THE UNIVERSITY OF CHICAGO

YOUNG, LOW-INCOME MOTHERS' INVOLVEMENT IN DOULA HOME VISITING SERVICES

A DISSERTATION SUBMITTED TO

THE FACULTY OF THE SCHOOL OF SOCIAL SERVICE ADMINISTRATION

IN CANDIDACY FOR THE DEGREE OF

DOCTOR OF PHILOSOPHY

BY

YUDONG ZHANG

CHICAGO, ILLINOIS

AUGUST 2020

TABLE OF CONTENTS

LIST OF TABLES iii
LIST OF FIGURES iv
ACKNOWLEDGEMENTS v
ABSTRACT vii
CHAPTER 1 INTRODUCTION 1
CHAPTER 2 SUPPORTIVE RELATIONSHIPS AND DIFFERENTIAL INVOLVEMENT IN DOULA HOME VISITING SERVICES 7
CHAPTER 3 FACTORS ASSOCIATED WITH YOUNG MOTHERS' SERVICE DURATION IN DOULA HOME VISITATION 52
CHAPTER 4 RELATIONSHIP AS AN ACTIVE INGREDIENT: COMMUNITY DOULA-MOTHER RELATIONSHIP AND PARENTING BEHAVIOR IN HOME VISITING SERVICES 94
CHAPTER 5 DISCUSSION 126
APPENDICES 135

LIST OF TABLES

Table 2.1 Estimated Means of the Ten Indicators of Relationship Profiles (N = 147)..... 28
Table 2.2 Demographics, Psychosocial Characteristics and Living Arrangements across the Four Latent Classes (N = 147 unless otherwise noted) 29
Table 2.3 Differences in Bonding and Agreement on Tasks/Goals with the Doula across Latent Classes..... 31
Table 2.4 Odds Ratios and 95% Confidence Interval of Doula Birth Attendance across Latent Classes (N = 138)..... 32
Table 2.5 Incidence Rate Ratios and 95% Confidence Intervals of Prenatal and Postnatal Doula Visits from the Binomial Negative Regressions..... 33
Table 2.6 Early discontinuation of services by latent class membership 34
Table 2.7 Process of Service Involvement in Relation to the Two Alternative Hypotheses 42
Table 3.1 Descriptive Statistics of Mothers Randomized to the Doula Home Visiting Service (N = 156)..... 64
Table 3.2 Service Participation (N = 153) 71
Table 3.3 Estimated Kaplan-Meier Survivor Function over Time 73
Table 3.4 Bivariate Association between Baseline Covariates and Hazard of Discontinuing Services..... 75
Table 3.5 Correlations across Baseline Covariates..... 76
Table 3.6 Estimated Hazard Ratios and 95% Confidence Intervals 78
Table 4.1 Baseline Characteristics of the Study Sample (N = 124)..... 109
Table 4.2 Descriptive Statistics of Parenting Behaviors at 3-Months Postpartum by Treatment Status..... 110
Table 4.3 Raw and Weighted Absolute Standardized Differences of Baseline Covariates..... 111
Table 4.4 Estimated Average Treatment Effect of a Very Positive Mother-Doula Relationship on Parenting Outcomes Using Different Cutoffs..... 114
Table B Distribution of Each Dimension of the Risk-taking Behavior.....136
Table C Measurement of Baseline Variables.....137
Table D1 Raw and Weighted Absolute Standardized Differences of Baseline Covariates of Three Models.....138
Table D2 Estimated Average Treatment Effect and Average Treatment Effect on the Treated: Additional Robustness Check.....139
Table E Sensitivity Analysis of Mother-Doula Relationship and Maternal Sensitivity: Effect of "Calibrated" Confounders.....141

LIST OF FIGURES

Figure 2.1 Changes in Agreement on Tasks/Goals with the Doula from Pregnancy to Postpartum 35
Figure 2.2 Changes of the Number of Visits from Prenatal to Postnatal Visits by Class 36
Figure 3.1 Distribution of the Discontinuation Months 72
Figure 3.2 Number of Mothers Enrolled in Services over Time 72
Figure 3.3 Kaplan-Meier Survival Estimate 74
Figure 3.4 Kaplan-Meier Survival Estimate by Each of the Six Covariate 76
Figure 4.1 Distribution of Estimated Propensity Score (N = 123) 112

ACKNOWLEDGEMENTS

I would like to thank my advisor and dissertation committee chair, Sydney Hans. The five years of mentorship you provided have facilitated both my intellectual and personal growth. You meet me where I am and encourage, challenge and nudge me to think with analytical depth and rigor and cultural sensitivity. You believe in me when I doubt myself and empower me to be assertive, reflective and resilient. You are the mentor I aspire to be in my own professional life.

Additionally, I received great support from my dissertation committee members, Jeanne Marsh and Jon Korfmacher, and reactors, Julia Henly and Miwa Yasui. Thank you for the insightful feedback to help me develop and refine my research and for the strong support on the journey from vague research ideas to proposal defense and finally, dissertation work. I also want to express my gratitude to Guanglei Hong, Stephen Raudenbush, Robert Gibbons, Don Hedeker, and Xu Qin, who exposed me to a great interdisciplinary environment and cultivated rigorous quantitative thinking and methodological skills in me.

I want to thank my mentors and research team members—Renee, Linda, Marianne, Karen, Nora, Olivia, and Annie. You provided scaffolding for me to learn the nitty-gritty on a big research project and become skillful at assembling building blocks to build my dissertation projects. You supported me in all of the final quarters and the qualifying exam. Our office chitchat always made me look forward to coming to work, knowing I would be surrounded with loving and caring colleagues. I will always miss our great research team.

I am incredibly thankful to Ellen. You were there for me when I first came to the U.S. and have accompanied and guided me and in both those happy moments, getting a Ph.D. and a job offer, and those dark moments, when I struggled to see light at the end of the tunnel. You are like a mom and a friend to me, who I know will always look out for me and be there for me when I am panicked, confused, or fearful. I want to express my gratitude to my friends Sihui,

Xuan, Qianhui, Mingchen, and Bichen. Thank you for many years of friendship ever since adolescence and being a strong family for me. I also want to thank Ivan for his unwavering love and support in good and bad times. Finally, I want to thank my parents and grandparents, who demonstrated great persistence and resilience in face of many life challenges and who inspired my curiosity to study social work and passion to use research to promote the wellbeing of disadvantaged families.

