016; Mora 2009; Sutter-Dallay et al., 2012; van der Waerden et al., 2015), as did lower self-esteem (Ramos-Marcuse et al., 2010). Findings regarding the role of demographic characteristics, including age, race, nativity, income, education level and marital status in predicting trajectory group membership have been inconsistent across studies (Kuo et al., 2012; McCall-Hosenfeld et al., 2016; Mora et al., 2009, Sutter-Dallay et al., 2012).

The aim of the current study is to hone in on an important but understudied factor that may predict trajectories of perinatal depression: support from the baby's biological father. Examining the link between fathers' roles and mothers' long-term mental health builds upon previous literature linking: (a) the broad construct of social support to lower depression rates in new mothers (Ngai & Chan, 2012; Razurel, Kaiser, Sellenet, & Epiney, 2013; Xi et al., 2009), and (b) partner support to lower depression rates among married and cohabiting mothers transitioning to parenthood (Dennis & Letourneau, 2007; Dennis & Ross, 2006; Montgomery et al., 2009). By focusing on two key predictors—father involvement and mothers' relationship satisfaction—the present investigation seeks to fill an important gap in the literature by considering fathers' range of opportunities to be involved in their families' lives, as well as the question of how fathers' roles can enhance maternal well-being across distinct family structures. Specifically, analyses will address how: (a) father involvement in parenting, and (b) mothers' prenatal relationship satisfaction predict the trajectory of maternal depression symptoms across the first year.

Fathers have unique opportunities to promote well-being for women during this sensitive period; identifying the specific aspects of fathers' roles that enhance maternal mental health can inform patient education and treatment for depression. Currently, the overrepresentation of married women in the depression trajectories literature leaves us with many questions as to the role of unmarried, non-residential fathers in shaping mothers' experiences. Given that 40% of U.S. births occur outside the context of marriage (Hamilton et al., 2016), it is vital that we gain a better understanding of the role of fathers across different family structures. The present study will address this gap in the literature by examining the role of fathers in shaping new mothers' mental health across diverse family forms, specifically resident (married or cohabiting) and non-resident father families. In the following section, a review of the father involvement literature is presented with an eye towards which aspects of involvement may be of particular importance during the sensitive period of new parenthood.

2.4 Father Involvement

Previous research reflects a variety of conceptualizations of father involvement (Amato, 1998; Coley & Hernandez, 2006; Hawkins & Palkovitz, 1996; Lamb, Pleck, Charnov, & Levine, 1985; Marsiglio, Day, & Lamb, 2004; Tamis-LeMonda & Cabrera, 2002). The current study assesses this construct primarily in terms of how much time fathers spend with their babies in the first month postpartum (Pilkington et al., 2015). Because the nature of caretaking shifts over time in response to children's developmental needs, conceptualization and measurement of father involvement varies greatly across studies. Some studies have shown that fathers' opportunities for involvement begin during a mother's pregnancy, through activities like accompanying women to doctor

visits, planning for the baby's arrival, and talking to the baby in utero (Fagan, Bernd & Whiteman, 2007; Shannon, Cabrera, Tamis-LeMonda, & Lamb, 2009; Tamis-LeMonda, Kahana-Kalman, & Yoshikawa, 2009). Additionally, fathers' participation in these types of activities may be crucial in the long term: higher levels of direct involvement in the prenatal period are typically predictive of more involvement following the baby's birth (Tamis-LeMonda et al., 2009). This finding holds up even among non-resident father families and amidst parents' relationship transitions, suggesting that establishing father involvement early on serves to help keep fathers involved in the long-term, even when families experience instability (Fagan et al., 2007; Shannon et al, 2009).

Like prenatal involvement, fathers' presence during their babies' birth predicts increased involvement across time (Bellamy, Thullen, & Hans, 2015; Shannon et al., 2009). For example, a study by Bellamy and colleagues (2015) showed that when low-income, unmarried fathers were present during the mother's delivery, they tended to participate in more childcare activities when babies were four months old (Bellamy et al., 2015). Thus, involvement in the practical aspects of parenting begins during pregnancy, highlighting the importance of assessing father involvement across the transition to parenthood.

After the baby's arrival, fathers may participate in caretaking through tasks like feeding, bathing, and changing diapers (Gavin et al., 2002). Previous studies have tended to assess fathers' level of involvement in terms of the *frequency* with which they perform a given task—e.g., how often fathers are engaged in hands-on tasks with their child, based on Likert scale reports (Coates & Phares, 2014)—or the *amount of time* spent with

their child in daily, weekly or monthly increments (Tamis-LeMonda et al., 2009; Ellerbe et al., working paper).

One concern regarding measurement of father involvement relates to questions of reporter objectivity and social desirability. Most studies rely on mothers' reports of fathers' behavior (Bellamy et al., 2015; Gonzalez, Jones, & Parent, 2014). Because each parent's biases may be reflected in their responses, it is optimal to integrate both parents' reports to control for reporter bias; however, given the challenges associated with collecting data from both parents (especially among non-resident father families), this approach is uncommon (Gavin et al., 2002; Raskin, Fosse, & Easterbrooks, 2015). Ultimately, the question of who provides data on father involvement should reflect the outcome of interest. For example, it is fitting to utilize mothers' reports of father involvement in determining predictors of maternal well-being, as her perceptions are likely linked to her well-being (Raskin et al., 2015).

2.5 Coparenting

Widening the lens on father involvement, we turn to coparenting, or the shared practice of child-rearing. Two domains of the co-parental relationship, *coparenting support* and *coparenting conflict*, capture variations in mothers' and fathers' shared caregiving experiences. High levels of *coparenting support* can create the sense that there is a "working alliance" between mother and father that centers on raising their child through shared decision-making practices (Coates & Phares, 2014; Doyle et al., 2014). For example, parents can work together to enforce consistent expectations and consequences regarding children's behavior (Doyle et al., 2014). In cases of high support, fathers act as an available resource in mothers' parenting efforts, and mothers can rely on

fathers' support around parenting issues (Ahrons, 1981). On the flip side, *coparenting conflict* refers to disagreements over child-rearing and the extent to which hostility underscores communication about these issues (Ahrons, 1981; Gonzalez, Jones, & Parent, 2014). Although the specifics of how support and conflict play out in daily life may vary between resident and non-resident father families, these core domains of coparenting are distinct from dimensions of romantic partnerships, and have been observed among married, divorced, cohabiting, and un-partnered parents (Ahrons, 1981; Doyle et al., 2014; Fagan & Kaufman, 2015).

In addition to their involvement in caretaking tasks and coparenting, fathers may support mothers in less tangible ways. We turn now to a discussion of how attending to mothers' relationship satisfaction assists in creating a comprehensive assessment of fathers' roles in promoting maternal mental health.

2.6 Mothers' Relationship Satisfaction

The extent to which mothers feel satisfied in their relationship with their baby's father may play a role in reducing her parenting stress and increasing emotional well-being (Choi, Palmer, & Pyun, 2012). Mothers' *relationship satisfaction* refers to the extent to which mothers feel satisfied in either their romantic partnership or non-romantic relationship with the biological father (Easterbrooks, Kotake, Raskin, & Bumgarner, 2016; Fagan & Lee, 2010; Pilkington et al., 2015). Unlike more nuanced dimensions of relationship quality that have been the focus of many studies, relationship satisfaction is a broad construct that can be assessed across diverse family structures.

Previous literature has documented a tendency for relationship satisfaction to decline across the transition to parenthood (Shapiro & Gottman, 2009). Thus, timing

must be considered carefully when assessing relationship satisfaction as a predictor of maternal mental health. Some cross-sectional findings have suggested that relationship satisfaction during pregnancy is *not* associated with depression at the same time point (Adewuya et al., 2007). However, one longitudinal study demonstrated that marital *dissatisfaction* during pregnancy predicted the development of postpartum depression months later (Lee et al., 2004). It is possible that prenatal relationship satisfaction serves as a protective factor in terms of mothers' mental health postnatally —in other words, higher relationship satisfaction during pregnancy may translate into "money in the bank" across the transition to parenthood by reducing the risk of depression after the baby's birth. The present study explores this possibility by assessing relationship satisfaction during pregnancy as a predictor of mothers' depression trajectory group membership.

In addition to father involvement and mothers' relationship satisfaction, fathers' financial contributions are of interest as a predictor of maternal mental health. Importantly, the logistics of paternal economic support look different in non-resident father families compared to those in resident father families (Carlson & Berger, 2013; Forste, Bartkowski, & Allen, 2009; Slade, 2013); thus, the present study examines fathers' economic support in non-resident father families.

2.7 Economic Support in Non-Resident Father Families

Recent research suggests that despite the declining popularity of the "father-breadwinner, mother-homemaker" model since its peak popularity in the 1950s, fathers are still expected to act as the primary financial provider for their children (Forste et al., 2009; Genesoni & Tallandini, 2009). Among low-income, non-resident fathers, who are disproportionately likely to earn low wages and experience unstable employment, the

social pressure to provide financially is particularly high (Forste et al., 2009). Furthermore, single mothers may attempt to increase non-resident fathers' motivation to contribute financially by leveraging fathers' access to direct involvement with children—a set of behaviors referred to as maternal gatekeeping (Fagan & Barnett, 2003). In other words, the degree to which non-resident fathers contribute financially may determine their opportunity to be involved in their children's lives in other ways, thereby making non-resident fathers' economic contributions a particularly meaningful variable to consider. An additional possibility is that for fathers with few economic resources, a sense of inadequacy may lead to withdrawal from parenting (Doherty, Kounski, & Erickson, 1998; Ellerbe, Jones, & Carlson, working paper). Thus, economic support can be conceptualized as one component of fathers' involvement that may have implications for mothers' mental health in non-resident father families.

Economic support can take many forms, including *formal economic support* via court-mandated payments to the mother and *informal economic support*, meaning monetary contributions made in the absence of a court order (Dungee Green, Halle, Le Menestrel, & Moore, 2001). In addition, fathers can provide *in-kind economic support* through the provision of necessities such as food, diapers, or medicine (Craigie, 2012; Garasky, Stewart, Gundersen, & Lohman, 2010; Slade, 2013).

Previous literature has highlighted the fact that among non-resident father families, fathers' provision of economic support plays out in distinctly different ways compared to resident father families (Carlson & Berger, 2013). Furthermore, non-resident fathers' economic contributions appear to be uniquely predictive of child outcomes. For example, in one study that utilized data from the Fragile Families and Child Well-being

study, an indirect link was established between fathers' child support payment and children's behavior problems and cognitive outcomes in early childhood (Choi et al., 2012). Specifically, when fathers contributed more money through both formal child support payments and informal cash contributions, mothers reported less parenting stress, and children exhibited fewer behavior problems and more advanced cognitive development at age three. This approach to understanding the role of father involvement in predicting child outcomes is common, and raises questions about the role of maternal mental health in these processes. The present study seeks to fill this gap in the literature.

To summarize, previous literature has documented father involvement as occurring in a number of ways, including fathers' time with baby, coparenting by mothers and fathers, mothers' relationship satisfaction, and non-resident fathers' economic support of their families. Given previous findings regarding the unique role of non-resident fathers in providing economically for their children, the present investigation examines fathers' economic support specifically in the context of non-resident father families. Through their varied roles, fathers have opportunities to promote maternal mental health. The following section reviews the state of our knowledge on fathers' roles in enhancing maternal well-being across the transition to parenthood, with attention to the role of family structure (i.e., resident versus non-resident father families).

2.8 Fathers' Promotion of Maternal Mental Health Across Complex Family Structures

Extant research suggests that father involvement plays a role in predicting mothers' experiences with depression, even before the baby is born. Specifically, cross-sectional findings have demonstrated that in a sample of adolescent mothers, more

involvement by fathers during the pregnancy predicted lower prenatal depressive symptoms (Fagan & Lee, 2010). Additionally, when fathers are involved in the practical aspects of parenting their newborns (e.g., by changing diapers and preparing bottles), mothers shoulder less of the total parenting workload, and may be less stressed and less depressed as a result (Cooper, McLanahan, Meadows, & Brooks-Gunn, 2009). It follows that mothers fare better when fathers are more involved in parenting—for example, via supportive coparenting. However, links between family structure, father involvement, and maternal depression have been inconsistent across previous studies. In particular, the literature on married and cohabiting families has tended to focus on protective aspects of parents' romantic relationships (Dennis & Letourneau, 2007; Dennis & Ross, 2006; Montgomery et al., 2009). On the other hand, much research on non-resident fathers' involvement has tended to focus on this construct as a predictor of child outcomes, overlooking the mother as a central figure in determining *how* father involvement might operate on child development (Hawkins & Palkowitz, 1999; Slade, 2013). Other literature has focused on father involvement as it relates to mothers' parenting behaviors and perceived stress (Choi et al., 2014; Harmon & Perry, 2011), constructs that are distinctly different from maternal depression.

A smaller literature has examined father involvement and maternal mental health in non-resident father families. Edwards and colleagues (2012) showed that more support from the baby's father (measured broadly in terms of the financial, emotional, and practical supports fathers provided) was associated with fewer depressive symptoms for mothers who were partnered or living with the baby's father. For non-partnered mothers, however, the authors found no association between fathers' support and depressive

symptoms (Edwards et al., 2012). On the other hand, Gonzalez and Barnett (2014) demonstrated that even after mothers had separated from their baby's father and entered romantic relationships with new partners, viewing the biological father as a supportive co-parent protected against maternal depression. These findings leave unanswered questions regarding the role that biological fathers can play in enhancing maternal mental health in the context of complex parental relationships; in particular, it is unclear whether fathers' provision of practical and emotional support can enhance maternal mental health when parents are not romantically involved with each other.

Turning to relationship satisfaction, previous studies suggest that higher relationship satisfaction is associated with better mental health outcomes for perinatal women (Abbott & Williams, 2006; Pilkington et al., 2015). However, there is insufficient evidence to determine whether relationship satisfaction is protective even when the biological parents are not romantically involved with one another. Given that unmarried mothers are at higher risk of developing perinatal depression compared to their married peers (Eamon & Zuehl, 2001; Misri, Abizadeh, & Nirwan, 2016), the potential for fathers to enhance well-being and promote recovery from depression must be examined. Thus, the present study examines mothers' relationship satisfaction as a predictor of maternal depression trajectories in both resident- and non-resident father families.

With regard to the literature on trajectories of perinatal depression, only two longitudinal studies have explicitly examined fathers' roles in promoting maternal mental health within both resident- and non-resident father families (Easterbrooks et al., 2015; Meadows, McLanahan, & Brooks-Gunn, 2008). These studies are of particular relevance to the present investigation because they: (a) assess maternal mental health at multiple

time points during the early years of parenthood and (b) draw from low-income samples that are diverse in terms of race and family structure. The findings of these studies, discussed in detail below, lay the groundwork for the design of the present study.

Utilizing data from the Fragile Families and Child Well-being Study, Meadows and colleagues (2008) assessed mothers' transitions into and out of co-residential relationships with romantic partners from their baby's birth until children were five years old. Assessing this type of change in family structure is important because unmarried parents are more likely than their married peers to experience instability in their romantic relationships (Osborne & Ankrum, 2015). Meadows and colleagues showed that changes in family structure differentially predicted mothers' mental health across the first five years of parenthood (Meadows et al., 2008). Specifically, the authors found that mothers' mental health tended to decline after ending a cohabiting relationship with the baby's biological father. However, mothers' mental health "bounced back" as they recovered from the separation. Notably, relationship dissolution earlier in the child's life was less detrimental to mothers' long-term mental health. In addition, transitioning from single to cohabiting with the father was associated with a temporary improvement in maternal mental health. Overall, these findings demonstrate that maternal mental health declines when mothers separate from their partners; inversely, mothers benefit from increased stability in their relationships. In addition, given the short-term nature of these associations, the study by Meadows and colleagues highlights the fact that family structure stability is hardly the sole predictor of mothers' well-being, and even amidst major life changes, mothers are resilient.

A major strength of the study by Meadows and colleagues is captured in their longitudinal assessment of maternal mental health, which allows the authors to identify the role of family transitions in predicting mothers' well-being. An important caveat regarding Meadows et al.'s results is that mental health was assessed using a score calculated by summing three dichotomous variables, including occurrences of (a) binge drinking, (b) illicit drug use, and (c) a diagnosis of major depressive disorder (i.e., a score of 2 would indicate that any two out of the three indicators was present). A predictor variable of this nature is limited in its ability to demonstrate nuanced increases and decreases in depressive symptoms over time. The present study builds upon findings by Meadows and colleagues in the following ways: first, the scope of the present investigation is limited to the perinatal period; second, the CES-D is used to track changes in depressive symptoms across this time frame; third, participants' changes in family structure (i.e., movement from resident father family to non-resident father family status, or vice versa) between pregnancy and one month postpartum are accounted for, with the acknowledgment that transitions into and out of relationships may either serve a protective function or act as environmental stressors that contribute to maternal depression.

An additional study conducted by Easterbrooks and colleagues (2016) assessed the link between father involvement and maternal depression in a racially diverse sample of adolescent mothers. These authors assigned participants to one of three trajectory groups to capture maternal depression across time ("stable non-depressed," "stable depressed," and "depression remits") by determining whether participants' scores fell above or below the clinical cutoff at each of two time points (12 months- and 24 months

after enrolling in a home visiting program for first-time adolescent parents). Next, they assessed mothers' satisfaction with the "quality of time" babies' fathers spent with infants. Higher satisfaction scores were associated with a decrease in mothers' depressive symptoms. These findings suggest that when fathers are more involved in parenting, mothers' mental health is likely to benefit. In addition, given that the majority of mothers sampled in the Easterbrooks study belonged to non-resident father families, these findings highlight the possibility that fathers can help to promote maternal mental health even when parents are not romantically involved with one another.

In sum, the present study builds upon previous literature in several key ways. First, the analytic technique of group-based trajectory modeling will allow for a nuanced examination of perinatal depression, capturing variation in the course of women's symptoms from the third trimester of pregnancy until one year postpartum. Importantly, this approach uses an unconditional model to predict membership to trajectory groups, which allows for the emergence of groups in the absence of predictors or covariates. It is then possible to identify factors associated with group membership—namely, father involvement and mothers' relationship satisfaction—through the use of logistic regression models that predict mothers' probability of belonging to each trajectory group. Finally, our use of a depressive symptom inventory (CES-D) to track level and change in women's symptoms expands upon the conceptualization of maternal mental health utilized by Meadows and colleagues (2008), which addressed well-being more broadly. Our development of a comprehensive model of fathers' ability to promote maternal well-being, which accounts for fathers' unique roles across resident and non-resident father

families, will determine the ways in which father involvement and mothers' relationship satisfaction can predict women's trajectories of depression across the perinatal period.

CHAPTER THREE

RESEARCH QUESTIONS

In light of previous research regarding (a) the course of perinatal depression and (b) fathers' roles across diverse family structures, research questions that guide the present investigation address low-income, resident- and non-resident father involvement as predictors of mothers' membership to perinatal depression trajectory groups. Research Questions 1 and 2 relate to the full sample of mothers in the present study, while Research Questions 3 and 4 explore how family structure may differentially shape the role of father involvement in predicting the course of perinatal depression.

3.1 Research Question 1

Are there distinct trajectories of depressive symptoms in a sample of low-income, employed women from the third trimester of pregnancy until one year postpartum?

Hypothesis 1**:** Based on previous studies on perinatal depression trajectories, it was hypothesized that women's depressive symptoms would follow one of four distinct trajectories marked by the following characteristics: (1) no or low levels of depression across time that never reach clinical significance; (2) clinically significant depressive symptoms during pregnancy (*antepartum depression*) that remit during the first year of parenthood; (3) clinically significant depressive symptoms that present for the first time following birth and remain high throughout the first year (*postpartum depression*); and (4) *chronic* depression that does not remit across the perinatal period (Campbell et al., 2007; Cents et al., 2013; Christensen et al., 2011; Kuo et al., 2012; Mora et al., 2009; Sutter-Dallay et al., 2012; Van der Warden et al., 2015; Vanska et al., 2011).

3.2 Research Question 2

Does (a) father involvement (i.e., presence at birth, time with baby) and (b) mothers' prenatal relationship satisfaction predict the depression trajectories of new mothers?

Hypothesis 2a: Higher levels of father involvement will predict better mental health for mothers across time (Carlson & Berger, 2013; Coley & Hernandez, 2006; Fagan & Lee, 2010; Jackson, Choi, & Preston, 2015). Specifically, based on cross-sectional data regarding fathers involvement and perinatal depressive symptoms, it is expected that when fathers are present at birth and spend more time with baby in the first month postpartum, mothers will have significantly better odds of belonging to the low symptom group compared to any of the other trajectory groups. On the other hand, when fathers are absent during their child's birth and spend less time with their baby, mothers are expected to have greater odds of belonging to the postpartum depression and chronic depression groups compared to other groups (Bellamy et al., 2015; Cooper et al., 2009; Fagan & Lee, 2010; Shannon et al., 2009).

Hypothesis 2b: Higher levels of maternal relationship satisfaction (measured during pregnancy) will predict better maternal mental health over time (Easterbrooks et al., 2016; Fagan & Lee, 2010; Lee et al., 2004; Razurel & Kaiser, 2015). Specifically, higher prenatal relationship satisfaction will be associated with greater odds that mothers will belong to the low symptom group compared to other trajectory groups (Easterbrooks et al., 2016; Fagan & Lee, 2010; Meadows, 2011), while lower prenatal relationship satisfaction will be associated with increased odds of belonging to the postpartum and chronic trajectory groups compared to the low symptom and antenatal depression groups

(Adewuya et al., 2007; Campbell et al., 2007; Gonzalez et al., 2014; Lee et al., 2004; Mora et al., 2009; Sutter-Dallay et al., 2012).

3.3 Research Question 3

Does family structure moderate the relation between (a) fathers' presence at birth and depression trajectory group membership; (b) fathers' time with baby and depression trajectory group membership, and (c) mothers' relationship satisfaction and depression trajectory group membership? Does accounting for change in family structure from the third trimester of pregnancy until one month postpartum help to explain these differences in group membership?

Hypothesis 3: To our knowledge, extant research has not examined the question of family structure moderating the relation between father involvement, relationship satisfaction and depression trajectory group membership. Thus, there is little evidence to guide this inquiry. However, it is possible that when parents are not living together, fathers' involvement in parenting and mothers' relationship satisfaction will act as more salient protective factors in enhancing maternal mental health, compared to situations in which these factors may be less novel. In accordance with this exploratory line of inquiry, it is expected that fathers' presence at birth, fathers' time with baby, and mothers' relationship satisfaction will interact with family structure to predict the probability of group membership. Specifically, compared to their married and cohabiting peers, mothers in non-residential father families are expected to have greater odds of belonging to the low symptom group compared to other trajectory groups when fathers are present at birth and spend more time with babies. The same finding is expected with regard to mothers' relationship satisfaction: mothers in non-resident father families are expected to

experience a greater protective benefit from higher relationship satisfaction (i.e., show significantly higher odds of belonging to the low symptom group compared to other trajectory groups), compared to mothers in resident father families.

With regard to change in family structure, transitioning out of cohabiting relationships between pregnancy and one month postpartum are expected to predict increased odds that mothers will belong to the postpartum- and chronic depression trajectory groups compared to other groups (Meadows et al., 2008; Osborne, Berger, & Magnuson, 2012). Meanwhile, transitioning into a cohabiting arrangement is expected to predict increased odds of belonging to the low symptom and antepartum depression groups compared to the other trajectory groups (Meadows et al., 2008).

Finally, previous research suggests that unique predictors of father involvement in resident and non-resident father families will predict trajectories of maternal depression (Gonzalez et al., 2014; Meadows, 2011; Smith & Howard, 2009). This hypothesis is explored further in Research Question 4.

3.4 Research Question 4

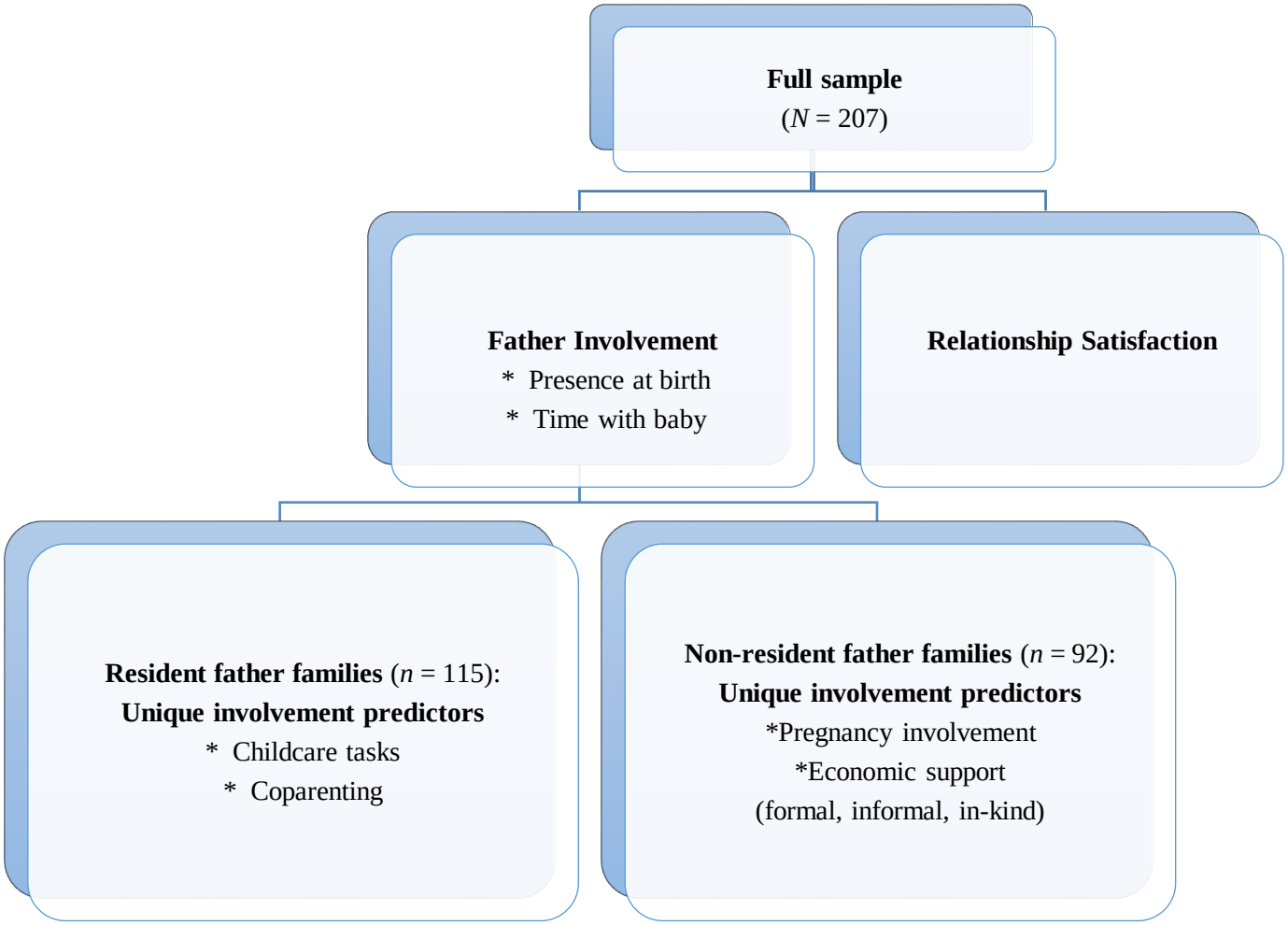
Are trajectories of maternal depression predicted when unique factors representing father involvement in resident- and non-resident father families are included in separate regression models?

Hypothesis 4a: Predicting trajectory group membership in resident father families (see Figure 1). It is expected that among women in resident father families, more father involvement (presence at birth; time with baby; childcare tasks; higher coparenting support; lower coparenting conflict) will be associated with greater likelihood that mothers will belong to the low symptom group versus any other trajectory group (Fox,

Bruce, & Combs-Orme, 2000). Additionally, among mothers in resident father families, greater relationship satisfaction is expected to predict increased likelihood that mothers will belong to the low symptom group compared to other trajectory groups (Dennis & Letourneau, 2007; Meadows, 2011), while lower prenatal relationship satisfaction will be associated with increased odds of belonging to the postpartum and chronic trajectory groups compared to the low symptom and antenatal depression groups (Adewuya et al., 2007; Campbell et al., 2007; Gonzalez et al., 2014; Lee et al., 2004; Mora et al., 2009; Sutter-Dallay et al., 2012).

Hypothesis 4b: Predicting trajectory group membership in non-resident father families (see Figure 1). It is expected that among women in non-resident father families, more father involvement (involvement during pregnancy; presence at birth; time with baby; formal-, informal-, and in-kind economic support) will predict increased likelihood that mothers will belong to the low symptom group versus any other trajectory group (Choi et al, 2014; Easterbrooks et al., 2016; Fagan & Lee, 2010; Smith & Howard, 2009). Non-resident father involvement during pregnancy is expected to be a particularly strong predictor of mothers' odds of belonging to the low symptom group (Fagan & Lee, 2010). Additionally, higher prenatal relationship satisfaction will be associated with greater likelihood that mothers will belong to the low symptom group versus any other trajectory group (Easterbrooks et al., 2016), while lower relationship satisfaction is expected to predict increased odds that mothers will belong to the postpartum depression or chronic depression trajectory groups compared to the other groups (Fagan & Lee, 2010).

Figure 1. Predictors of perinatal depression trajectory group membership for the full sample and by family structure



CHAPTER FOUR

METHOD

4.1 Participants

Participants took part in the Work and Family Transitions Project (WFTP), a longitudinal study funded by the National Institute of Mental Health that examines the transition to parenthood for low-income families. Data collection took place between 2003 and 2009. Participants were recruited through prenatal classes at hospitals and birth clinics, as well as through Women, Infants, and Children (WIC) offices in Western Massachusetts. Criteria for inclusion were as follows: (1) participants were employed for a minimum of 20 hours per week prior to giving birth; (2) the mother planned to return to work within the first six months after the baby's birth; and (3) participants were considered "working-class" based on their educational attainment (no higher than an Associate's degree) and employment in unskilled or semi-skilled positions.

At the initial data collection time point, 207 women in their third trimester of pregnancy participated in the study. The sample was diverse in terms of race and ethnicity: 47 women identified as Black, 74 as Latina, 75 as White, 1 as Asian, and 10 as Multiracial. Among the Latina subsample, the majority (90%) identified as Puerto Rican. Participants belonged to either resident father families (n = 115) or non-resident father families (n = 92). Among the participants who belonged to resident father families, 82 were unmarried and cohabiting and 33 were married. On average, mothers were 24.5 years old at the time of recruitment. Average take-home incomes fell between $13,544 ($SD$ = $7,333) for non-resident father families and $40,571 ($SD$ = $17,072) for resident father families

4.2 Procedure

Data were collected at five time points across the transition to parenthood: first during women's third trimester of pregnancy (Time 1), and again at approximately one month postpartum (Time 2), three months postpartum (Time 3), six months postpartum (Time 4), and one year postpartum (Time 5). Participants were interviewed in their homes by the principal investigator and a team of trained graduate research assistants. The exception to this was the fourth time point, when babies were 6 months old, at which time data were collected via a mailed questionnaire packet. Participants received $50 upon completion of each of the four in-home interviews, and $25 after completing the mailed questionnaire.

4.3 Measures

4.3.1 Depressive Symptoms

At each of the five time points, participants completed the Center for Epidemiological Studies Depression Scale (CES-D), a 20-item measure that assesses the major facets of depressive symptoms, including low mood, feelings of guilt and worthlessness, helplessness and hopelessness, loss of appetite, and sleep disturbances (Radloff, 1977; see Appendix A). This questionnaire asks respondents to indicate the frequency with which they had experienced depressive symptoms during the previous week, using a 4-point scale ranging from 0 (Rarely or none of the time / less than 1 day) to 3 (Most or all of the time / 5-7 days). Items include "I felt depressed," "I felt hopeful about the future," and "I could not 'get going.'" Four of the 20 items were recoded so that a high score is consistent with more severe depressive symptoms. The range of possible

scores on the CES-D is 0-60, with scores of 16 and above indicating clinically significant depressive symptoms.