ABSTRACT

Early life experiences strongly shape developmental trajectories in a wide range of domains, such as mental, emotional and behavioral health, education, and employment. Children living in poverty face disproportionate adversities starting from infancy. Home visiting has become a widely used service approach nationwide in promoting maternal and infant health and early childhood development. It has been increasingly acknowledged that home visiting is a multidimensional and complex process, that interventions rarely conform precisely to what is expected, and that considerable variability exists in the quantity and quality of services and in the characteristics and needs of families receiving services. Therefore, despite the effectiveness established through randomized controlled trials, newer generations of research have increasingly focused on how home visitation works, for whom it works, and under which contexts it works.

This three-paper dissertation used data from mothers who were assigned to the intervention group in a randomized controlled trial of doula-enhanced home visiting services. It explored the variation in the service implementation process and associated mother and family characteristics, and the causal role of the mother-doula relationship in promoting positive parenting. This dissertation found that: (1) There were differential patterns of supportive relationships across mothers, and that there was evidence for both "relationship-driven" and "needs-driven" mechanisms explaining mothers' involvement with their service providers; (2) Half of mothers remained in services at one year postpartum, and the largest percentage of attrition occurred from the second to the third month postpartum. Mothers who reported higher levels of risk-taking behavior and were at educational risk, who used only English at home, and who were in later months of pregnancy at service initiation discontinued services more rapidly; (3) A very positive mother-doula relationship was associated with greater maternal sensitivity

and careful handling of the infant, but not associated with maternal intrusiveness, detachment or stimulation.

This dissertation revealed an important variability in the quantity and quality of services received by home visiting participants and demonstrated the importance of strong mother-home visitor relationships. Ongoing supportive and reflective supervision, peer support, and training for home visitors are critical in encouraging them to continue engaging high risk mothers and help them be gently persistent in their efforts to build trust with mothers. As family demographics become more diverse in the U.S., home visiting programs need to train their workforces to meet the needs of families facing different challenges and adversities. A continued research interest in the service delivery process and active ingredients is needed for successful intervention programs.

CHAPTER 1
INTRODUCTION

There is robust evidence that early life experiences strongly shape developmental trajectories in a wide range of domains, such as mental, emotional, and behavioral health, education, and employment (Hernandez, 2011; Yoshikawa et al., 2012). Children living in poverty face disproportionate adversities starting from infancy, and poverty may put poor children at a higher risk when facing academic, socioemotional and mental health challenges through neurodevelopmental processes and gene expression, such as blunting the hypothalamic-pituitary-adrenal axis in the brain and undermining stress response systems via epigenetic changes (Blair & Raver, 2012; Hackman et al., 2010; Kundakovic & Champagne, 2015). Parenting and childcare resources are also important mechanisms accounting for the impact of poverty on child development (Hackman et al., 2010). Parents struggling with poverty are limited economically in their ability to provide learning opportunities within the home, and are less likely than other parents to be nurturing, stimulating and responsive to their children's needs (Duncan et al., 2014). Poor children are more likely to live in distressed neighborhoods and substandard housing environments, and to have less access to high quality day care or school resources than more economically advantaged peers (Evans, 2004; Leventhal & Brooks-Gunn, 2003).

Home Visiting as a Service Delivery Model

Given the critical role that early life experiences play in various developmental domains across the life course, early childhood programs have been developed and implemented to ameliorate the adverse effect of poverty on families and children. Investment in early childhood interventions yields the greatest rate of return compared to investment in other life stages: It has been calculated that in the best early childhood programs, every invested dollar yields between

$7 and $10 in benefits (Heckman, 2006; Heckman et al., 2010). Evaluations of center-based programs such as the Perry Preschool Project and the Carolina Abecedarian Project not only demonstrated effectiveness in improving cognitive, non-cognitive, and social skills in childhood, but also in education and employment outcomes in adulthood (Anderson, 2008; Campbell et al., 2002; Garces et al., 2002).

Although many evidence-based early childhood interventions take place in centers, interventions for infants and toddlers in low-income families are more likely to be home-based. Home visiting, where professionals or highly trained paraprofessionals meet with families regularly in their homes, has become a widely used service approach nationwide in promoting maternal and infant health and early childhood development (Adirim & Supplee, 2013; Olds, 2002). In Fiscal Year (FY) 2019, home visiting programs in all 50 states, the District of Columbia, and five U.S. territories received public funding through the federal Maternal, Infant, and Early Childhood Home Visiting (MIECHV) Program, as well as other federal, state, local government, and private funding sources. More than one million home visits were provided to over 154,000 parents and children through the MIECHV Program in FY 2019 (Health Resources and Services Administration & Administration for Children and Families, 2020).

There is a large number of early childhood home visiting models and a growing body of research on their effectiveness. Healthy Families America, Nurse Family Partnership, Early Head Start (home-based) and Parents as Teachers are some of the widely used models that have been demonstrated to be effective in promoting a wide range of short-term outcomes (e.g., maternal and newborn health, positive parenting practices, school readiness, and achievement) and longer-term outcomes (e.g., family economic-sufficiency and decreased crime, domestic violence and

child maltreatment) (DuMont et al., 2008; Kirkland & Mitchell-Herzfeld, 2012; LeCroy & Krysik, 2011; Love et al., 2005; Miller, 2015; Olds, 2002).

As public support for infant and early childhood home visiting has increased, evidence based models have established increasingly well-developed curricula, training protocols, and implementation standards that can be utilized by local agencies implementing programs (Home Visiting Evidence of Effectiveness, 2019). Although different models have different curricula and standards, there are similarities across them. Many program models aim to provide weekly visits during pregnancy and the first year of life, with home visits becoming less frequent, moving from weekly to bi-weekly, monthly, and quarterly over time (Michalopoulos et al., 2015). Services are available free of charge to at-risk families with young children up to three or five years at their home, eliminating potential barriers such as the need for childcare and transportation costs (McGuigan & Gassner, 2016). Home visitors provide a variety of services which include offering health education, teaching parenting skills, promoting early learning, providing guidance on infant care and feeding practices, and conducting screenings and providing referrals to address postpartum depression, substance abuse and family violence (Michalopoulos et al., 2015). While program models give home visitors guidance about the content of their visits, most programs recognize the importance of working with mothers from where they are at, and provide voluntary, culturally appropriate, and individually tailored services to family needs. Home visitors themselves may have professional training, such as in nursing or social work, but often are paraprofessionals, whose training in helping at-risk families comes on the job (Sandstrom et al., 2020).

Unpacking the "*Black Box*" of Home Visiting

The demonstrated effectiveness of home visiting services has been established primarily through the gold standard—randomized controlled trials (RCT) via intent-to-treatment (ITT) analysis which assumes a monolithic treatment applied to all families (Korfmacher, Kitzman, & Olds, 1998). However, it has been increasingly acknowledged that home visiting is a multidimensional and complex process (Wen et al., 2010), that interventions rarely conform precisely to what is expected, and that considerable variability exists in the quantity and quality of services and in the characteristics and needs of families receiving services (Holland et al., 2014; Korfmacher et al., 1998; Wen et al., 2010). Therefore, there has been a growing body of literature on the variation in implementation process and factors associated with such variation. Additionally, shifting from the traditional ITT analysis of *whether* the intervention works, newer generations of research have increasingly focused on *how* it works, *for whom* it works, and *under which contexts* it works.

In line with these research goals, this three-paper dissertation will seek to better understand the implementation process of home visiting services and *how* home visiting interventions work. This dissertation will use data from mothers who were assigned to the intervention group in a randomized controlled trial (RCT) of four home visiting programs in Illinois. The four programs are representative of a larger group of home visiting programs funded by that state that use doulas in addition to traditional home visitors to enhance the intervention impact on early maternal and newborn health outcomes. Doulas are community health workers who have special training in pregnancy health, childbirth preparation, labor and delivery support, lactation counseling, and newborn care. In the Illinois programs, they provide home-based education and support during the last half of pregnancy and for approximately six weeks postpartum (Hans et al., 2018).

This dissertation will explore two aspects of home visiting implementation that vary across participants in these programs – the duration of family involvement with the program and the quality of the working alliances between doulas and mothers. The three papers are motivated by the following gaps in the existing literature.

First, mothers participating in home visiting programs are embedded in complex social relationships, which may shape their service involvement (Brookes et al., 2006; Guterman, 2001). But little is known about how mothers' relationships vary and how relationships are associated with service involvement over time. Specifically, it is unclear whether mothers with strong supportive relationships tend to be more or less involved in services. Those with strong supportive relationships may become more involved with program services since their lifelong experiences with supportive other people may make it easier to trust and build positive relationships with home visitors. In other words, positive relationships in natural social networks beget positive relationships in home visiting services (i.e., a relationship-driven explanation). However, it is also possible that mothers with strong supportive relationships in their networks may become less involved with services since they may already have adequate resources in their social network to cope with the transition to motherhood, thus perceiving the home visiting services as unnecessary. On the other hand, mothers with less supportive relationships may be more involved in services since they may have a stronger need for home visiting services given the relatively scarcity of support available in their social network (i.e., a needs-driven explanation).

Second, it is common that families discontinue home visiting services during the time frame while they are still eligible. For example, about half of families discontinued services by the child's first birthday (Duggan et al., 2000; McGuigan et al., 2003), and up to 67% left before

receiving the full duration of services in some programs (Gomby et al., 1999). However, few studies have explored the month-to-month trend in program discontinuation, which may reveal critical a service window for home visitors to strategize in engaging families. Existing studies show that service attrition is shaped by factors at multiple levels, but have produced inconsistent findings regarding roles of participant- and family-level factors (Bower et al., 2020; McGuigan et al., 2003). With regard to individual level factors, home visiting scholars have explored the role of maternal depression in service involvement, they have paid limited attention to mothers' risk-taking behavior (e.g., substance use and multiple sex partners), which has been suggested to be an important factor in service utilization of adolescents by the healthcare literature.

Third, the home visitor-mother relationship has long been theorized to be the agent of change of parenting behavior in home visiting programs (Kelly & Barnard, 1999; Li & Julian, 2012). However, studying the impact of the parent-home visitor relationship on parenting is challenging since the quality of the relationship cannot be randomized, thus its effect could be confounded by other variables. Methodological advances in causal inference can be applied to test the impact of home visitor-mother relationships.

CHAPTER 2
SUPPORTIVE RELATIONSHIPS AND DIFFERENTIAL INVOLVEMENT IN DOULA HOME VISITING SERVICES

Abstract

Background: Social support and personal relationships can shape mothers' involvement with home-visiting services. One argument is that home-visiting involvement is relationship-driven: Mothers who lack supportive relationships have difficulty trusting service providers and have low uptake of services. An alternative hypothesis is that involvement is needs-driven: Mothers with low social support perceive a greater need for services and have stronger involvement. This study aims to test the alternative hypotheses by examining patterns of mothers' past and current relationships and associations with mothers' working alliances with doulas providing home based services and use of doula services.

Method: Data were collected from young, low-income pregnant women (n=147) who participated in doula-enhanced home-visiting programs. Doulas provided home visits starting in pregnancy until six weeks postpartum and provided support at the birth at the hospital. At enrollment before receiving services (mid-pregnancy), mothers reported the quality of relationships (trust, communication, alienation, and support) with their current parent figure (usually their mother; PF) and the father of their baby (FOB), their experience of childhood rejection by their caregiver, and their experience of general closeness in relationships. At 37-weeks of pregnancy and 3-weeks postpartum, mothers reported on their working alliances with doulas (i.e., bonding, agreement on tasks/goals). Data on doula services were retrieved from administrative systems, including the number of prenatal and postpartum doula visits, whether doulas attended birth, and whether mothers discontinued services before 6-weeks postpartum.

Results: Latent profile analysis identified four relationship profiles: strong support from PF, FOB and others (27%), moderate support overall (40%), moderate support from FOB but alienation with PF (15%), and moderate support from PF but alienation with FOB (18%). The four classes did not differ on bonding with doulas. Mothers in the *strong support* class reported the highest agreement on tasks/goals with doulas both prenatally and postpartum. Compared to the *strong support* class, mothers in the *alienation with PF* class reported a similar level of tasks/goals agreement at 37-weeks of pregnancy, but experienced sharp decrease and a significantly lower level at 3-weeks postpartum. Mothers in the *alienation with PF* class were less likely to have doulas attend childbirth compared to the *moderate support* class, and they received fewer doula home visits prenatally compared to the other three classes. The number of doula visits decreased for the other three groups postpartum, however, visits remained stable for mothers in the *alienation with PF* class. The four groups did not differ on the number of postpartum doula home visits or early discontinuation of services.