The CES-D has been established as a reliable measure of depressive symptoms across a variety of demographic categories, including age, race, and gender, and income level (Knight, Williams, McGee, & Olaman, 1997; Radloff, 1977). In addition, this measure is commonly used to assess depressive symptoms in perinatal populations (Mora et al., 2009). For the present sample, Cronbach's alphas ranged from .87 to .89 across the five time points, indicating good reliability.

4.3.2 Family Structure

At each time point, participants responded to the prompt, "Are you currently living with the baby's father?" Based on responses to this item, family structure was coded as a dichotomous variable (0 = resident father family; 1 = non-resident father family), and assessed as a predictor of mothers' trajectory group membership at Times 1 and 2. Father residency status was chosen as the most relevant indicator of family structure in the present study because this factor is used widely in the literature on father involvement (Dungee Green et al., 2001; Hofferth & Goldscheider, 2010; Nepomnyaschy & Garfinkle, 2011).

Because marital status is a more common indicator of family structure in the literature on perinatal mental health, we assessed whether participants' depression scores varied as a function of marital status. Based on their response to the question, "Are you married to the baby's father?" participants received a marital status code at each of the five time points (1 = married; 2 = cohabiting; 3 = single). One-way ANOVAs with a Tukey post-hoc test were conducted to determine whether marital status at each time

point was related to CES-D scores at each time point (see Table 16). At Time 1, married women were significantly less depressed (M = 12.67; SD = 6.73) than cohabiting women (M = 17.87; SD = 10.48). There were no other significant differences between married, cohabiting and single women at any of the five time points. Furthermore, there were no consistent patterns in terms of depression scores and marital status across time; thus, it was determined that grouping married and cohabiting women together under the resident father family code was acceptable for the analytic procedure.

Table 16**:** Average depression scores (CES-D) and standard deviations for married, cohabiting and single women at each time point

	Full Sample	**Married**	**Cohabiting**	**Single**
Time 1 *3rd trimester*	16.70 (9.66) *N* = 207	12.67a (6.73) *n* = 33	17.87a (10.48) *n* = 82	17.11 (9.49) *n* = 92
Time 2 *1 month postpartum*	12.45 (9.17) *N* = 182	12.56 (9.58) *n* = 33	11.77 (8.55) *n* = 75	13.09 (9.66) *n* = 9.66
Time 3 *4 months postpartum*	12.25 (8.97) *N* = 177	9.16 (5.97) *n* = 32	13.03 (9.76) *n* = 77	12.81 (9.00) *n* = 68
Time 4 *6 months postpartum*	12.55 (9.12) *N* = 120	11.76 (8.16) *n* = 33	11.54 (9.74) *n* = 46	14.34 (9.10) *n* = 41
Time 5 *12 months postpartum*	12.72 (9.32) *N* = 148	12.46 (7.50) n = 35	11.31 (9.12) n = 55	14.22 (10.38) n = 58

Note. Depression was measured using the CES-D. Scores range from 0 – 60; scores of 16 and above suggest the presence of clinically significant symptoms. The superscript ([a]) indicates that mean depression scores for married and cohabiting women were significantly different at Time 1.

4.3.3 Father Involvement

Mothers' reports of father involvement were assessed across and within family structure groups. The conceptualization of father involvement in the present study acknowledges that resident- and non-resident fathers have different types of opportunities to be involved with their children. These differences are accounted for through measurement of aspects of involvement that may be either common or unique across family structures. Aspects of father involvement that are expected to be common across family structures are assessed in the full sample. Additional measures assess unique opportunities that may exist for resident- and non-resident fathers. Unless otherwise noted, all measures of father involvement were obtained at Time 2, when babies were approximately one month old.

4.3.3.1 Measures of Involvement in the Full Sample: Fathers' presence at birth

Previous research has demonstrated that fathers' presence during the birth of their child is an early form of involvement that predicts better maternal mental health outcomes (Bellamy et al., 2015; Shannon et al., 2009). To assess this aspect of involvement, mothers were asked, "Who was present at the birth?" Interviewers then verbally provided a list of non-medical support people who may have been present during her delivery, including the baby's biological father. Participants indicated whether the father was present by stating "yes" or "no." A dichotomous variable was then created to account for whether or not the baby's father was present during the baby's birth (0 = No; 1 = Yes).

4.3.3.2 Measures of Involvement in the Full Sample: Fathers' time with baby

Mothers were asked to provide information about who cares for their child during a typical week by completing a daily chart with the interviewer (see Appendix B). These reports accounted for the number of hours per week that babies spent: (a) with fathers only; (b) with fathers and others; (c) with mothers and fathers together; (d) with mothers only, and (e) with non-parental caregivers. For the purpose of data analysis, two variables were created to capture fathers' time with baby: *fathers' alone time with baby* (weekly hours fathers spent with baby when mothers were *not* present) and *fathers' total time with baby* (weekly hours fathers spent with both babies and mothers).

4.3.3.3 Resident Father Families: Fathers' childcare tasks

Using a measure adapted from Barnett and Baruch's (1987) *Childcare Responsibility* inventory (see Appendix C), a list of 15 common childcare tasks was provided to participants (e.g., *feeding the baby, changing the baby's diaper, soothing the baby, playing with the baby*). Participants belonging to resident father families were asked to estimate the percentage of childcare tasks that each person in the household completed. Mothers' reports of fathers' percentage of childcare tasks were included in predictor models.

4.3.3.4 Resident Father Families: Coparenting support

Ahrons' (1981) *Coparental Relationship* questionnaire was used to assess co-parental support as a distinct domain of coparenting (see Appendix D). Four items assessed this construct, including "When you need help regarding your child, do you seek it from (coparent?)" and "Would you say that (coparent) is a resource to you in raising your child?" Responses were given on a 5-point scale, where 1 indicates "Never" and 5

indicates “Always.” A high score on this subscale indicates a high degree of perceived support from the baby’s father. Cronbach’s alpha for *coparental support* among resident father families was .74.

Notably, at the time of data collection, this measure was intended to assess the coparenting relationship across resident and non-resident father families. However, a low response rate on this measure from mothers in non-resident father families (n = 32) made it difficult to assess *coparental support* across family structure groups. Thus, in the present study, *coparental support* was only assessed in resident-father families.

4.3.3.5 Non-resident Father Families: Father involvement during pregnancy

Mothers belonging to non-resident father families were asked to report whether their baby’s father was involved in preparing for the baby’s arrival by responding to the prompt, “During your pregnancy, did the baby’s father help in other [non-financial] ways, such as providing transportation to the prenatal clinic or helping with chores?” Participants responded by answering “Yes” or “No.”

4.3.3.6 Non-resident Father Families: Fathers’ economic support

Non-resident father involvement may take any of the following economic forms: *formal economic support* via court-mandated payments to the mother; *informal economic support*, meaning monetary contributions made in the absence of a court order; and *in-kind economic support* through the provision of necessities such as food, diapers, or medicine (Craigie, 2012; Slade, 2013). Mothers answered questions about fathers’ contributions in each of these economic forms at one month postpartum (see Table 2). To assess *formal economic support*, mothers were asked, “Do you have a legal agreement or child support order that requires [biological father] to provide financial support to the

baby?" with the option to respond "Yes" or "No." Because only three mothers reported having a formal legal agreement in place, formal economic support was excluded from analyses.

To assess fathers' *informal economic support*, mothers were asked: "Has (biological father) paid anything toward your child's support since he/she was born?" with the option to respond "Yes" or "No." An additional follow-up question revealed that although the majority of mothers (56.2%) reported that they had not received any money from fathers in the first month after babies' births, contributions ranged from $0 to $1,500 (*M* =$145; *SD* = $293).

Mothers also completed a brief questionnaire regarding fathers' provision of *in-kind economic support* by indicating the frequency with which fathers purchased six types of items commonly used for infant care. Mothers responded to the prompt "How often does the baby's biological father buy the following items: Clothes, toys, medicine, child care items (diapers, baby wipes), formula/food, anything else?" using a 4-point scale (1 = "Never," 2 = "Rarely," 3 = "Sometimes," 4 = "Often." Mothers' responses to each of these items was recoded so that 1 = "ever purchased" and 0 = "never purchased." Next, a cumulative variable was created representing fathers' total in-kind support on a scale of 1 to 6, with higher scores representing more in-kind support. For example, a father who had *ever* purchased diapers and formula in the first month after birth (but no other items on the list) would receive a score of 2.

Table 2: Items assessing non-resident fathers' provision of economic support

Economic Support Factor	Questionnaire Item
Formal	"Do you have a legal agreement or child support order that requires [biological father] to provide financial support to baby?"
Informal	"Has (biological father) paid anything toward your child's support since he/she was born?"
In-kind	"How often does biological father buy the following items: Clothes, toys, medicine, child care items (diapers, baby wipes), formula/food, anything else?"

Note. Participants responded to items at Time 2, when babies were one month old.

4.3.4 Mothers' Relationship Satisfaction

At the first time point, all participants were asked to rate their level of relationship satisfaction using a 7-point scale, where 1 indicated "Extremely Dissatisfied" and 7 indicated "Extremely Satisfied." Participants belonging to resident father families received the question, "How satisfied are you with your relationship with your partner/spouse?" while participants belonging to non-resident father families received the question, "How satisfied do you currently feel in your relationship with [baby's father]?" (Schumm et al., 1983).

4.3.5 Control Variables

Previous studies have identified a number of demographic risk factors linked with the likelihood of developing perinatal depression. Parity was selected as a control variable in the present study, based on findings that first-time mothers are less likely to develop depression in the postpartum period compared to women who have given birth previously (Di Florio et al., 2014; Iwata et al., 2016). Additionally, maternal age was

controlled for, given that previous studies have produced mixed results for the role of this factor in predicting mental health outcomes (McMahon et al., 2015; Sutter-Dallay et al., 2012). The question of whether women sought treatment for depression during pregnancy was also considered, as this factor may alter the course of depression across the year. To account for this factor, we controlled for whether or not women reported either (a) engagement in counseling or (b) treatment with psychotropic medication at the first time point. Finally, in light of the racial diversity represented in the present study, and given that ethnic minority group membership was identified as a risk factor for chronic depression in two previous studies (Cents et al., 2013; van der Waerden et al., 2015), race was also included as a control variable in the present study.

CHAPTER FIVE

ANALYTIC PLAN

The process of answering each of the research questions involved three main steps, as outlined by Nagin (2005). First, a longitudinal model of maternal depression trajectories was developed using group-based developmental modeling (GBM) in the software program STATA, along with the *traj* plugin designed by Jones and Nagin (2013). The goal of this analysis was to identify discrete groups of individuals for whom depression scores change in similar ways from the third trimester of pregnancy until one year postpartum. The process of selecting the best model was guided by previous research on perinatal depression trajectories (Mora et al., 2009; Sutter-Dallay et al., 2012; Vanska et al., 2011). Models were tested using linear, cubic, and quadratic terms until the best model was identified. In total, 29 possible solutions were tested. The best model was selected by examining two goodness of fit indicators, the Baysean Information Criterion (BIC) and posterior probabilities (Nagin, 2005).

Next, as a means of becoming familiar with the data, group profiles were developed for each of the trajectory groups by running cross-tabulation analyses using demographic and predictor variables. Examining these data descriptively is the first step in determining whether there are "shared characteristics of trajectory group members that distinguish them from their counterparts in other trajectory groups (Nagin, 2005, pp. 81-82)." After reviewing group profiles, the next step is to determine which set of factors best predict trajectory group membership. A series of multinomial logit "risk factor" models are run to establish the combination of control variables and predictors that provide the best estimate of group membership. Goodness of fit indicators are also

reviewed, including BIC values and posterior probabilities, which help to determine whether the predictor model is a more accurate estimate of an individual's likelihood of being assigned to the "correct" group, compared to the original trajectory model that contained no predictors. In addition to these objective means of evaluating models, Nagin writes that "subjective judgment (Nagin, 2005, p. 61)" must also be relied upon throughout the process of developing the best predictor model in order to integrate theory that guides the research questions. The best model seeks to answer the question, "collectively, can these characteristics predict an individual's trajectory group membership with high probability? (Nagin, 2005, p. 106)." The following example illustrates a case in which subjective judgment would be necessary: a well-fit unconditional model estimates that a large number of participants are assigned to a given trajectory group. The estimated membership to this group then drops considerably when a predictor is added to the model. Even if the posterior probability is high and the BIC is low (indicating goodness of fit), subjective judgment would deem this predictor model inferior to the unconditional model because correct assignment was estimated for far fewer participants in the predictor model.

Throughout the process of model testing, risk factor models are run multiple ways, in order to position each trajectory group as the reference group. This technique poses the questions, "Is the probability of membership to Group A different from Groups B, C, and D, based on Factor X? Is the probability of membership to Group B different from Group C and D based on Factor X?" and so on. Shifting the reference group also serves as a pairwise test to determine whether the impact of each variable differs significantly in predicting probability of membership to each trajectory group.

An analysis of missing data was conducted prior to addressing Research Questions 2-4. When data were missing on the father involvement and relationship satisfaction measures, a review of each family's circumstances was conducted in order to determine whether or not data were missing at random (MAR). Data were deemed to be MAR if, for example, a participant was running late to the interview and was unable to complete all measures. Multiple imputation was used to compute values for MAR data on each control and the predictor variable. This process involved using SPSS to generate five imputed datasets. Final imputed values were calculated for each control and predictor by averaging the five imputed values. This imputation process allowed for optimal prediction of the probability that women would follow a given depression trajectory group. Descriptive statistics for post-imputation values for each predictor variable can be viewed in Table 17.

Table 17**:** Descriptive statistics for continuous predictors of mothers' depression trajectories in the full sample of mother and by family structure groups (post-imputation)

Predictors for the Full Sample	***N***	**Yes**	**No**	
Dad present at birth	207	79%	21%	
	N	**Mean**	***SD***	**Range**
Dads' time with baby alone	202	10.08	19.26	-12.08 – 140.00
Dads' total time with baby	207	37.95	34.16	-6.02 – 210.00
Relationship satisfaction (phase 1)	207	5.36	1.54	1.00 – 7.00
Change in relationship satisfaction (1 – 2)	207	-0.12	1.69	-6.00 – 5.00
Predictors for Resident Father Families	***N***	**Yes**	**No**	
Dad present at birth	115	96.5%[a]	3.5%	
	N	**Mean**	***SD***	**Range**
Dads' time with baby alone	115	13.15[b]	20.28	-18.87 – 112.25
Dads' total time with baby	115	50.62[c]	30.40	-1.08 – 165.00
Relationship satisfaction	115	5.95[d]	1.11	2 - 7
Childcare tasks	115	31.42%	12.45	0.47% - 51.33%
Coparenting support	115	4.37	0.66	2.00 – 5.42
Coparenting conflict	115	2.13	0.67	0.95 – 4.75
Predictors for Non-resident Father Families	***N***	**Yes**	**No**	
Dad involved during pregnancy				
Dad present at birth	92	56.5% [a]	43.5%	
Formal economic support				
Informal economic support				
	N	**Mean**	***SD***	**Range**
Dads' time with baby alone	92	5.59[b]	16.86	-9.59 – 140.00
Dads' total time with baby	92	22.13 [c]	32.07	-6.02 – 210.00
Relationship satisfaction	92	4.63[d]	1.69	1 - 7
In-kind economic support				

Note. Different letter superscripts (a, b, c) indicate that mean scores for resident- and non-resident father families were significantly different.

Four families had missing predictor data that was not random. In these cases, unique circumstances prohibited babies' fathers from being involved with parenting. For example, one mother reported that her husband had been deported; another mother reported that her baby's father was murdered shortly after they learned of her pregnancy

(see Table 18). In these four cases, predictor data were not imputed, and the analytic procedure dropped these participants from the predictor models.

Table 18: Predictor data for moms who "never" have contact with bio dad at phase 2

Family	Family Structure (ph. 1)	Family Structure (ph. 2)	Relationship Satisfaction	Time with Baby	Presence at birth	Pregnancy Involvement	Informal Economic	In-kind Economic	CCT	Cop	Decision
248	0	1	missing	missing	0				miss	miss	Delete—dad was missing/deported
262	1	1	6	0	0	1	0	0			Keep
274	1	1	missing	0	0	0	0	0			Keep
291	1	1	missing	0	0	0	0	missing			Conceived by assault—delete from predictor models
292	1	1	missing	0	0	Missing	0	missing			Dad not known-—delete from predictor models
296	1	1	4	missing	0	1	0	missing			Answered relationship questions, but dad was in jail phases 1-4; Keep but don't impute for involvement variables b/c he didn't have opportunity to be involved
302	1	1	1	0	0	0	0	0			Keep
315	1	1	3	0	0	0	0	0			Keep
329	1	1	1	missing	0	0	0	missing			Keep
348	0	1	5	missing	1				miss	miss	Keep
357	1	1	missing	0	0	missing	0	0			Dad was murdered during 1st trimester—delete from predictor models
363	1	1	missing	0	0	0	0	0			Keep
365	1	1	1	0	0	0	0	0			Keep
370	1	1	1	0	0	0	0	0			Keep

376	0	1	2	missing	1		miss	miss	Keep

Note. For family structure, 0 = resident father family; 1 = non-resident father family. For presence at birth, 0 = no; 1 = yes

CHAPTER SIX

RESULTS

6.1 Descriptive Data

Two hundred and seven women participated in the study at Time 1 (third trimester of pregnancy), and 195 of these participants completed measures at Time 2 (1 month postpartum). At Time 3, 182 mothers participated in the study; 126 participated at Time 4, and 150 participated at Time 5. The GBM technique requires only one data point in order to estimate the trajectories of a given sample; thus, the trajectory model in the present study was based on data from all 207 mothers, accounting for each participant's depression scores at all available time points.

In terms of race and ethnicity, 36.2% of the sample identified as Latina (n = 75); 35.6% identified as White (n = 74), and 22.6% identified as African American (n = 47). Additionally, 4.8% identified as multiracial or mixed-race (n = 10), and 0.5% identified as Asian (n = 1). Most Latina-identified women who participated in the study indicated that they were of Puerto Rican descent. The majority of women reported that they had been born in the U.S. (82.1%; n = 170), while 17.9% (n = 37) were born outside of the U.S. Most participants had completed high school (53.1%; n = 110), while 12.1% of the sample had not completed high school or earned their GED (n = 25), and 34.6% had obtained an associate's degree (n = 72). None of the participants held a college degree. In terms of parity, approximately half of the women who participated in the study (55%) were having their first baby. Thirty women (14.5%) reported receiving counseling or psychiatric treatment during pregnancy.

Additional sample demographics were obtained for the full sample of 207 mothers during the third trimester of pregnancy (see Table 3). At the first time point, mothers' average age was 25.32 (*SD* = 5.49); mothers' ages ranged from 17.9 years to 42.4 years. Mothers' age did not differ significantly based on family structure.

Table 3: Demographics for in the full sample of mothers and by family structure

	N	**Mean**	***SD***	**Range**
Full sample				
Age	207	25.32	5.49	17.9 - 42.4
Mothers' work hours	207	34.19	12.49	0 – 90
Mothers' income	207	$15,275	$8,726	$0 - $73,542
Resident Father Families				
Age	115	25.89	5.49	18.2 – 42.4
Mothers' work hours	115	34.82 [a]	10.63	0 - 58
Mothers' income	114	$16,800	$9,504	$0 - $73,542
Family take-home income	115	$40,571	$17,072	$352 - $105,600
Non-resident Father Families				
Age	92	24.59	5.44	17.9 – 40.8
Mothers' work hours	92	33.40 [a]	14.51	0 - 90
Mothers' income	90	$13,544	$7,333	$0 - $31,000

Note. [a] indicates that average work hours for resident- and non-resident father families were significantly different at the level of a trend ($p < .10$). Mean scores on other demographic variables displayed in this table did not differ significantly based on family structure.

6.2 Mothers' Depression Across Time

On average, the full sample of mothers scored just above the clinical cutoff during pregnancy (*M* = 16.70; *SD* = 9.66). Depression scores dropped approximately 4 points between Times 1 and 2, and average scores varied little across the remainder of the first year (see Table 4). There were no significant differences in depression scores reported by participants in resident- versus non-resident father families at any of the five time points.

Table 4: Average depression scores and standard deviations (CES-D) at each time point for the full sample and by depression trajectory group

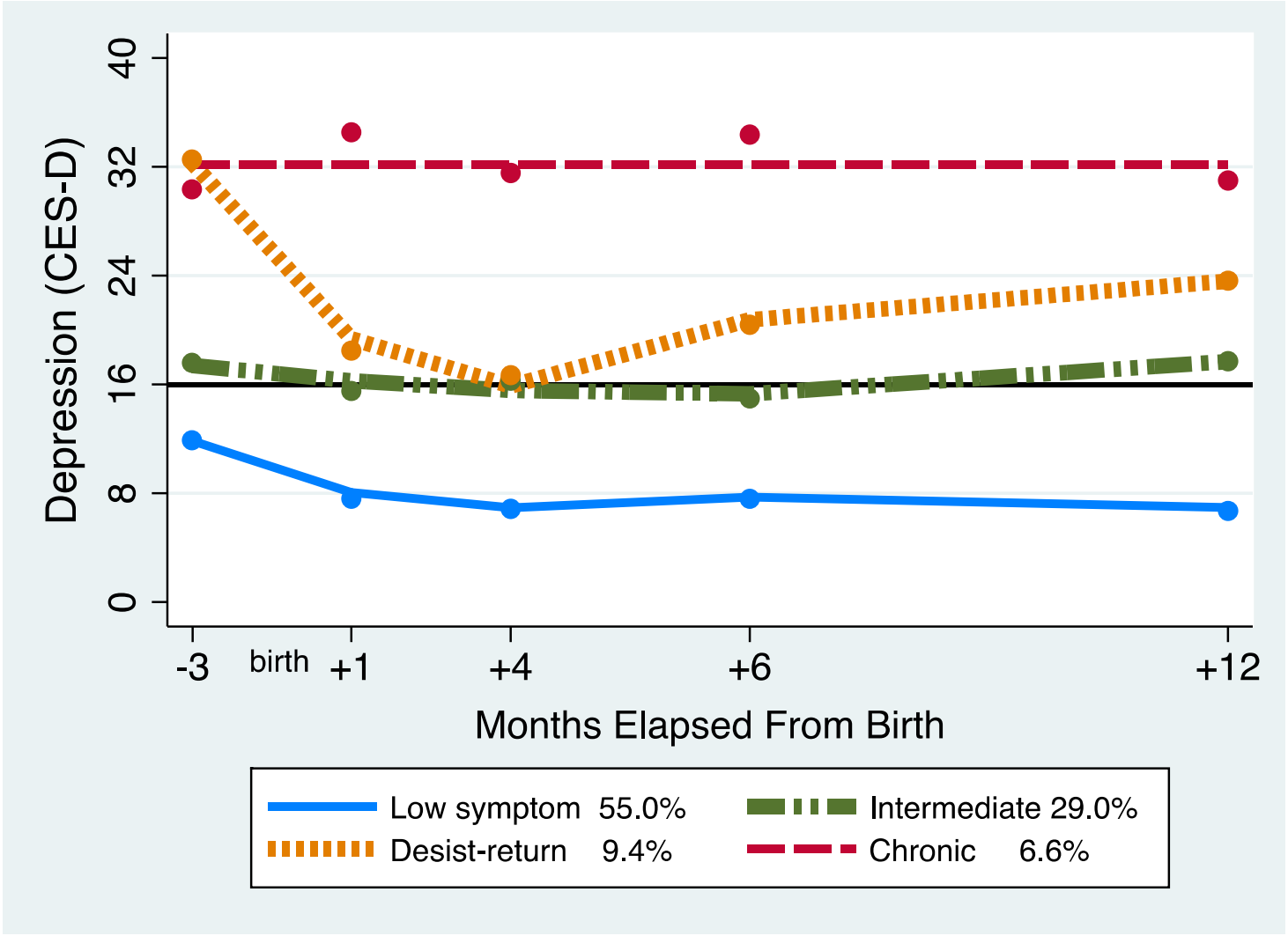
	Full Sample	**Low Symptom**	**Intermediate**	**Desist-Return**	**Chronic**
Time 1 *3rd trimester*	16.70 (9.66) *N* = 207	11.86 (6.46) *n* = 114	17.41 (5.63) *n* = 60	33.0 (5.94) *n* = 20	30.83 (10.64) *n* = 13
Time 2 *1 month postpartum*	12.45 (9.17) *N* = 182	7.43 (4.78) *n* = 101	15.67 (5.91) *n* = 52	17.11 (7.39) *n* = 18	35.73 (8.95) *n* = 11
Time 3 *4 months postpartum*	12.25 (8.97) *N* = 177	6.65 (4.14) *n* = 93	16.19 (7.27) *n* = 53	16.74 (6.72) *n* = 19	31.11 (7.48) *n* = 12
Time 4 *6 months postpartum*	12.55 (9.12) *N* = 120	7.37 (5.02) *n* = 64	14.97 (5.42) *n* = 37	19.45 (9.57) *n* = 11	33.32 (7.89) *n* = 8
Time 5 *12 months postpartum*	12.72 (9.32) *N* = 148	6.66 (4.61) *n* = 84	17.56 (5.94) *n* = 44	24.99 (6.59) *n* = 11	30.58 (7.10) *n* = 9

Note. Depression was measured using the CES-D. Scores range from 0 – 60; scores of 16 and above suggest the presence of clinically significant symptoms.

6.3 Research Question 1: Trajectories of Perinatal Depression

To determine whether mothers' symptoms of depression follow distinct trajectories across the perinatal period, we utilized censored normal (CNORM) model estimation to model trajectories based on continuous scores of depression using the CES-D. Depressive symptom scores were obtained at the third trimester of pregnancy (Time 1); one month postpartum (Time 2), three months postpartum (Time 3), six months postpartum (Time 4), and one year postpartum (Time 5). Based on assessment of the Baysean Information Criterion (BIC), an indicator of goodness of fit, it was determined that a four-group model best fit the data (see Figure 2). The final step required to answer Research Question 1 involved analyzing posterior probabilities. Values above 0.70 (meaning 70% accuracy) indicate that the model is a good fit for the data (Nagin & Odgers, 2010).

Figure 2. Group-based trajectory models of perinatal depression in the full sample of mothers from the third trimester of pregnancy until one year postpartum. This figure represents the findings for Research Question 1.



Consistent with previous research, these findings suggest that the course of perinatal depression varies. Furthermore, women appear to hang together in meaningful ways in terms of how their symptoms change throughout the first year of parenthood. In the present study, women were likely to belong to one of the following four trajectory groups:

(1) a *low symptom* group (55.0% of sample) who continuously reported minimal symptoms. Mothers assigned to the low symptom trajectory group showed an average depression score that fell below the clinical cutoff at Time 1 (M = 11.86, SD = 6.46) and average scores for this group declined and stayed low across the first year. The average posterior probability indicated that participants were assigned to this group with 89% accuracy.

(2) an *intermediate* group (29.0% of the sample) whose average score was just above the clinical cutoff during pregnancy (M = 17.41; SD = 5.63) and hovered within 1-2 points throughout the year. The average posterior probability indicated that participants were assigned to this group with 85% accuracy.

(3) a *desist-return group* (9.4% of the sample) who reported the highest average depression scores initially (M = 33.0; SD = 5.94); declined to average levels just above the clinical cutoff by the fourth month postpartum, then increased in the second half of the year. The average posterior probability indicated that participants were assigned to this group with 79% accuracy.

(4) a *chronic* group (6.6% of sample) who reported a high average depression score during pregnancy (M = 30.83; SD = 10.64) and remained high throughout

the year. The average posterior probability indicated that participants were assigned to this group with 94% accuracy.

Table 4 provides descriptive data for mothers' depression scores (CES-D) at each time point in the full sample, as well as by trajectory group. Descriptive demographic data for the four trajectory groups (see Table 5) show that women who were slightly younger tended to belong to the desist-return group (M = 23.13 years) and the chronic group (M = 24.05), whereas the low symptom (M = 25.11 years) and intermediate groups (M = 26.72) were comprised of slightly older women. In terms of parity, the majority of women in each trajectory group were having their first baby. One exception is noted, with 43% of the intermediate group having their first baby. More women in the desist-return group reported seeking psychological treatment during pregnancy compared to their peers. Mothers in each trajectory group worked between 34 and 36 hours per week at the first time point; the exception was mothers in the desist-return group, who worked an average of 30.33 hours per week. Finally, average reports for mothers' take-home income were higher in the low symptom and intermediate groups compared to the desist-return groups.

After confirming that this four-group trajectory model best fit the data and examining group profiles, Research Questions 2-4 were addressed in order to determine the best predictors of group membership.

Table 5: Group means and frequencies for demographic characteristics by depression trajectory group

	Low Symptom	Intermediate	Desist-Return	Chronic
Demographic Factor				
Age	25.11	26.72	23.13	24.05
First baby	58.8%	43.3%	60.0%	61.5%
Treatment during pregnancy	6.1%	20.0%	40.0%	23.1%
Mothers' income	$16,009	$15,113	$12,691	$13,566
High school or less	62.1%	64.3%	73.7%	92.3%
White	37.7%	36.7%	30.0%	23.1%
Black	22.8%	21.7%	30.0%	15.4%
Latina	34.2%	35.0%	35.0%	61.5%
Other race	5.3%	6.7%	5.0%	0%

Note. All descriptive data were measured at Time 1, when mothers were in their third trimester of pregnancy. Family take-home income is only available for resident-father families.

6.4 Research Question 2: Predicting Trajectory Group Membership in the Full Sample

Descriptive statistics for predictor variables are displayed in Table 6. The majority of mothers (79.7%) reported that their baby's biological father was present during birth. It should be noted that some participants may have experienced birth-related circumstances that limited who was able to be physically present. For example, one mother who had an emergency cesarean explained that only one additional person was allowed in the room, and she chose for her mother to accompany her.

Table 6: Descriptive statistics for predictors of mothers' depression trajectory groups

Predictors for the Full Sample	***N***	**Yes**	**No**	
Dad present at birth	194	79.7%	20.3%	
	N	**Mean**	***SD***	**Range**
Dads' alone time with baby	120	9.75	25.10	0 - 140
Dads' total time with baby	120	38.83	39.98	0 – 210
Relationship satisfaction	189	5.46	1.56	1 - 7

Note. Father involvement (presence at birth, time with baby) was assessed at Time 2. Time with baby is measured in hours per week. Outliers on this measure represent families in which fathers were not employed at Time 2. Relationship satisfaction was assessed at Time 1.

On average, fathers spent 9.75 hours (*SD* = 25.10) of alone time per week with babies (i.e., without the mother present), and 38.83 hours (*SD* = 39.98) with their babies in total (when mothers were also present). Prenatal relationship satisfaction was also assessed as a predictor of trajectory group membership. The average relationship satisfaction score was 5.46 (*SD* = 1.56), indicating that overall, mothers were "somewhat satisfied."

All continuous variables were standardized prior to analysis. Pearson's correlations, one-way ANOVAs, and chi square tests of independence assessed for multicollinearity among predictor variables and controls. Variables that were highly collinear ($r > .50$) were tested separately in predictor models. Fathers' alone time with baby and total time with baby were positively correlated ($r = .72$, $p < .001$). Fathers' total time with baby was positively correlated with mothers' relationship satisfaction ($r = .23$,

p = .001); however, there was not a significant correlation between fathers' alone time with baby and mothers' relationship satisfaction (r = .09, p = .19). Treatment during pregnancy was significantly associated with prenatal relationship satisfaction, such that mothers who received treatment tended to report less satisfaction in their relationships (M = -.76, SD = 1.21), compared to women who did not receive treatment (M = .13, SD = .96): $F(1, 201) = 21.78$, $p < .001$. Additionally, age was associated with parity, such that younger women were more likely to be having their first baby than older women: $F(1, 205) = 43.44$, $p < .001$. To address the issue of multicollinearity among controls, age and parity were each tested separately in models with predictor variables. Across models, parity was a stronger and more consistent predictor of mothers' trajectory group membership.

The first step in predicting trajectory group membership is to develop group profiles in order to examine predictor data descriptively across trajectory groups (Nagin, 2005).

These group profiles (see Table 7) show little variability in fathers' presence at birth across trajectory groups. Mothers assigned to the low symptom group reported the highest average scores for fathers' alone time and total time with baby. Additionally, the highest relationship satisfaction scores were observed among mothers assigned to the low symptom group.