Conclusion/Implication: There is heterogeneity among young mothers regarding the quality and structure of their past and current relationships. The relationship-driven hypothesis was supported by the higher levels of agreement on tasks/goals among mothers who already had the experience of strong relationships. The needs-driven hypothesis was supported by the increased levels of postpartum involvement among mothers who experienced parental rejection in childhood and alienation from their current parent figure. Home visitors may engage young mothers more effectively if they are aware of mothers' relationships with key people in their lives and how these relationships might impact service uptake.

Keywords: social support, service involvement, working alliance, home visiting, adolescent mothers, latent profile analysis

Supportive Relationships and Differential Involvement in Doula Home Visiting Services

Introduction

A large body of literature from developmental psychology, economics and neurobiology reveals that children living in poverty lag behind their well-to-do counterparts in cognitive and social development, and that disparities in socioemotional development, academic achievement, health and mental health begin during early life (Anda et al., 2006; Duncan, Ziol-Guest, & Kalil, 2010; Knudsen, Heckman, Cameron, & Shonkoff, 2006; Yoshikawa, Aber, & Beardslee, 2012). To buffer the adverse impacts of poverty on the development of young children, home visiting has become the main service delivery approach of interventions targeting low-income families with infants and toddlers (Adirim & Supplee, 2013; Gomby et al., 1999).

Home visiting programs have used a variety of different models, curriculums, and training approaches. Home visiting services may be delivered by professionals (Olds, 2006), such as nurses or social workers, or well-trained community workers (Duggan et al., 2000; S. L. Hans et al., 2018). Despite a robust body of scientific findings demonstrating the effectiveness of multiple home visiting service models in improving child development and family well-being (DuMont et al., 2008; Kirkland & Mitchell-Herzfeld, 2012; LeCroy & Krysik, 2011; Love et al., 2005; T. R. Miller, 2015; Olds, 2002), the sizes of intervention effects in well-designed studies are generally modest. One of the possible reasons for these modest effects is that many mothers do not engage as frequently or deeply with the intervention as the model developers intend (Alonso-Marsden et al., 2013) and that mothers vary significantly in their involvement, which includes participation (i.e., the quantity of services received) and engagement (i.e., the emotional quality of the mother's interaction with the service providers) (Korfmacher et al., 2008). Many home visiting programs face challenges in participation and retention. For example, a study of

over 80,000 Nurse Family Partnership participants showed that 28% dropped out services after an average of 6.7 visits (Holland et al., 2018). Another study reported that mothers received about half the number of home visits as expected by protocol (Korfmacher et al., 1998). Beyond participation in program activities, engagement with service providers has been suggested to be an important factor shaping service process and outcomes (Marsh et al., 2012). Many home visiting models characterize their approach as being relationship-based (Bernstein, 2002; Humphries & Korfmacher, 2012; Kelly & Barnard, 1999), meaning the effectiveness of the intervention depends on the quality of the helping relationship that develops between the parent and the home visitor.

It is important therefore to gain insight into factors that contribute to the quantity of service utilization and the quality of the parent-home visitor relationship. Evidence shows that a variety of factors shape parents' involvement in home visiting services, including the practitioner's and the parent's personal characteristics and previous experiences in health care and social relationships (McNaughton, 2000) and program and neighborhood characteristics (Bower et al., 2020). This paper will use quantitative analyses to explore whether mothers' past and current relationships in their social networks are related to their service involvement.

Supportive Relationships and Involvement in Psychotherapy

Issues of client involvement are relevant to a broad set of social services (Marsh et al., 2012), and scholars studying psychotherapy have long been interested in studying factors associated with client involvement in mental health treatment (Gelso & Carter, 1985). One important involvement indicator that has gained scholarly attention within psychotherapy research is the working alliance between the therapist and the client. In his seminal work, Bordin (1975) conceptualized working alliance as encompassing three components: bonds (e.g.,

interpersonal attachments, liking, and trusting), tasks (e.g., agreements between the therapist and the client in what to be done in therapy), and goals (e.g., consensus on outcome expectations between the therapist and the client). There is strong evidence that the working alliance plays an important role in treatment success (Horvath, 2000).

Bordin (1975) also argued that the working alliance may be influenced by past relationships and unresolved bonds in early phases of therapy. Working alliances with therapists can be viewed as a special type of attachment bond (Pistole, 1989). The therapist assumes the role of a consistently responsive attachment figure to foster the client's trust and provide a secure base for exploration of his/her feelings, memories and interpersonal environment (Bowlby, 1988). The working models or mental representations of relationships the client developed in other relationship experiences shape his/her capacity to trust and form attachments with the therapist, and to take responsibility in the joint work in therapy (Gelso & Carter, 1985).

A robust empirical literature has examined the association between clients' relationships and attachment history with the working alliances they form with therapists (Bernecker et al., 2014). In this literature, scholars examined many aspects of relationships, such as past and current social functioning (the ability to form and sustain close interpersonal relationships), family relationships (the amount of conflict and emotional isolation), and generalized hostile attitudes toward others, and found that clients with poor current and past relationships tend to establish poorer working alliances with therapists (Kokotovic & Tracey, 1990; Moras & Strupp, 1982). Clients with higher levels of social support and attachment security tend to establish stronger working alliances with therapists (Diener & Monroe, 2011; Keller et al., 2010; Mallinckrodt, 1991). The role of childhood attachment experiences with parents has gained special attention in this literature due to the continuity of childhood and adult attachment (Styron

& Janoff-Bulman, 1997). Research has shown that parental bonds (e.g., memories with parents until 16 years old) are related to working alliances with the therapist, even after controlling for current attachment in close relationships, self-efficacy, and length of treatment (Mallinckrodt, 1991; Mallinckrodt et al., 1995). The client's early experiences of emotional bonds with parents could be "among the most potent factors that affect their ability to form productive working alliances" (Mallinckrodt et al., 1995).

Supportive Relationships and Involvement in Home Visiting Services

Home visiting scholars have long been aware that mothers enrolled in home visiting services often faced challenges or discordance in their family relationships in childhood and with their caregivers or partners (Bosquet & Egeland, 2001; Cox et al., 1991). Mothers may experience anxiety about others not being available and discomfort with trusting/depending on others (Cluxton-Keller et al., 2014), but it is also noted that mothers' attachment anxiety and avoidance vary significantly (McFarlane et al., 2010). The roles of adult attachment and social relationships of mothers enrolled in home visiting services have been examined in relation to their service involvement. In one study, four types of adult attachment of mothers were identified: secure, dismissing (e.g., presenting idealistic accounts of past that are not supported by evidence), preoccupied (e.g., confused/overwhelmed/preoccupied with past and current relationships), and unresolved (e.g., showing disorganization of speech and thought about specific traumatic issues) (Korfmacher et al., 1997). Secure mothers were found to have higher levels of service participation, emotional commitment to the intervention, and positive relationships with intervention facilitators and members in the group sessions than unresolved or dismissing mothers.