Table 7: Group means and frequencies for predictor variables by depression trajectory group in the full sample of mothers

	Low Symptom	Intermediate	Desist-Return	Chronic
Father Involvement				
Dad present at birth	80.7%	76.7%	75.0%	76.9%
Dads' alone time (weekly hours)	12.19	7.15	6.49	5.97
Dads' total time with baby	41.45	36.55	30.01	26.05
Mothers' Relationship Satisfaction	5.78	4.94	4.46	5.03

Note. Father involvement (presence at birth, time with baby) was assessed at Time 2. Time with baby is measured in hours per week. Outliers on this measure represent families in which fathers were not employed at Time 2. Relationship satisfaction was assessed at Time 1.

Next, a series of risk factor models tested the best solution for predicting group membership. Table 8 presents findings from this series of models with the low symptom group positioned as the reference group. First, a control-only model tested parity and treatment during pregnancy as predictors of membership to each group compared to the low symptom group (see Table 8, Model 1). In terms of parity, women having their first baby were less likely to belong to the intermediate group compared to the low symptom group. Additionally, women who received treatment during pregnancy had significantly greater odds of belonging to both the intermediate and the desist-return group compared to the low symptom group. Notably, additional models tested race/ethnicity as a control variable through the inclusion of a series of dichotomous variables (White = 1; non-White = 0; Black = 1; non-Black = 0; Latina = 1; non-Latina = 0; Other race = 1; non-Other race = 0). These models were run with each trajectory group positioned as the reference in order to determine whether membership to any of these four racial groups predicted the probability of membership to any of the four depression trajectory groups. None of these models demonstrated that race or ethnicity predicted probability of group membership. For the sake of parsimony, these findings are not reported in tables, and race/ethnicity was not included as a control in predictor models.

Table 8: Regression coefficients and associated standard errors for models predicting trajectory group membership (low symptom group is reference)

	Model 1 (controls only)			**Model 2** (controls + presence at birth)			**Model 3** (controls + alone time)			**Model 4** (controls + total time)			**Model 5** (controls + relationship satisfaction)		
	G2	G3	G4	G2	G3	G4	G2	G3	G4	G2	G3	G4	G2	G3	G4
Variable															
First baby	-0.84* (.42)	1.64 (1.51)	-0.08 (.59)	-0.71 (.43)	1.36 (1.13)	-0.16 (.62)	-0.74 (.44)	1.79 (1.27)	0.03 (.60)	-2.78 (1.55)	-2.51 (1.43)	-2.30 (1.54)	101.92 (2053.64)	101.49 (2053.64)	101.96 (2053.64)
Treatment during pregnancy	1.48* (.72)	2.85** (.84)	1.43 (.84)	13.31 (41.34)	14.35 (41.34)	13.01 (41.34)	1.59+ (.83)	3.29** (.94)	1.62 (.91)	-1.96 (1.74)	0.79 (1.20)	0.21 (1.37)	-80.94 (5285.37)	-78.86 (5285.37)	-79.21 (5285.37)
Dad present at birth	-	-	-	-0.34 (.58)	0.40 (1.00)	-0.41 (.72)	-	-	-	-	-	-	-	-	-
Dads' alone time	-	-	-	-	-	-	-0.19 (.22)	-0.74 (.87)	-0.32 (.43)	-	-	-	-	-	-
Dads' total time	-	-	-	-	-	-	-	-	-	-2.19* (1.10)	-1.62 (.91)	-2.23* (1.01)	-	-	-
Relationship satisfaction	-	-	-	-	-	-	-	-	-	-	-	-	42.47 (1721.61)	41.92 (1721.61)	41.88 (1721.61)
Goodness of fit															
Posterior probability	.919 (*n* = 118)			.879 (*n* = 105)			.917 (*n* = 113)			.795 (*n* = 35)			.999 (*n* = 2)		
BIC	-2861.26			-2842.55			-2813.81			-2827.38			-2838.21		

Note. G2 = Intermediate symptom group. G3 = Desist-return group. G4 = Chronic group. Continuous variables (alone- and total time, relationship satisfaction) were standardized prior to inclusion in these models. Posterior probabilities provide an estimate of the likelihood that an individual will be correctly assigned to the low symptom group. Associated *n*s indicate the number of participants assigned to the low symptom group in a given model. BIC values are an additional goodness-of-fit indicator. Larger BICs suggest that the model is a better fit. $^{**}p < .01$; $^{*}p < .05$; $^{+}p < .06$.

Next, a series of models tested each of the predictors along with controls. Neither fathers' presence at birth nor fathers' alone time with baby predicted membership to any group compared to the low symptom group; however, receiving treatment during pregnancy predicted membership to both the intermediate and desist-return group when fathers' alone time was included in the model (see Table 8, Model 3). Turning to the fourth model, when fathers spent more total time with baby (i.e., when mothers were also present), mothers were less likely to belong to either the intermediate or the chronic group compared to the low symptom group (see Table 8, Model 4). Notably, posterior probabilities for Model 4 indicate that when parity, treatment during pregnancy, and time with baby were included in the model, only 35 mothers were assigned to the low symptom group, and correct assignment was estimated with 79.5% certainty. By comparison, the unconditional model without predictors estimated correct assignment of 122 participants to the low symptom group with 89% certainty. Thus, although fathers' total time with baby was a significant predictor, the overall model did not provide a good estimate of group membership. Additionally, Model 5 revealed that relationship satisfaction was not a significant predictor of membership to the low symptom group when parity and treatment during pregnancy were controlled for.

Finally, a sixth model tested the question of whether relationship satisfaction would predict group membership when fathers' total time with baby was also in the model. Table 9 presents the results of this model. When relationship satisfaction was added to a predictor model including parity, treatment during pregnancy, and fathers' total time with baby, less total time with baby continued to be a significant predictor of mothers' odds of belonging to the intermediate and chronic groups compared to the low

symptom group (see Table 9). Additionally, fathers' total time became significant at the level of a trend in terms of predicting membership to the desist-return group compared to the low symptom group. Relationship satisfaction was not significant in this model; however, posterior probabilities indicated that this model was better than the model containing only father's total time and controls (see Table 8, Model 4). Still, neither predictor model was better than the unconditional model at estimating group membership. Ultimately, the only predictor model that improved the likelihood of correctly predicting mothers' membership to the low symptom group was the "control only" model containing parity and treatment during pregnancy (see Table 8, Model 1). This model estimated women's likelihood of belonging to the low symptom group with 91.9% accuracy, compared to the model with no predictors, which estimated group membership with 89% accuracy.

Table 9: Regression coefficients and associated standard errors for the best model predicting trajectory group membership (low symptom group is reference)

	Model 6 (controls + total time + relationship satisfaction)		
	G2	G3	G4
Variable			
First baby	3.62*	-3.20	-2.95
	(1.60)	(1.61)	(1.68)
Treatment during pregnancy	-2.89	-0.09	-0.58
	(1.70)	(1.39)	(1.55)
Dad present at birth	-	-	-
Dads' alone time	-	-	-
Dads' total time	-3.94**	-2.50+	-3.26*
	(1.34)	(1.31)	(1.42)
Relationship satisfaction	0.89	-0.19	0.02
	(.63)	(.52)	(.61)
Goodness of fit			
Posterior probability	.881 (*n* = 31)		
BIC	-2827.62		

Note. G2 = Intermediate symptom group. G3 = Desist-return group. G4 = Chronic group. Continuous variables were standardized prior to inclusion in these models. Posterior probabilities provide an estimate of the likelihood that an individual will be correctly assigned to the low symptom group. Associated *n*s indicate the number of participants assigned to the low symptom group in a given model. BIC values are an additional goodness-of-fit indicator. Larger BICs suggest that the model is a better fit. $^{**}p < .01$ $^{*}p < .05$; $^{+}p < .06$.

Next, the process above was repeated, positioning: a) the intermediate group as the reference, and b) the desist-return group as the reference. There were no significant predictors of mothers' membership to the intermediate group versus the desist-return or chronic groups, or the desist-return group versus the chronic group.

In sum, for the full sample of mothers, father involvement and relationship satisfaction were not robust predictors of mothers' probability of belonging to any of the four trajectory groups. Instead, the "control only" model provided the best estimate of women's membership to the low symptom group. Specifically, women having their first baby were more likely to be assigned to the low symptom group than the intermediate group, and women who received treatment during pregnancy were more likely to belong to the intermediate and the desist-return group compared to the low symptom group. Next, the question of whether family structure moderates the relation between each predictor and probability of depression trajectory group membership was examined.

6.5 Research Question 3: Predicting Trajectory Group Membership Based on Family Structure

In terms of family structure at Time 1, 55.6% of the sample (n = 115) belonged to resident father families, while 44.4% (n = 92) belonged to non-resident father families. At Time 2 (1 month postpartum), 11% of mothers (n = 23) reported a change in their family structure since the baseline interview during pregnancy. Thirteen of the mothers originally identified as belonging to non-resident father households had moved in with the baby's father, while 10 mothers had moved out of resident father arrangements. Neither family structure at Time 1 nor family structure at Time 2 predicted trajectory

group membership. Additionally, change in family structure from Time 1 to Time 2 was not a significant predictor of trajectory group membership.

To address Research Question 3, moderation models were built to explore the question of whether family structure at Time 1 (i.e., resident- versus non-resident father status) interacted with (a) fathers' presence at birth, (b) fathers' alone- and total time with baby, and (c) mothers' relationship satisfaction to predict mothers' probability of belonging to each depression trajectory group, controlling for parity and treatment during pregnancy. The first step in addressing this question required centering continuous predictor variables. Next, interaction terms were created using family structure at Time 1 and each of the predictor variables of interest (fathers' presence at birth; fathers' alone time with baby; fathers' total time with baby; mothers' relationship satisfaction). A series of moderation models then tested whether each father involvement predictor and relationship satisfaction interacted with family structure to predict mothers' probability of trajectory group membership. In step 1, only the predictor was included with controls. In step 2, both the predictor and family structure were added to the model with controls. Step 3 included each variable along with an interaction term. The only finding to emerge from these models was in regard to relationship satisfaction. There was a main effect for relationship satisfaction at the level of a trend when predicting mothers' odds of belonging to the chronic versus the low symptom group. When family structure was controlled for, there was also a significant main effect for relationship satisfaction predicting mothers' odds of belonging to the desist-return versus the low symptom group. Of note, unlike the models for Research Question 2, in which continuous predictors were standardized for the purpose of analysis, centering the relationship satisfaction variable

appears to reduce collinearity between the variables in the model to the extent that an effect was detectable. Finally, there were no significant interactions between family structure and any of the four predictors.

6.6 Research Question 4: Unique Models for Predicting Trajectory Group Membership Based on Family Structure

The final research question asked, can mothers' membership to depression trajectory groups be predicted by father involvement factors that are unique to resident and non-resident father families? To address this question, it was first necessary to determine whether the four-group trajectory model best fit the data when resident- and non-resident father families were separated into discrete groups. In fact, the original trajectory model required minor amendments to best fit the data for resident- and non-resident father families. To develop the best models, the process described for Research Question 1 was repeated for each family structure group until the optimal model solutions were achieved. This process yielded trajectory models that were similar to the model for the full sample—each contained a low symptom group that comprised the majority of the sub-sample, as well as a desist-return and chronic group. The main difference between the full sample model (see Figure 2) and the sub-sample models for resident father families (see Figure 3) and non-resident father families (see Figure 4) is that the intermediate groups in the resident- and non-resident father family models were subsumed by the desist-return groups. Compared to their married and cohabiting peers, mothers in non-resident father families who belonged to the desist-return group tended to report higher average depression levels at baseline, and show a greater increase in depression between Time 3 and Time 4. By the end of the first year, however, mothers in

the desist-return groups showed nearly identical average depression scores regardless of family structure.

Next, the previously described process of determining the best predictors of group membership was followed for each family structure group. Findings are discussed separately for resident and non-resident father families in the following sections.

Figure 3. Group-based trajectory models of perinatal depression among mothers in resident father families from the third trimester of pregnancy until one year postpartum. This figure represents the trajectory model that was used to answer Research Question 4 with the sub-sample of women from resident father families.

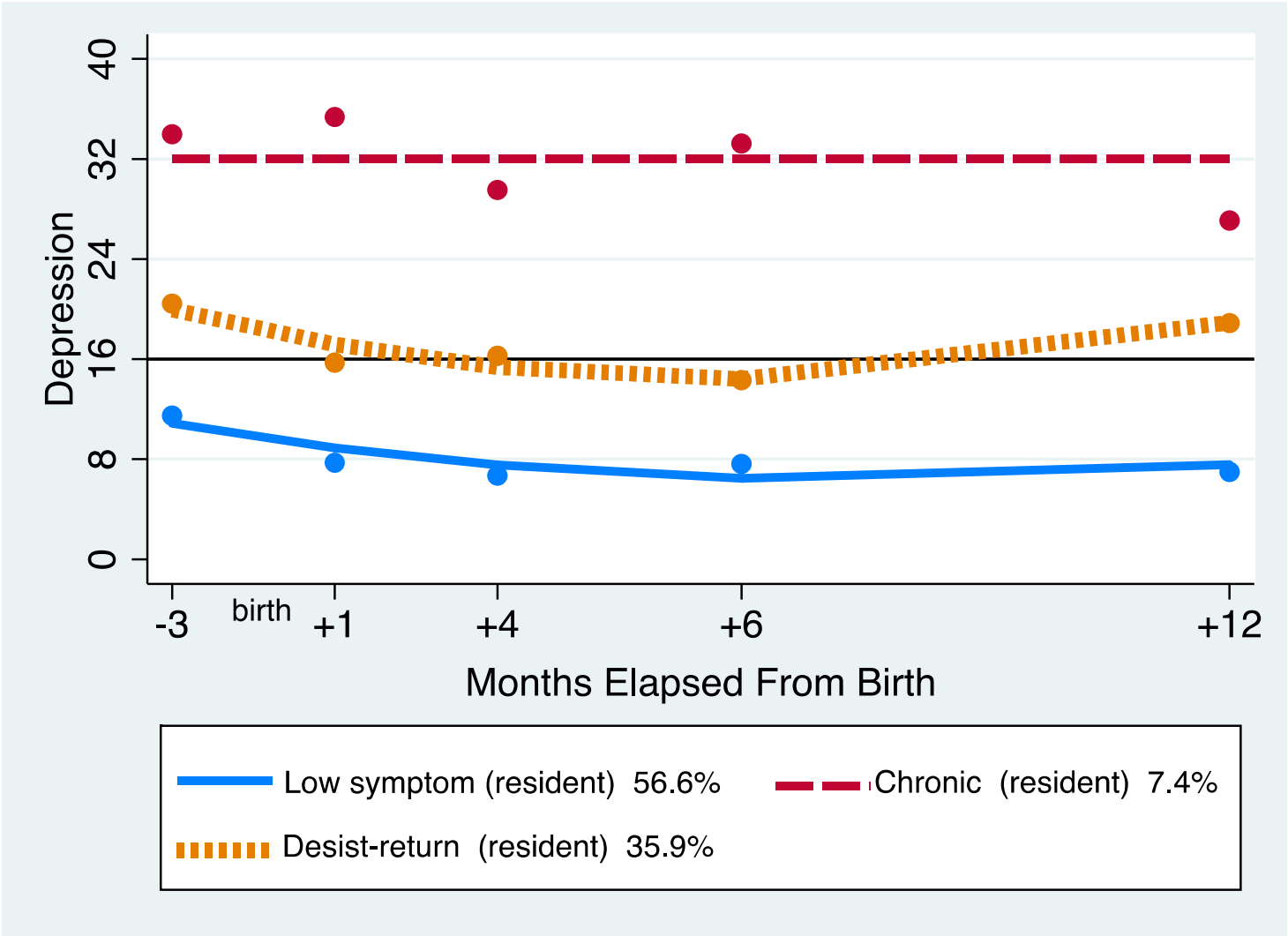
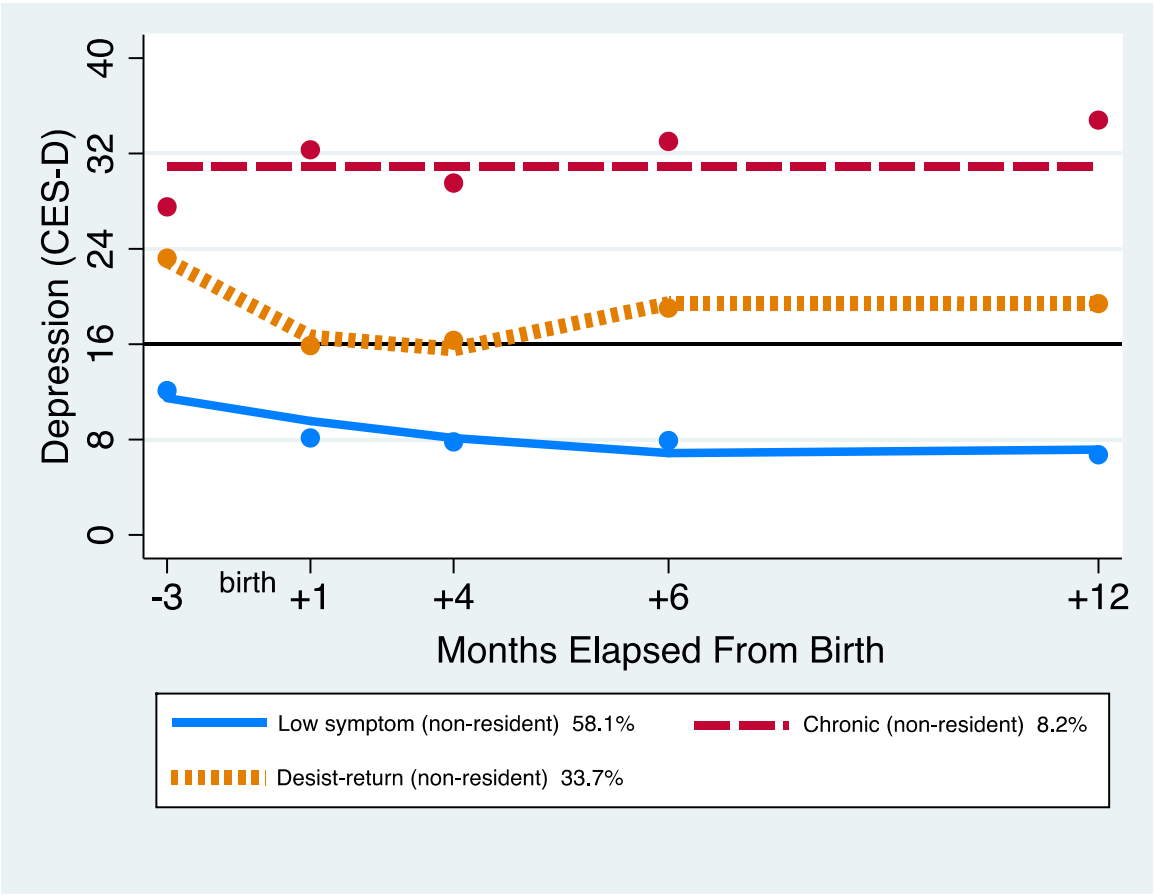


Figure 4. Group-based trajectory models of perinatal depression among mothers in non-resident father families from the third trimester of pregnancy until one year postpartum. This figure represents the trajectory model that was used to answer Research Question 4 with the sub-sample of women from non-resident father families.



6.6.1 Resident Father Families

First, group profiles were developed to examine predictor data descriptively across trajectory groups (see Table 10). Mothers in the desist-return group tended to be slightly older than their peers, while mothers in the chronic group tended to be younger. The majority of women in the low symptom and chronic groups were having their first baby, while slightly less than half of women in the desist-return group were having their first baby. No women in the low symptom group reported receiving treatment during pregnancy, whereas 20-25% of women in the desist-return and chronic groups reported treatment during pregnancy. These profiles show little variability in fathers' presence at birth across trajectory groups. Mothers assigned to the low symptom group reported the highest average scores for fathers' alone time and total time with baby. Mothers assigned to the chronic group reported the highest percentage of childcare tasks performed by their partners. On average, mothers assigned to the low symptom group reported the highest level of coparenting support and the lowest level of coparenting conflict compared to their peers. The highest average relationship satisfaction score was observed among mothers assigned to the desist-return group.

Table 10: Group means and frequencies for controls and predictors among resident father families

	Low Symptom	Desist-Return	Chronic
Control Variables			
Age	25.76	26.57	24.15
First baby	63.6%	43.6%	90.0%
Treatment during pregnancy	0%	25.6%	20%
Father Involvement			
Dad present at birth	95.5%	97.4%	100%
Dads' alone time with baby	15.81	8.79	12.59
Dads' total time with baby	55.47	44.19	43.62
Childcare tasks	31.77%	29.85%	35.21%
Coparenting support	4.49	4.19	4.25
Coparenting conflict	1.89	2.32	2.92
Relationship Satisfaction	5.33	5.51	5.23

Note. Controls and father involvement variables were assessed at Time 2. Time with baby is measured in hours per week. Relationship satisfaction was assessed at Time 1.

Bivariate correlations and one-way ANOVAs tested for multicollinearity among predictor variables and controls. Variables that were highly collinear ($r > .50$) were tested separately in predictor models. Among resident father families, fathers' alone time with baby and total time with baby were positively correlated ($r = .70$, $p < .001$). Fathers' total time with baby was positively correlated with mothers' relationship satisfaction at the level of a trend ($r = .18$, $p = .06$), such that mothers who were more satisfied with their relationships during pregnancy tended to have partners who spent more time with babies after birth. Mothers' age was positively correlated with fathers' alone time ($r = .24$, $p = .01$) and total time ($r = .20$, $p = .03$), such that older mothers tended to have partners who spent more time with their babies. Fathers' proportion of childcare tasks was negatively correlated with mothers' age ($r = -.46$, $p < .001$), such that younger mothers tended to have partners who performed more childcare tasks. There was also a significant association between parity and fathers' childcare tasks, such that first-time mothers

tended to report that their partners performed a higher proportion of tasks (M = .16, SD = .83), compared to women with older children (M = -.23, SD = 1.18): $F(1,111) = 4.08$, p = .04. Variables that were highly collinear ($r > .50$) were tested separately in predictor models.

A series of risk factor models containing one variable at a time determined which factors predicted the likelihood that mothers in resident father families would belong to each depression trajectory group. In models for which the low symptom group was the reference, none of the control variables were significant; thus, controls were not included in predictor models. Additionally, there were no significant findings for fathers' presence at birth, alone time or total time with baby, or childcare tasks. Less coparenting support increased the odds that mothers would belong to the desist-return group compared to the low symptom group (see Table 11, Model 6). More coparenting conflict increased the odds that mothers would belong to both the desist-return and the chronic group versus the low symptom group (see Table 11, Model 7). In addition, less relationship satisfaction increased the odds that mothers would belong to the desist-return versus the low-symptom group (see Table 11, Model 8).

Table 11: Regression coefficients and associated standard errors for models predicting trajectory group membership among resident father families (low symptom group is reference)

	Model 1 (controls only)		**Model 2** (presence at birth)		**Model 3** (alone time)		**Model 4** (total time)		**Model 5** (childcare tasks)		**Model 6** (coparenting support)		**Model 7** (coparenting conflict)		**Model 8** (relationship satisfaction)	
	G2	G3	G2	G3	G2	G3	G2	G3	G2	G3	G2	G3	G2	G3	G2	G3
Variable																
First baby	-0.84 (.53)	1.37 (1.13)	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Treatment during pregnancy	18.59 (2659.18)	118.01 (2659.18)	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Dad present at birth	-	-	-0.05 (1.39)	14.39 (2732.15)	-	-	-	-	-	-	-	-	-	-	-	-
Dads' alone time	-	-	-	-	-0.33 (.27)	-0.23 (.44)	-	-	-	-	-	-	-	-	-	-
Dads' total time	-	-	-	-	-	-	-0.44 (.25)	-0.51 (.46)	-	-	-	-	-	-	-	-
Childcare tasks	-	-	-	-	-	-	-	-	-0.11 (.28)	0.40 (.45)	-	-	-	-	-	-
Coparenting support	-	-	-	-	-	-	-	-	-	-	-0.62* (.29)	-0.59 (.39)	-	-	-	-
Coparenting conflict	-	-	-	-	-	-	-	-	-	-	-	-	1.46*** (.42)	2.28*** (.56)	-	-
Relationship satisfaction	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-0.79* (.35)	-0.02 (.63)
Goodness of fit																
Posterior probability	.927 (n = 65)		.915 (n = 65)		.899 (n = 65)				.906 (n = 64)		.914 (n = 62)		.912 (n = 65)		.907 (n = 65)	
BIC	-1621.91		-1627.77		-1620.70				-1620.93		-1618.50		-1604.96		-1623.53	

Note. G2 = Desist-return group. G3 = Chronic group. Posterior probabilities provide an estimate of the likelihood that an individual will be correctly assigned to the low symptom group. Associated *n*s indicate the number of participants assigned to the low symptom group in a given model. BIC values are an additional goodness-of-fit indicator. Larger BICs suggest that the model is a better fit. ***$p < .001$; *$p < .05$.

Finally, a series of multivariate risk factor models tested the best solution for predicting group membership. Table 12 presents findings from this series of models with the low symptom group positioned as the reference group. A model that included both coparenting support and coparenting conflict showed that coparenting conflict continued to predict membership to both the desist-return and the chronic group compared to the low symptom group (see Table 12, Model 9). However, the posterior probability produced by this model showed that the combination of these predictors did not provide a better solution for predicting group membership than coparenting conflict alone (see Table 11, Model 7). However, including coparenting support, coparenting conflict and relationship satisfaction provided a better solution (see Table 12, Model 10). Compared to the model with no predictors, which estimated the likelihood that mothers would be correctly assigned to the low symptom group with 71% accuracy, Model 10 predicted membership to the low symptom group with 97% accuracy. This model was also provided the best estimate of low symptom group membership compared to the other predictor models displayed in Tables 11 and 12.

Table 12: Regression coefficients and associated standard errors for the best model predicting trajectory group membership among resident father families (low symptom group is reference)

	Model 9 (coparenting support + coparenting conflict)		**Model 10** (coparenting support + coparenting conflict + relationship satisfaction)		**Model 11** (coparenting conflict + relationship satisfaction)	
	G2	G3	G2	G3	G2	G3
Variable						
Coparenting support	-0.37 (.28)	-0.26 (.52)	-0.48 (.42)	-0.07 (.74)	-	-
Coparenting conflict	1.41** (.43)	2.25*** (.58)	2.00* (.89)	3.44** (1.29)	2.00 (1.73)	2.87* (1.22)
Relationship satisfaction	-	-	-2.97* (1.18)	-1.32 (1.47)	-2.49^{+} (1.29)	-1.43 (1.26)
Goodness of fit						
Posterior probability	.912 (n = 65)		.969 (n = 49)		.909 (n = 43)	
BIC	-1608.71		-1617.16		-1620.46	

Note. G2 = Desist-return group. G3 = Chronic group. Continuous variables were standardized prior to inclusion in these models. Posterior probabilities provide an estimate of the likelihood that an individual will be correctly assigned to the low symptom group. Associated *n*s indicate the number of participants assigned to the low symptom group in a given model. BIC values are an additional goodness-of-fit indicator. Larger BICs suggest that the model is a better fit. $^{***}p < .001$; $^{**}p < .01$ $^{*}p < .05$; $^{+}p < .06$.

Next, the process described above was repeated to determine whether father involvement and relationship satisfaction differentially predicted membership to the desist-return group compared to the chronic group. None of the variables tested were significant.

In sum, the best model for predicting trajectory group membership among resident father families showed that higher coparenting support, lower coparenting conflict, and higher relationship satisfaction were protective factors the predicted membership to the low symptom group compared to the desist-return and chronic groups. Next, we predict trajectory group membership among mothers in non-resident father families.

6.6.2 Non-resident Father Families

First, group profiles were developed to examine predictor data descriptively across trajectory groups (see Table 13). There was little variability in mothers' age across groups. Approximately half of the mothers assigned to the low symptom and desist-return groups were having their first baby, while 25% of mothers assigned to the chronic group were having their first baby. Mothers assigned to the low symptom group were the least likely to report treatment during pregnancy.

Table 13: Group means and frequencies for predictor variables by depression trajectory group among mothers in non-resident father families

	Low Symptom	Desist-Return	Chronic
Control Variables			
Age	24.22	25.22	25.02
First baby	51.8%	50.0%	25.0%
Treatment during pregnancy	12.5%	32.1%	25.0%
Father Involvement			
Dad involved during pregnancy	74.0%	55.6%	28.6%
Dad present at birth	59.3%	59.3%	50.0%
Dads' time with baby alone	7.87	2.81	1.65
Dads' total time with baby	25.01	23.70	5.68
Informal economic	48.2%	40.7%	25.0%
In-kind economic	70.3%	36.8%	50.0%
Relationship Satisfaction	5.09	4.09	3.30

Note. Controls and father involvement variables were assessed at Time 2. Time with baby is measured in hours per week. Relationship satisfaction was assessed at Time 1.

In terms of father involvement, the majority of mothers assigned to the low symptom group reported that fathers were involved during pregnancy; fathers' involvement during pregnancy was the least common among mothers assigned to the chronic group. There was little variability in fathers' presence at birth, with approximately half the sample reporting that fathers were present across trajectory groups. Mothers in the low symptom group reported that fathers spent the most time with babies, both alone and in total. In terms of economic support, mothers assigned to the low symptom group were the most likely to report receiving cash from fathers through

informal arrangements, while mothers assigned to the chronic group were the least likely to report this type of support. The majority of mothers assigned to the low symptom group reported receiving in-kind economic support, while mothers assigned to the desist-return group were the least likely to report in-kind support. Finally, on average, mothers assigned to the low symptom group were the most satisfied in their relationships with babies' fathers, while mothers assigned to the chronic group were the least satisfied.

Bivariate correlations, chi square tests of independence, and one-way ANOVAs tested for multicollinearity among predictor variables and controls. Variables that were highly collinear were tested separately in predictor models. Fathers' alone time with baby and total time with baby were positively correlated ($r = .75$, $p < .001$). Additionally, relationship satisfaction was significantly associated with the dichotomous predictor *fathers' involvement during pregnancy*, such that mothers were more satisfied when fathers helped prepare for babies' arrival ($M = .30$, $SD = .83$), compared to when fathers did not help prepare for babies' arrival ($M = -.64$, $SD = 1.02$): $F(1,82) = 20.94$, $p < .001$. Additionally, higher prenatal relationship satisfaction was also associated with more in-kind economic support from fathers ($r = .21$, $p < .05$). There was also a significant association between treatment during pregnancy and prenatal relationship satisfaction, such that women who received treatment tended to report lower relationship satisfaction ($M = -.55$, $SD = 1.07$), compared to women who did not receive treatment ($M = .13$, $SD = .94$): $F(1,87) = 6.74$, $p = .01$.

Next, a series of risk factor models containing one predictor at a time determined which factors predicted the likelihood that mothers in non-resident father families would belong to each depression trajectory group. Table 14 presents findings from this series of

models with the low symptom group positioned as the reference group. Comparing odds that mothers would belong to the desist-return versus the low symptom group, there was a trend for treatment during pregnancy, whereby mothers were more likely to belong to the desist-return group when they had received treatment. Because treatment during pregnancy was only marginally significant, this control was not included in the predictor models in order to preserve power. As shown in Table 14, mothers were more likely to belong to the chronic group compared to the low symptom group when fathers were not involved during pregnancy (see Model 2). There were no significant findings for fathers' presence at birth, alone- or total time with baby, or fathers' informal economic involvement. When fathers provided less in-kind support in the first month postpartum, mothers were more likely to belong to the desist-return group compared to the low symptom group (see Table 14, Model 7). Additionally, lower relationship satisfaction increased the odds that mothers would belong to both the desist-return group and the chronic group compared to the low symptom group (see Table 14, Model 8).