Another study measured mothers' levels of attachment anxiety and avoidance and showed that mothers with low attachment anxiety had high levels of trust with the home visitor, regardless of the home visitor's attachment status. However, for mothers with high attachment anxiety, their trust was dependent on the attachment of the home visitor: These mothers only reported higher levels of trust when their home visitors were either low on attachment anxiety or high on avoidance (McFarlane et al., 2010). Evidence also shows that mothers from supportive families could easily develop bonds with their home visitors and engage with services (Beasley et al., 2018); while mothers with low family support could either develop strong or weak bonds (Brookes et al., 2006). One study found that mothers who felt rejected by their parents and had suffered abuse from past partners reported that they were unwilling to address any problems with home visitors as they learned to be very independent from hurtful relationships (Brookes et al., 2006).

Although the dominant view in the literature is that strong relationships with family facilitate relationships with home visitors, an alternative view is that mothers' higher needs for support may facilitate relationships with home visitors and increase their use of service. A few methodologically strong studies suggested that mothers who had more psychosocial and parenting risks, such as low levels of social support, were more likely to demonstrate involvement in home visiting services since their perceived need for services may be greater or service providers target needier families and provide more intense service (Ammerman et al., 2006; Duggan et al., 2000). Evidence suggests that mothers in social networks of low density and with less frequent kin contact have fewer readily available helping resources (e.g., advice, information, and instrumental aid) and experience more stress. Therefore, they are more likely to

be connected to and use services from professional helping systems such as parent group and home visiting services than their counterparts in tight-knit networks (Birkel & Reppucci, 1983).

The Supportive Networks of Young Mothers in Home Visiting Services

Because many home visiting models serve first-time low-income mothers (e.g., Healthy Families America and Nurse-Family Partnership), young mothers, including those who are teenagers, often make up an important proportion of home visiting participants. For example, the mean age at service enrollment of mothers in many home visiting programs is between 18 to 20 years old (Cullen et al., 2010; Olds et al., 2002) and the percentage of mothers aged 18 or below is often over a quarter (e.g., 30%, DuMont et al., 2008; Mistry et al., 2016; 22% to 40%, Wagner, Spiker, Linn, & Hernandez, 2003). The family support landscape of young mothers can be very different from that of older mothers and the role of grandmothers or other parent figures may be particularly important. Young mothers usually live with their own mother or another adult parent figure (PF),with co-residence rates over 70% in some home visiting programs (Hans et al., 2018; Mistry et al., 2016) and identify parent figures as their primary source of social support (DeVito, 2007). Although many young mothers do not live with the infant's father, they often seek social support from the father, especially when they do not have a positive relationship with the parent figure (DeVito, 2007). Social support has been shown to be a key factor shaping young mothers' psychological well-being and parenting practices, especially support from a mother's parent figure (PF) and father of the baby (FOB) or her partner (Chase-Lansdale et al., 1994; Edwards et al., 2012; Voight et al., 1996).

For young mothers enrolled in home visiting services, the role of their social support networks, especially the relationship with their parent figure, may be particularly important to intervention involvement and success, because family members may control access to the home

(Daro & Harding, 1999), they are often present during home visits, and they may be important decision makers regarding childrearing practices (Dunifon, 2013). Additionally, addressing young mothers' relationships with family members and partners is often necessary when home visitors provide support to young mothers.

Complexity of young mothers' supportive relationships. As discussed above, existing home visiting literature offers different predictions regarding the association between levels of social support and service involvement. One possible way to resolve this discrepancy in the literature is to take a more complex view of mothers' social support and relationships and to recognize that mothers' support networks differ – not only in degree of support – but with respect to the quality of that support and who provides it. Mothers' social support may be multifaceted (DeVito, 2007) and includes aspects such as the timing (e.g., childhood versus current relationships), sources (e.g., parent figure, father of the baby/partner, general social network), quality of relationships, and types of support (e.g., emotional versus tangible). There are also differences among young mothers with respect to the degree to which members in social networks can serve as sources not only of support, but also of conflict, stress, negative feedback and/or disagreements (Gee & Rhodes, 2003; Olds et al., 2002; Voight et al., 1996; Wen et al., 2010). Young mothers also differ with respect to their histories of support during childhood, with a history of being maltreated in childhood by her own mother common in mothers in home visiting services (DuMont et al., 2008). Scholars have addressed the complexity of supportive relationships of young mothers by using sum scores of various aspects of social support (see e.g., Wen et al., 2010), which is an additive approach commonly used in developmental sciences to capture the cumulative risk and protective factors composed of multidimensional aspects in social environment (Fraser et al., 1999; Lucio et al., 2011).

However, there is significant heterogeneity among young mothers' supportive relationships that may be lost in addressing support with an additive approach. More than three decades ago, researchers observed that "a high level of individual difference is evident among adolescent mothers" and that young mothers "exhibit a far more variable pattern of behaviors" compared to older mothers (Culp et al., 1988). In the following decades, person-oriented statistical techniques have been used to explicitly model the heterogeneity across different dimensions of characteristics and samples of families in early childhood interventions. Person-oriented approaches aim to examine psychosocial characteristics by looking at patterns of behaviors or attitudes (Sterba & Bauer, 2010). For example, latent class analysis and cluster analysis have been used to examine parenting behavior (see e.g., Brady-Smith et al., 2013; Driscoll & Easterbrooks, 2007; Zhang, Edwards, & Hans, 2019), mother-father relationships and coparenting arrangements (Raskin et al., 2016) and the demographics, socioeconomic disadvantages and psychological vulnerability among young mothers enrolled in home visiting services (Mistry et al., 2016). These studies suggest that despite a seemingly homogenous group, young mothers are composed of meaningful subgroups who demonstrate varying patterns of behavior or characteristics. It is reasonable to hypothesize that the supportive relationships of young mothers are also composed of varying profiles or patterns. Employing a person-oriented approach to address the multidimensionality or complexity in young mothers' supportive relationships may help address the discrepancy in existing literature regarding the association between social support and service involvement.