Table 14: Regression coefficients and standard errors for models predicting trajectory group membership among non-resident father families (low symptom group is reference)

	Model 1 (controls only)		**Model 2** (pregnancy)		**Model 3** (presence)		**Model 4** (alone time)		**Model 5** (total time)		**Model 6** (informal)		**Model 7** (in-kind)		**Model 8** (rel. sat.)	
	G2	G3	G2	G3	G2	G3	G2	G3	G2	G3	G2	G3	G2	G3	G2	G3
Variable																
First baby	0.08 (.56)	-0.97 (.93)	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Treatment	1.31+ (.69)	0.97 (.99)	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Pregnancy involvement	-	-	-1.11 (.60)	-2.35* (1.11)	-	-	-	-	-	-	-	-	-	-	-	-
Dad present at birth	-	-	-	-	-0.05 (.56)	-0.34 (.84)	-	-	-	-	-	-	-	-	-	-
Dads' alone time	-	-	-	-	-	-	-0.57 (.58)	-1.74 (1.93)	-	-	-	-	-	-	-	-
Dads' total time	-	-	-	-	-	-	-	-	-0.10 (.27)	-1.67 (1.12)	-	-	-	-	-	-
Informal economic support	-	-	-	-	-	-	-	-	-	-	-0.33 (.55)	-1.19 (1.04)	-	-	-	-
In-kind economic support	-	-	-	-	-	-	-	-	-	-	-	-	-0.72* (.33)	-0.66 (.47)	-	-
Relationship satisfaction	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-0.66* (.29)	-1.04* (.42)
Goodness of fit																
Posterior probability	.928 (n = 54)		.931 (n = 47)		.920 (n = 54)		.919 (n = 54)		.919 (n = 54)		.922 (n = 54)		.929 (n = 55)		.926 (n = 53)	
BIC	-1215.09		-1134.51		-1213.33		-1211.61		-1211.22		-1212.48		-1209.82		-1208.44	

Note. G2 = Desist-return group. G3 = Chronic group. Continuous variables were standardized prior to inclusion in these models. Posterior probabilities provide an estimate of the likelihood that an individual will be correctly assigned to the low symptom group. Associated *n*s indicate the number of participants assigned to the low symptom group in a given model. BIC values are an additional goodness-of-fit indicator. Larger BICs suggest that the model is a better fit. $^{*}p < .05$.

Table 15: Regression coefficients and associated standard errors for the best model predicting trajectory group membership among non-resident father families (low symptom group is reference)

	Model 9		**Model 10**		**Model 11**	
	G2	G3	G2	G3	G2	G3
Variable						
Pregnancy involvement	-0.26 (.73)	-1.21 (1.21)	-	-	-0.51 (.68)	-1.37 (1.19)
In-kind economic support	-0.51 (.33)	-0.28 (.49)	-0.58 (.33)	-0.59$_{+}$ (.31)	-	-
Relationship satisfaction	-0.53 (.36)	-1.11* (.53)	-0.58 (.48)	-0.97* (.44)	-0.56 (.34)	-1.14* (.52)
Goodness of fit						
Posterior probability	.919 (n = 49)		.932 (n = 53)		.913 (n = 49)	
BIC	-1138.85		-1210.70		-1135.81	

Note. G.2 = Desist-return group. G3 = Chronic group. Continuous variables were standardized prior to inclusion in these models. Posterior probabilities provide an estimate of the likelihood that an individual will be correctly assigned to the low symptom group. Associated *n*s indicate the number of participants assigned to the low symptom group in a given model. BIC values are an additional goodness-of-fit indicator. Larger BICs suggest that the model is a better fit. $^{**}p < .01^{*}p < .05$; $_{+}p < .06$.

Finally, a series of multivariate risk factor models tested the best solution for predicting group membership. Table 15 presents findings from this series of models with the low symptom group positioned as the reference group. These models revealed that above and beyond fathers' involvement during pregnancy and fathers' in-kind support, mothers' prenatal relationship satisfaction continued to predict membership to the chronic group versus the low symptom group. Specifically, higher relationship satisfaction during pregnancy was protective, while lower relationship satisfaction increased the odds of belonging to the chronic trajectory group. The model that predicted women's membership to the low symptom group with the greatest accuracy included both in-kind economic support and relationship satisfaction (see Table 15, Model 10). Whereas the unconditional trajectory model for non-resident father families estimated women's likelihood of belonging to the low symptom group with 90% accuracy, Model 10 measured women's likelihood of belonging to the low symptom group with 93% accuracy. Because relationship satisfaction was collinear with the majority of other predictors tested for non-resident father families, none of the multivariate predictor models provided a more drastic increase in accuracy of predicting group membership.

Notably, the process described above was repeated to determine whether father involvement and relationship satisfaction differentially predicted membership to the desist-return group compared to the chronic group. None of the variables tested were significant.

Together, predictor models indicate that different combinations of variables predict membership to perinatal depression trajectory groups for women in resident- and non-resident father families. Findings are discussed further in the following section.

CHAPTER SEVEN

DISCUSSION

The current investigation sought to determine whether distinct trajectories of depressive symptoms could be identified in a sample of low-income, employed women from the third trimester of pregnancy until one year postpartum. Additionally, father involvement and mothers' relationship satisfaction were examined as predictors of mothers' depression trajectory group membership, both in the full sample of mothers and separately for resident-father and non-resident father families.

Support was established for the first hypothesis that women would follow one of four distinct trajectory groups based on their depression scores across the perinatal period. Consistent with the hypothesis and with previous research, it was determined that the largest portion of the sample (55%) was characterized by consistently low depressive symptoms from pregnancy until one year postpartum (Cents et al., 2013; Christensen et al., 2011; Kuo et al., 2012; Luoma et al., 2015; Mora et al., 2009; Sutter-Dallay et al., 2012; Van der Warden et al., 2015; Vanska et al., 2011). These findings show that even in a sample of low-income women, who are likely to be at risk for developing perinatal depression (Abrams & Curran, 2009; Misri et al., 2016), over half never experience clinically significant depressive symptoms during the transition to parenthood.

Also, as hypothesized, a small portion of the sample endorsed chronically high levels of depression across the perinatal period; specifically, just under 7% of the 207 women who participated in the present study were assigned to the *chronic depression* trajectory group (Cents et al., 2013; Mora et al., 2009; Sutter-Dallay et al., 2012; Van der Warden et al., 2015; Vanska et al., 2011). These women reported average scores on the

CES-D that fell between 30.83 and 35.73 at each time point—at least double the clinical cutoff. This presentation of depressive symptoms appears to be distinct from depression that occurs specifically within the perinatal period; rather, chronic symptoms may be indicative of comorbid mental health concerns and high levels of stress (Cents et al., 2013). Previous literature indicates that chronic maternal depression may impair women's ability to engage in sensitive caregiving (Campbell et al., 2007); thus, it is particularly important that future research targets interventions that reach women with chronic depressive symptoms in the perinatal period.

It was also hypothesized that the following distinct trajectory groups would be identified: (a) an *antepartum depression* group, marked by clinically significant depressive symptoms during pregnancy that remit during the first year of parenthood, and (b) a *postpartum depression* group, marked by clinically significant depressive symptoms that present for the first time following birth and remain high throughout the first year. However, these groups were not identified in the present study. Instead, a *desist-return group* emerged, marked by an average depression score of 33.0 during pregnancy, followed by a decline to just above the clinical cutoff by four months postpartum, and a pattern of worsening depressive symptoms in the second half of the year. Just under 10% of women in the present study were assigned to this group.

One important consideration is that contextual factors, such as women's return to work following their baby's birth, may help to explain increasing levels of depression for women in the second half of the postpartum year. Although the present study does not explicitly test aspects of women's work experiences as risk factors, participants did return to work soon after giving birth; the average maternity leave time was approximately 7

weeks, with some women returning to work just days after giving birth (Hennigar, Halpern, & Perry-Jenkins, under review). If poor workplace conditions are implicated in the relapse of depressive symptoms, specific workplace supports could make all the difference in promoting sustained recovery from depression among this group of women. Future research should explore this possibility in order to enhance the well-being of women at high risk of experiencing postpartum depression.

Interestingly, the *desist-return* group embodied characteristics of both antepartum and postpartum depression, suggesting that the same women might experience antepartum and postpartum depression, with a brief near-recovery period following the baby's birth. To our knowledge, no other study has documented this possibility. This finding carries important clinical implications: namely, women who recover from antepartum depression should continue to be monitored closely throughout the postpartum period. Continued treatment after symptoms remit may also be implicated as a precautionary measure in order to prevent relapse during this sensitive period.

A study by Luoma and colleagues (2015) also raises long-term considerations for treatment of women presenting with the *desist-return* pattern of depression. Theirs is the only previous study to have used group-based developmental modeling to identify a pattern similar to the *desist-return* trajectory. Luoma and colleagues measured depressive symptoms at four time points during the perinatal period, and also when children were 4-5 years; 8-9 years; and 16 to 17 years old. They identified an "intermittent" depression trajectory group, marked by some variations in depressive symptoms that remained below the clinical cutoff across the first year of parenthood, then fluctuated above and below the clinical cutoff throughout children's later years. In light of these findings, it is possible

that women assigned to the *desist-return* trajectory in the present study are at risk for continuing to experience periodic episodes of depression in the long term. If that is the case, treatment approaches should focus on equipping women with the awareness and skills to monitor their symptoms and seek help right away when symptoms worsen. In particular, there is strong empirical support for the effectiveness of mindfulness-based cognitive therapy (MBCT) in treating recurrent major depressive disorder (van der Velden et al., 2015). Testing the effectiveness of empirically supported treatments like MBCT in perinatal populations and adapting these treatments as necessary to fit the specific needs of new mothers are important next steps for future studies to address.

Finally, the present study identified an *intermediate depressive symptom* group, marked by symptoms that consistently hovered around the clinical cutoff (a CES-D score of 16), with average scores falling between 14.97 and 17.56 across the five time points. The intermediate symptom group characterized the trajectory of just under 30% of the sample. This finding was unexpected and not consistent with the hypotheses. Although six other studies identified what researchers referred to as "moderate-" or "intermediate symptom" trajectory groups (Campbell et al., 2007; Cents et al., 2013; Fredriksen et al., 2017; Kuo et al., 2012; Ramos-Marcuse et al., 2010; Van der Warden et al., 2015), none of these groups in previous studies were marked by clinically significant depressive symptoms; rather, they helped to distinguish between women with no depressive symptoms and women with mild (though not clinically elevated) depressive symptoms. In contrast, the intermediate trajectory group identified in the present study was marked by average depression scores that were clinically significant at three time points: during pregnancy, at 4 months postpartum, and 12 months postpartum. Additionally, these

women's average scores fell within one point below the clinical cutoff at 1 month- and 6 months postpartum.

In the present study, the intermediate symptom trajectory was distinct from the *desist-return group* in that depression levels showed very little variation across time. This group paralleled the unchanging pattern of the *chronic depression group*, but was characterized by less severe symptoms. The fact that nearly one third of the sample were assigned to this group suggests that there is clinical utility in identifying women on the brink of clinical depression during the perinatal period, particularly because less sensitive screening instruments may fail to identify these women as candidates for support.

In sum, findings for the first research question extend those of previous studies to demonstrate that among low-income, employed women, distinct trajectories of depressive symptoms can be identified during the perinatal period. These findings support a growing body of evidence that perinatal depression is a heterogeneous construct marked by variations in timing, severity, and course of symptom presentation (Santos, Tan, & Salomon, 2017). Therefore, approaches to screening and treatment must be tailored in order to capture and respond to these variations in symptomology.

To address the question of what factors differentially predict the probability of mothers' membership to each of the four trajectory groups, we first examined father involvement and mothers' relationship satisfaction in the full sample of mothers. Support was not established for the hypothesis that fathers' presence during birth would predict mothers' probability of belonging to a lower symptom trajectory group. Of note, previous literature suggests that fathers' presence at birth is an important indicator of fathers' long-term involvement in parenting (Bellamy et al., 2015; Shannon et al., 2009). In turn, more

father involvement (measured in a variety of ways depending on children's developmental stage) has been linked to various indicators of maternal well-being (Choi et al., 2014; Harmon & Perry, 2011). Thus, it is surprising that fathers' presence at birth did not predict maternal depression trajectory group membership. Because the majority of mothers reported that fathers were indeed present at birth, it may be that lack of variability explains our inability to find support for this hypothesis.

It is also surprising that fathers' time with baby did not emerge as a strong protective factor in terms of predicting maternal depression trajectory group membership. It is possible that the limited support for this hypothesis is related to involvement by multiple caregivers, which could serve as a buffer to potential negative effects of paternal absence. Sociological literature suggests that low-income families tend to rely heavily on extended kin networks (Gerstel, 2011). Indeed, at Time 1 in the present study, the overwhelming majority of participants reported receiving some degree of emotional, financial, or practical support from friends and family members during their pregnancy, and many continued to report that at least one "secondary caregiver" was regularly involved in their child's care throughout the remainder of the study. Thus, it could be that for mothers in low-income families, employing more nuanced measures of involvement in childcare that capture multiple caregivers' contributions is necessary in order to understand the links between social support and perinatal depression.

Parity and treatment during pregnancy were the best predictors of mothers' odds of belonging to the low symptom trajectory group versus the intermediate and desist-return groups. Specifically, women having their first baby were more likely to be assigned to the low symptom group than the intermediate group. This finding is

consistent with previous literature suggesting that first-time mothers are less likely to develop postpartum depression compared to women who have given birth previously (Di Florio et al., 2014; Iwata et al., 2016). Additionally, women who received treatment during pregnancy were more likely to belong to the intermediate and the desist-return group compared to the low symptom group. Again, this finding is not surprising, and seems to indicate that pregnant women with more significant depressive symptoms are more likely to seek help than women who are not suffering from clinically significant depressive symptoms. This finding highlights the need for treatment to be readily available to women in the perinatal period; a missed opportunity for expedient entry into treatment during this sensitive period could prolong women's struggles and make the transition to parenthood more challenging. Because obstetric providers often overlook the opportunity to screen for perinatal depression and refer patients to the appropriate supports (Goodman & Tyer-Viola, 2010), increased efforts to train providers in best practices for preserving and optimizing maternal mental health is of utmost importance.

Given of the lack of clear evidence from previous studies regarding the role that fathers can play in protecting maternal mental health across diverse family structure groups, the present study took multiple approaches to examining resident- and non-resident fathers' roles. We determined that fathers' residency—assessed first during pregnancy, then again following the baby's birth—was not a significant predictor of mothers' depression trajectory group membership. Additionally, mothers' transitions into or out of a cohabiting relationship with the baby's father between pregnancy and babies' first month was not predictive of group membership probability. These findings are important because previous literature has identified single motherhood and mothers'

relationship instability as risk factors for poorer maternal and child outcomes (Campbell et al., 2007; Eamon & Zuehl, 2001; Meadows et al., 2008; Sutter-Dallay et al., 2012). Although support was not established for the hypothesis in this regard, these (lack of) findings are good news, given that over 40% of births in the U.S. are to unwed mothers (Hamilton et al., 2016), as they suggest that simply being a single mother is *not* a risk factor for experiencing perinatal depression. Additionally—and importantly—change in family structure was not clearly associated with maternal mental health, as previous researchers have demonstrated (Meadows et al., 2008; Osborne et al., 2012).

In addition, contrary to our expectations, family structure did not moderate the association between father involvement and mothers' depression trajectory group membership, or between mothers' relationship satisfaction and trajectory group membership. Thus, father involvement and mothers' prenatal relationship satisfaction did not have a differential impact on trajectory membership as a function of family structure. It may be that only testing fathers' presence at birth and time with baby in the full sample of mothers offered an inadequate assessment of how fathers' parenting practices enhance maternal well-being. Indeed, findings regarding unique aspects of father involvement within resident and non-resident father families point to an array of unique predictors of maternal mental health.

Among resident father families, lower levels of coparenting conflict consistently predicted mothers' probability of belonging to the low symptom group. This finding is compelling because it suggests that aspects of the parental relationship, rather than fathers' performance of specific tasks or parenting behaviors, are protective in terms of mothers' mental health. This finding highlights the importance of feeling that one is "on

the same page" as one's partner when it comes to parenting, even in the first month of babies' lives. Furthermore, there are encouraging implications for providers who work with new parents—including prenatal educators, home visitors, clergy, and mental healthcare providers—and can equip new parents with specific behavioral strategies for reducing conflict around shared parenting. Building upon previous findings that have established coparenting as a potentially responsive target of intervention (Feinberg & Kan, 2008), the present study suggests that reducing coparenting conflict may lower the risk that women will experience depression in the perinatal period.

As hypothesized, higher relationship satisfaction also predicted lower depressive symptoms for mothers in resident father families. Specifically, higher relationship satisfaction predicted mother's odds of belonging to the low symptom versus the desist-return trajectory group. This finding provides further evidence that feeling more satisfied with one's relationship during pregnancy is protective in the long term (Lee et al., 2004). Thus, in addition to the importance of boosting couple's skills in collaborative coparenting, targeting their romantic relationship as a point of intervention is also important as a means of reducing maternal depression.

Turning to predictors of trajectory group membership among women in non-resident father families, relationship satisfaction was the most robust predictor of trajectory group membership. Among single mothers, the odds of belonging to the low symptom group compared to the chronic group were higher when mothers reported greater satisfaction in their relationships with their baby's father. To our knowledge, the present study is the first of its kind to link prenatal relationship satisfaction to perinatal depression among women in non-resident father families; no other literature to date has

captured the possibility that relationship satisfaction is worth considering as a longitudinal predictor of maternal mental health outside of romantic partnerships. It is our hope that these findings will support a much-needed shift in the discourse surrounding single parenthood by suggesting that parenting outside the context of a romantic relationship is *not* necessarily indicative of strained parental dynamics. On the contrary, these findings suggest that single mothers *can* feel satisfied in their relationships with babies' fathers, and that this satisfaction may enhance maternal well-being across the perinatal period.

Contrary to our expectations, non-resident fathers' involvement during pregnancy, time with baby, and economic support did not emerge as strong predictors of mothers' depression trajectory group membership. Although fathers' involvement during pregnancy and higher levels of in-kind economic support were significant in individual predictor models of mothers' odds of belonging to the low symptom group, together, these factors provided only a slight improvement in terms of predicting mothers' odds of belonging to the low symptom group. Because prenatal relationship satisfaction is highly correlated with both fathers' involvement during pregnancy and fathers' in-kind support in the first month postpartum, it appears that building a multivariate model that included all of these factors was redundant.

The interrelatedness of fathers' involvement during pregnancy, mothers' prenatal relationship satisfaction, and fathers' in-kind economic support after birth point to a specific profile of involved non-resident fathers as being supportive during the mothers' pregnancy, participating in more satisfying interpersonal exchanges with the baby's mother, and providing more material support (such as diapers, formula, clothes and toys)

after the baby's birth. Future research should determine whether a causal relationship can be established between these factors; for example, does participating in preparations for his baby's arrival serve to engage a prospective father in a long-term commitment to parenting? Another possibility is that maternal gatekeeping prohibits fathers who are not involved during pregnancy from becoming involved after birth. Developing a clearer understanding of these pathways could inform intervention efforts aimed at enhancing both father involvement and maternal mental health in non-resident father families.

Several limitations of the present study should be highlighted. First, although the current study: a) established support for the hypothesis that distinct trajectories of perinatal depressive symptoms could be identified in a sample of low-income, employed women, and b) identified several factors that predicted women's probability of belonging to the low symptom trajectory group, our approach was unable to identify factors that distinguished between the intermediate, desist-return, and chronic groups. Santos and colleagues (2017) suggest a possible explanation for this lack of findings in their recent literature review. The authors assert that a limitation of the group-based approach to modeling perinatal depression trajectories lies in the inability of this approach to monitor variations in specific symptoms across time. For example, a woman whose sense of hope and self-worth increases after her baby's birth, but who suffers sleep deprivation and associated irritability during the postpartum stage might receive the same score on the CES-D before and after birth, even though her symptoms and experiences had shifted. If this woman had been assigned to the intermediate symptom group in the present study, she would appear to be stably depressed despite these changes. This limitation to the methodology calls for the development of more nuanced statistical techniques that

account for variation in individual symptom level (Santos et al., 2017), as well as a mixed methods approach to data analysis that might highlight the richness and deeply personal nature of women's experiences across the transition to parenthood.

Two potential limitations related to measurement should also be considered. Although a number of researchers have used the CES-D to assess depressive symptoms in perinatal populations (Campbell et al., 2007; Mora et al., 2009; Sutter-Dallay et al., 2012; van der Warden et al., 2015), there is controversy related to the inclusion of two items related to somatic symptoms. While some researchers suggest that these items over-estimate the severity of symptoms in pregnant women (Dayan & Creveuil, 2009), others have found that removing these items from the CES-D does not improve its psychometric properties (Kabir, Sheeder, & Stevens-Simon, 2008). Thus, it is unclear whether use of the full 20-item CES-D in the present study constitutes a limitation.

A second limitation of the present study relates to the utilization of a one-item measure of relationship satisfaction. Although use of a full scale may have improved construct validity, the item "How satisfied are you in your relationship with [spouse/partner/baby's father]?" was selected based on its relevance for mothers across family structure groups.

Additionally, there are both strengths and weaknesses associated with the within-group approach to examining perinatal depression trajectories among women in both resident- and non-resident father families. Although it is our view that building separate models that include unique father involvement predictors acknowledges the idea that family processes may be inherently different when parents are living together and engaged in a romantic relationship, the present study was unable to examine some aspects

of father involvement that may be shared across family structure groups. In particular, collecting data on coparenting support and conflict among women in non-resident father families might have expanded our understanding of strengths that exist among some single parents. This limitation reflects not only a weakness of the present study, but of the typical approach to examining father involvement narrowly within specific family structure groups, and highlights the need to understand maternal mental health in light of more inclusive measures of father involvement (Carlson, VanOrman & Turner, 2016; Hawkins & Palkovitz, 1999).

Given that women in the present study tended to return to work less than two months after giving birth, it could be that unassessed aspects of the transition back to paid employment would help to explain findings related to the course of perinatal depression. Finally, sample size limitations did not allow for an exploration of whether race and family structure interact to differentially predict associations between father involvement and maternal mental health. Given that a considerable literature has documented varied patterns of father involvement according to both race and family structure (Dungee Green et al., 2001; Nepomnyaschy & Garfinkel, 2011), future research should explore the possibility that there may be different processes by which father involvement enhances maternal well-being across racial and ethnic groups.

Finally, it must be noted that findings produced by the present study are correlational in nature. Although the longitudinal design and statistical modeling technique offer a strong means of assessing the association between father involvement and maternal depression trajectories, it was not possible to determine a causal relationship among these variables.

Overall, the present study makes an important contribution to the study of maternal mental health by building upon a small body of extant research demonstrating that perinatal depression is a heterogeneous phenomenon (Santos et al., 2017). Importantly, the present study is the first of its kind to consider the diverse and nuanced ways in which father involvement and mothers' relationship satisfaction (regardless of whether or not parents are in a romantic partnership) predict perinatal depression trajectory group membership. Future studies examining the course of perinatal depression would benefit from attending to several goals informed by findings from the present study. First, coparenting support and conflict should be examined as longitudinal predictors of maternal mental health across diverse family structure groups. Additionally, establishing causal pathways between predictors of father involvement in non-resident father families would help to inform interventions aimed at increasing both non-resident father involvement and maternal mental health. Following larger samples of racially diverse new mothers across family structure groups could shed additional light on the processes by which fathers' roles can enhance maternal well-being in the perinatal period. Finally, women's transition back to paid employment following their baby's birth must be examined as a predictor of perinatal depression trajectories.

APPENDIX A
FEELINGS INVENTORY (CES-D)

Mother Form
(Radloff, 1977)

Instructions: Below is a list of the ways you might have felt or behaved recently. Using the scale provided, please circle the number that indicates how often you have felt this way during the PAST WEEK.

0	1	2	3
Rarely or none of the time (less than 1 day)	Some or a little of the time (1-2 days)	Occasionally or a moderate amount of time (3-4 days)	Most or all of the time (5-7 days)

1.	I was bothered by things that don't usually bother me.	0	1	2	3
2.	I did not feel like eating; my appetite was poor.	0	1	2	3
3.	I felt that I could not shake off the blues even with help from my family or friends.	0	1	2	3
4.	I felt that I was just as good as other people.	0	1	2	3
5.	I had trouble keeping my mind on what I was doing.	0	1	2	3
6.	I felt depressed.	0	1	2	3
7.	I felt that everything was an effort.	0	1	2	3
8.	I felt hopeful about the future.	0	1	2	3
9.	I thought my life had been a failure.	0	1	2	3
10.	I felt fearful.	0	1	2	3
11.	My sleep was restless.	0	1	2	3
12.	I was happy.	0	1	2	3
13.	I talked less than usual.	0	1	2	3
14.	I felt lonely.	0	1	2	3
15.	People were unfriendly.	0	1	2	3
16.	I enjoyed life.	0	1	2	3
17.	I had crying spells.	0	1	2	3
18.	I felt sad.	0	1	2	3
19.	I felt that people dislike me.	0	1	2	3
20.	I could not get "going."	0	1	2	3

APPENDIX B
TIME WITH BABY

Mother Form

We're going to use the following chart to see, in a typical week, who your child spends time with. We will begin when your child wakes up in the morning and end when they go to bed at night.

	SUN	MON	TUES	WED	THURS	FRI	SAT
Start time:	_____	_____	_____	_____	_____	_____	_____
End time:	_____	_____	_____	_____	_____	_____	_____
Total Hrs:	_____	_____	_____	_____	_____	_____	_____
Adults:	_____ ( ) _____ ( ) _____ ( )	_____ ( ) _____ ( ) _____ ( )	_____ ( ) _____ ( ) _____ ( )	_____ ( ) _____ ( ) _____ ( )	_____ ( ) _____ ( ) _____ ( )	_____ ( ) _____ ( ) _____ ( )	_____ ( ) _____ ( ) _____ ( )
Start time:	_____	_____	_____	_____	_____	_____	_____
End time:	_____	_____	_____	_____	_____	_____	_____
Total Hrs:	_____	_____	_____	_____	_____	_____	_____
Adults:	_____ ( ) _____ ( ) _____ ( )	_____ ( ) _____ ( ) _____ ( )	_____ ( ) _____ ( ) _____ ( )	_____ ( ) _____ ( ) _____ ( )	_____ ( ) _____ ( ) _____ ( )	_____ ( ) _____ ( ) _____ ( )	_____ ( ) _____ ( ) _____ ( )
Start time:	_____	_____	_____	_____	_____	_____	_____
End time:	_____	_____	_____	_____	_____	_____	_____

Total Hrs:	_____	_____	_____	_____	_____	_____	_____
Adults:	_____ ( ) _____ ( ) _____ ( )	_____ ( ) _____ ( ) _____ ( )	_____ ( ) _____ ( ) _____ ( )	_____ ( ) _____ ( ) _____ ( )	_____ ( ) _____ ( ) _____ ( )	_____ ( ) _____ ( ) _____ ( )	_____ ( ) _____ ( ) _____ ( )
Start time:	_____	_____	_____	_____	_____	_____	_____
End time:	_____	_____	_____	_____	_____	_____	_____
Total Hrs:	_____	_____	_____	_____	_____	_____	_____
Adults:	_____ ( ) _____ ( ) _____ ( )	_____ ( ) _____ ( ) _____ ( )	_____ ( ) _____ ( ) _____ ( )	_____ ( ) _____ ( ) _____ ( )	_____ ( ) _____ ( ) _____ ( )	_____ ( ) _____ ( ) _____ ( )	_____ ( ) _____ ( ) _____ ( )
Start time:	_____	_____	_____	_____	_____	_____	_____
End time:	_____	_____	_____	_____	_____	_____	_____
Total Hrs:	_____	_____	_____	_____	_____	_____	_____
Adults:	_____ ( ) _____ ( ) _____ ( )	_____ ( ) _____ ( ) _____ ( )	_____ ( ) _____ ( ) _____ ( )	_____ ( ) _____ ( ) _____ ( )	_____ ( ) _____ ( ) _____ ( )	_____ ( ) _____ ( ) _____ ( )	_____ ( ) _____ ( ) _____ ( )

7a. Describe complex arrangements here:

_____

_____

_____

1. **Total hours with mom** _____
2. **Total hours with dad** _____
3. **Total hours with mom and others** _____
4. **Total hours with dad and others** _____
5. **Total hours with mom and dad** _____
6. **Total hours with secondary caregiver** _____
7. **Total hours with other caregivers'** _____

APPENDIX C
CONTRIBUTIONS TO CHILD CARE –MULTIPLE CAREGIVERS

Mother Form
(Adapted from Barnett & Baruch, 1987)

Now, please tell us what percentage (out of 100%) of the time you expect to do each of the following child care tasks once the baby arrives. Then tell us what percentage of the time that you expect anyone else in your household will do each task. Be sure that all the percentages total 100% for each task.

Sample Task	Mother	Father	SC	Other1	Other2	Total
Take baby on car ride	25 %	25 %	50 %	NA%	NA%	**=100%**

	Mother	Father	Sec. Care. *	Other1 *: _____	Other2 *: _____	Other3 *: _____	Other4 *: _____	Other5 *: _____
1. Feeding the baby								
2. Changing the baby's diaper								
3. Soothing the baby								
4. Getting up at night with the baby								
5. Putting the baby to sleep								
6. Giving the baby a bath								
7. Helping the baby learn new skills								
8. Dressing the baby								
9. Planning the baby's activities								

10. Picking up after the baby								
11. Playing with the baby								
12. Reading/singing to the baby								
13. Taking the baby on an outing								
14. Taking the baby to a doctor's appointment								
15. Taking care of the baby when he or she is sick								

*Secondary Caregiver name: _____ Relationship _____ (_____)

*Other Caregiver1 name: _____ Relationship _____ (_____)

*Other Caregiver2 name: _____ Relationship _____ (_____) _____

*Other Caregiver3 name: _____ Relationship _____ (_____)

*Other Caregiver4 name: _____ Relationship _____ (_____)

*Other Caregiver5 name: _____ Relationship _____ (_____)

APPENDIX D
COPARENTAL RELATIONSHIP

Mother Form
(Ahrons, 1981)

Who do you coparent with, if anyone? (Name_____, Relation _____)
(__ __) (**IF RESPONDENT DOES NOT COPARENT, SKIP THIS QUESTIONNAIRE**). Think back over the past several months and indicate how often you and (coparent) have related in the following ways.

Never 1	Every Few Months 2	Once/Twice Monthly 3	Once/Twice Weekly 4	Daily 5

1.	Talking about extended family	1	2	3	4	5
2.	Talking about old friends	1	2	3	4	5
3.	Talking about new experiences in your present lives	1	2	3	4	5
4.	Discussing finances not related to child	1	2	3	4	5
5.	Talking about your relationship	1	2	3	4	5
6.	Talking about personal problems	1	2	3	4	5
*7.	Helping each other with household tasks	1	2	3	4	5
*8.	Going out to dinner without the children	1	2	3	4	5

Think back over the past several months and indicate whether the following child-rearing issues have been shared between you and (coparent).

Never 1	Rarely 2	Sometimes 3	Often 4	Always 5

1.	Discuss school and/or medical problems	1	2	3	4	5
2.	Discuss child's accomplishments and progress	1	2	3	4	5
3.	Discuss child-rearing problems	1	2	3	4	5
4.	Plan special events for the child	1	2	3	4	5
5.	Discuss personal problems child may be experiencing	1	2	3	4	5
6.	Discuss major decisions regarding child's life	1	2	3	4	5
7.	Discuss finances in regard to child	1	2	3	4	5
8.	Discuss problems in coparenting	1	2	3	4	5
9.	Discuss daily decisions regarding child's life	1	2	3	4	5

Using the following scale, please answer the following questions regarding your relationship with (coparent).

Never 1	Rarely 2	Sometimes 3	Often 4	Always 5

1.	When you and (coparent/other caregiver) discuss parenting issues, how often does an argument result?	1	2	3	4	5
2.	How often is the underlying atmosphere one of hostility and anger?	1	2	3	4	5
3.	How often is the conversation stressful and tense?	1	2	3	4	5
4.	Do you and (coparent/other caregiver) have basic differences of opinion about issues related to child rearing?	1	2	3	4	5
5.	When you need help regarding your child, do you seek it from (coparent/other caregiver)?	1	2	3	4	5
6.	Would you say that (coparent/other caregiver) is a resource to you in raising your child?	1	2	3	4	5
7.	Would you say that you are a resource to (coparent/other caregiver) in raising your child?	1	2	3	4	5
*8.	Do you feel that (coparent/other caregiver) understands and is supportive of your special needs as a parent?	1	2	3	4	5

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