Study Questions

In sum, existing studies have examined separate dimensions of young mothers' supportive relationships and their associations with service involvement, but less is known about

the variability in the structure and quality of their supportive relationships (e.g., taking into account the multidimensionality of supportive relationships and heterogeneity of young mothers simultaneously) and the associations with service involvement. Based on existing literature, two competing hypotheses are proposed:

(1) Relationship-driven hypothesis: Young mothers with high quality past and current supportive relationships may be more likely to build trusting relationships with home visitors and better utilize services; while those with problematic/abusive and low quality of relationships may engage less.

(2) Needs-driven hypothesis: Young mothers with a high quality of past and current supportive relationships may engage less with home visitors and utilize fewer services; while those with problematic/abusive and low quality of relationships may engage more and use services more.

This study sets out to identify profiles of supportive relationships of young, low-income mothers, and then to examine how mothers with different relationship profiles differed regarding demographic and psychosocial characteristics. Next, this study will examine how the profiles are associated with mothers' participation and engagement of home visiting services, exploring whether the relationship-driven hypothesis or needs-driven hypothesis may be underlying the service involvement process.

Methods

Sample and Procedure

Data were from a randomized controlled trial (RCT) of doula home visiting services provided in four program sites (n=312). (For a detailed description of the RCT study, please refer to Hans et al., 2019). Mothers in the intervention group received doula-enhanced home visiting

services from programs that incorporated doulas into existing evidence-based models of Healthy Families America (2019) or Parents as Teachers (2019). Since the main interest of the current paper is on service involvement and relationships with service providers, only data from participants in the intervention group were used (*n*=156). Furthermore, nine additional participants were excluded from all analyses because of missing information on key variables. Four out of the nine participants reported that they did not have a parent figure (PF), and five mothers reported that they had no contact with the father of the baby (FOB) due to the father's death (*n*=1), leaving the country (*n*=1), imprisonment (*n*=1) and participants not knowing who the father was (*n*=2). The final analytic sample size was 147. The sample was composed of young (M = 18.5 years, SD = 1.88), ethnically diverse mothers (African American 49.7%, Latina 41.5%, White/other 8.8%).

In order to identify the mother's parent figure, she was asked the question, "Is there someone you would say is like a parent to you now, who watches out for you and is responsible for your well-being?" The majority of mothers identified their biological mother (*n*=116, 78.9%), about 10% identified their grandmother (*n*=15, 10.2%), others identified their father (n=8), adoptive mother/legal guardian (*n*=2), sister (*n*=2), aunt (*n*=1), brother (*n*=1), godmother (*n*=1), or their boyfriend's mother (*n*=1). Approximately 80% lived with their parent figure (*n*=116, 78.9%). About a quarter lived with the father of the baby (*n*=36, 24.5%) and three quarters were in a relationship with the father (e.g., married, engaged, in a couple/boyfriend/partner relationship; *n*=108, 73.4%).

Demographic, psychosocial and working alliance data were gathered from interviews with the mothers at enrollment during pregnancy (i.e., baseline), 37 weeks of pregnancy, and 3 weeks postpartum. Interviews were usually conducted at the mother's home and administered in

the mother's preferred language—English or Spanish. Administrative data of service records were available from management information systems (MIS) regarding date of service, time service began, length of service (in minutes), person delivering service, location of service (home, hospital, phone). Data from the MIS systems were crosschecked against mother report for accuracy.

Each mother worked with a team of two service providers—one community doula whose work focused on providing specialized support and education during the pregnancy and early postpartum period and one family support workers whose work focused on providing general family support and parent education throughout infancy and early childhood. Doulas started to conduct weekly home visits during pregnancy, sometimes jointly with home visitors, preparing mothers for labor and delivery and discussing lactation, early bonding with the infant, newborn care, and mothers' health and mental health. Doulas came to the hospital during labor and delivery to offer the mothers physical comfort, emotional support, and breastfeeding counseling. Doulas continued to make regular home visits after the birth until six weeks, during which time they focused on mothers' postpartum health and baby's early development. Family support workers started to increase the frequency of their visits postpartum and became the primary service provider after six weeks postpartum, offering services throughout infancy and toddlerhood. This study focuses on the doula-mother relationship, not the family support workers-mother relationship.

Measures

Supportive Relationships

The following ten indicators were used to identify the relationship/support profiles of the participants.

Perceived parental rejection. Three subscales from the Parental Acceptance-Rejection Questionnaire (PARQ; Rohner, 2005) were used to measure the extent to which mothers perceived acceptance-rejection from her primary caregiver in childhood: Warmth and affection, hostility and aggression, and indifference and neglect. Mothers responded to 16 items on a 4-point Likert scale (4 = "almost always true" 1 = "almost never true"). Sample statements were "when I was between 6 and 12, my [childhood caregiver] … totally ignored me," "took an active interest in me," and "frightened or threatened me when I did something wrong." The PARQ has been well validated internationally (Rohner & Ali, 2016). The Cronbach's alpha of the 16 items was 0.85. Positively worded items were reverse coded and the sum of the 16 items indicated the level of perceived rejection in childhood.

Trust, communication, and alienation with current parent figure and father of the baby. The Inventory of Parent and Peer Attachment (IPPA; Armsden & Greenberg, 1987) was used to measure participants' perceived attachment with their current parent figure and father of the baby. Mothers responded on a 5-point Likert scale (5 = "almost always true" 1 = "almost never true") across three domains—trust, communication and alienation, each of which had three items. Sample statements included "my [parent figure/baby's father] respect my feelings," "if he/she knows something is bothering me, he/she asks me about it," and "he/she doesn't understand what I'm going through these days." Cronbach's alpha for the trust, communication, and alienation subscales were 0.80, 0.78, and 0.63 for parent figure, and 0.90, 0.90, and 0.69 for father of the baby. Higher scores on each subscale indicated more trust, better communication, and greater level of alienation.

Received support from current parent figure and father of the baby. The mean score of a six-item scale created for the study was used to measure support provided by parent figure and

the father of the baby. Participants responded on a 5-point Likert scale (5 = “very often” 1 = “never”). The six items were: during the past 3 months how often has your [current parent figure/baby’s father] “bought you things you needed or given you money to buy things you need?” “listened to your worries, concerns, or problems?” “answered your questions and given you advice when you wanted it?” “done something with you that you both enjoy?” “given you help you needed, like with transportation, schoolwork, a household chore, or something like that?” and “helped you make plans for after your baby is born?” Cronbach's alpha for the six items was 0.88 for the parent figure, and 0.94 for the father of the baby.

General social support. The level of support from the participants’ general social network was measured by the Social Provisions Scale (Cutrona & Russell, 1987), which included six subscales--attachment, social integration, reassurance of worth, reliable alliance, guidance, and opportunities for nurturance. Participants responded on a 4-point Likert scale (4 = “strongly agree” 1 = “strongly disagree”) to each item. Sample statements included “there are people I can depend on to help me if I really need it,” “there is someone I could talk to about important decisions in my life,” and “I have close relationships that provide me with a sense of emotional security and well-being.” Cronbach's alpha for the 24 items was 0.84. Negatively worded items were reverse coded, and the total sum score was used.

Mother Characteristics

Depressive symptoms. The Center for Epidemiological Studies-Depression scale (CES-D; Radloff, 1977) was used to measure participants’ depressive symptoms at baseline, 37-weeks pregnancy, and 3-weeks postpartum interview. The CES-D scale has been shown to have good psychometric properties for low-income mothers (Atkins 2014). Mothers responded to 20 items on a 4-point scale (4 = most of the time (5-7 days); 1 = rarely or none of the time (less than 1

day)) about symptoms in the past week. Sample statements included “During the past week I thought my life had been a failure” and “I could not get ‘going’.” Ratings on negatively worded statements were reverse coded and the sum scores were used. A sum score of 16 or greater indicates a risk for clinical depression.

Service Involvement

Service involvement outcomes of interest included participation and engagement. Engagement was measured by the bonding and agreement about tasks/goals with the doula.

Bonding and agreement about tasks/goals with the doula. To measure the quality of the relationship with the doula, a modified version of Tracey & Kokotovic’s (1989) 12-item Working Alliance Inventory WAI short form (WAI-S) was used at both the 37-weeks prenatal interview and the 3-weeks postnatal interview. Mothers responded on a 4-point Likert scale (4 = “Always” 1 = “Never”) to 12 items. Although the WAI has three four-item subscales—bonding, tasks, and goals, studies have shown that a two-factor structure better captures the working relationship since clients usually have trouble distinguishing between tasks and goals (Gessnitzer & Kauffeld, 2015). Therefore, scores from both the tasks and the goals subscales were summed to measure participants’ agreement about tasks/goals in their working relationship with the doula. The Cronbach's alpha of the eight task/goal items was 0.76 at 37-weeks pregnancy and 0.83 at 3-weeks postpartum. The sum score of the four items in the bonding subscale was used to measure participants’ emotional bond and closeness with the doula, and Cronbach's alpha of the four items was 0.88 at 37-weeks pregnancy and 0.89 at 3-weeks postpartum. Since bonding and agreement about tasks/goals were highly skewed to the left, they were first reflected and then transformed using logarithm to alleviate skewness in the following analyses (Chatterjee & Hadi, 2015).

Three types of participation outcomes were examined, including number of prenatal and postnatal doula visits, doula birth attendance, and early discontinuation of services.

Number of prenatal and postnatal doula visits. In the administrative system, the date, beginning time, and duration (in minutes) of each doula service were recorded by the doulas. The number of total prenatal and postnatal doula visits were calculated using the administrative data and was cross-checked against participants' self-report data (For details, please see Appendix A). Since each participant was enrolled in services and gave birth at different times they had varying exposure time for prenatal visits. The exposure time for prenatal visits was created by calculating the length of time from the first doula home visit to the baby's date of birth. Since all participants were eligible for postpartum doula services until six weeks postpartum, the exposure time for postnatal visits was the same for each mother.

Doula birth attendance. At the 3-weeks postpartum interview, participants responded to the questions "was your doula present when you gave birth?" "If no, was another doula present for the birth?" and "Did your doula visit you in the hospital the next day or so?" Mothers who responded "yes" to at least one of the three questions were coded 1 on the doula birth attendance outcome. Those whose doulas were not present during labor or delivery and did not visit in the hospital were coded as 0. The self-report data were cross-checked against the service record in the administrative system in which "doula attended birth" or "no doula attended birth" was noted for the baby's date of birth, or "doula hospital service" was noted immediately after the birth. There were 13 participants who did not have interview data at 3-weeks postpartum, and their doula birth attendance was filled solely based on information from the administrative system.

Early discontinuation of services. In the administrative system, if a participant's last doula service date was before 6-weeks postpartum, she was coded as 1 in the outcome of early discontinuation of services. Otherwise, she was coded as 0.

Analysis Methods

First, latent profile analysis was conducted to generate relationship/supportive profiles for mothers in the doula home visiting intervention group. The latent class of interest—supportive relationship profiles—was measured by the ten continuous indicators at baseline. Mothers who shared similar characteristics in their relationship/support were grouped into one latent class. Models with two to four classes were examined. Both substantive interpretability and statistical criteria were taken into account, including Bayesian Information Criterion (BIC; Schwarz, 1978) (model with smaller BIC was preferred), entropy (a value closer to 1 was preferred), and Vuong-Lo-Mendell-Rubin likelihood ratio test (significant *p*-value indicated the model with *k* classes fits better than *k*-1 classes). The class prevalence, class-specific means and standard deviations of each indicator, and the probability of belonging to each latent class for each mother were estimated. Mothers were then assigned to the latent class to which they had the highest probability of belonging (i.e., maximum probability assignment). Since the assigned class membership may contain classification error, a weight equal to the value of the maximum probability was created and used in the following analyses (Cheng, 2012; Kamata et al., 2018; Nese et al., 2017).

Second, in order to understand how mothers in different profiles may differ in terms of demographic and psychosocial characteristics, associations between latent class membership and mother age, race/ethnicity, education, depressive symptoms, co-residence status with the parent figure and the father of the baby, and program sites were examined using analysis of variance

(ANOVA) or ordinary least square regressions with weights. Distribution of covariates in which the classes significantly differed were shown in order to understand how the classes differed.

Third, weighted regressions were used to examine whether the mothers' supportive relationship profiles were associated with eight outcomes of service involvement. These outcomes included bonding with the doula at 37-weeks pregnancy and 3-weeks postpartum (continuous), agreement on tasks/goals with the doula at 37-weeks pregnancy and 3-weeks postpartum (continuous), whether or not the doula had attended the birth or visited at the hospital immediately after birth (dichotomous); total number of prenatal visits (count), total number of postnatal visits (count), and whether the mother dropped out of doula services before 6-weeks postpartum (dichotomous). Weighted ordinary least squares regressions were used for continuous outcomes, logistic regressions were used for dichotomous outcomes, and Poisson/negative binomial regressions were used for count outcomes. Although it is a common practice in variable-oriented analyses (e.g., ordinary least square regression) to include covariates, variables of maternal characteristics were not controlled in this person-oriented analysis because the variable of the latent class membership already represented varying characteristics and it is not feasible to additionally control for mother's characteristics within each latent class. However, after each regression, the dummy variables of program site were additionally controlled for to examine whether the regression results were robust to inclusion of organizational-level information. (The four program sites had different policies and doulas, so the variable of program sites may serve as a rough proxy for some organizational-level differences.) The longitudinal changes of the working alliance from the 37-weeks pregnancy to 3-weeks postpartum and the change of the number of visits from prenatal visits to postnatal visits

by supportive relationship profiles were also examined. Analyses were conducted in in *MPlus* 8.0 (Muthén & Muthén, 1998) and Stata 15.0 (StataCorp, 2017)

Results

Latent Profile Analysis

After considering the statistical fit indices and the substantive interpretations, a four-class latent profile analysis solution was chosen. It has an entropy value of 0.96. Table 2.1 shows the means of each indicator across the four classes. Mothers classified in Class 2, comprising 27% of the sample, experienced the lowest levels of rejection in childhood, the least alienation from their current parent figure (PF) and father of the baby (FOB), the highest levels of trust, communication with, and support from their parent figure and the father of the baby, and the highest level of support. This class is labeled as *strong support from PF, FOB and others*. Class 3 is the largest subclass in the sample (40%), and mothers classified in this class scored moderately on all ten indicators. Therefore, Class 3 is labeled as *moderate support overall*. Mothers in Class 1 comprised the smallest class in the sample (15%) and reported the highest levels of rejection in childhood and current alienation from parent figure, and the lowest levels of trust, communication with and support from the parent figure. Despite a difficult relationship with their parent figure, they had a relatively strong relationship with the FOB. Therefore, Class 1 is labeled as *moderate support from FOB but alienation with PF* (shortened as *alienation with PF*). Mothers in Class 4 (18%) demonstrated the opposite relationship profile as that of Class 1: They reported moderate levels of rejection in childhood, and trust, communication with, alienation and support from their current parent figure, but the highest level of alienation and the lowest levels of trust, communication with, and support from the father of the baby. Therefore, Class 4 is labeled as *moderate support from PF but alienation with FOB* (shortened as *alienation*

with FOB). The level of general social support was similar across Class 1, 3 and 4, much lower than that of Class 2.

Table 2.1 Estimated Means of the Ten Indicators of Relationship Profiles (N = 147)

	Class 1	Class 2	Class 3	Class 4
	15% Moderate support from FOB but alienation with PF	27% Strong support	40% Moderate support	18% Moderate support from PF but alienation with FOB
Perceived rejection in childhood	**26.01**	*17.60*	22.11	22.77
Parent figure				
trust	*8.47*	**14.55**	12.79	13.52
communication	*7.75*	**14.18**	12.08	12.98
alienation	**9.45**	*4.87*	7.64	8.00
support	*2.88*	**4.61**	4.22	4.51
Father of the baby				
trust	13.21	**14.89**	12.23	*6.05*
communication	13.26	**14.21**	11.38	*4.55*
alienation	6.90	*4.75*	7.78	**10.04**
support	4.35	**4.73**	3.90	*1.39*
General social support	*74.99*	**84.26**	76.70	77.40

Note. Highest value of each indicator was bolded; lowest value was in italic.

Characteristics of the Four Latent Classes

Table 2.2 shows the distribution of maternal characteristics by latent class membership. The four classes differed on maternal age, depressive symptoms and co-residence status with father of the baby at three time points. Latent class membership was not associated with maternal race/ethnicity, education levels, co-residence with parent figure at all three interview waves, or program site. In general, mothers in the *strong support* class (Class 2) were older, had fewer depressive symptoms, and were the more likely to live with the father of the baby than their

counterparts in the other three classes. Compared to mothers in Class 2, mothers in *moderate support* (Class 3) showed more depressive symptoms throughout time: their average CES-D scores at the baseline and the 37-weeks prenatal interview were close to 16—the cutoff indicating a risk for clinical depression. The mean depressive symptoms of mothers in *alienation with FOB* (Class 4) were above the cutoff (18.81) at baseline but decreased significantly across time, and became statistically indistinguishable from *strong support* (Class 2) at 3-weeks postpartum. Almost none of the mothers in *alienation with FOB* (Class 4) lived with the father of the baby. The depressive symptoms of mothers in *alienation with PF* (Class 1) remained relatively high across time.

Table 2.2 Demographics, Psychosocial Characteristics and Living Arrangements across the Four Latent Classes (N = 147 unless otherwise noted)

	Class 1	Class 2	Class 3	Class 4	Significant comparison (p<0.05)
n	21	39	61	26	
%	14.29%	26.53%	41.50%	17.69%	
	Moderate support from FOB but alienation with PF	Strong support	Moderate support	Moderate support from PF but alienation with FOB	
Maternal age	18.41	19.08	18.26	18.04	2 > 3, 4
Maternal ethnicity					
African American	12 (57.14%)	18 (46.15%)	32 (52.46%)	11 (42.31%)	
Latina	9 (42.86%)	20 (51.28%)	22 (36.07%)	10 (38.46%)	
White/Other	0 (0%)	1 (2.56%)	7 (11.48%)	5 (19.23%)	
Maternal education					
Less than high school	15 (71.43%)	21 (53.85%)	40 (65.57%)	14 (53.85%)	
High school degree or GED	4 (19.05%)	12 (30.77%)	16 (26.23%)	12 (46.15%)	
Some postsecondary education	2 (9.52%)	6 (15.38%)	5 (8.20%)	0 (0%)	

Table 2.2, continued

Depressive symptoms					
Baseline	16.05	8.13	15.39	18.81	1, 3, 4 > 2
37-weeks prenatal	14.00	7.93	16.10	15.00	1, 3, 4 > 2
3-weeks postnatal	13.50	6.38	13.36	9.35	1, 3 > 2 3 > 4
Coresidence with father of the baby					
Baseline	5 (23.81%)	18 (46.15%)	12 (19.67)	1 (3.85)	2 > 3, 4
37-weeks prenatal (*n* = 121)	6 (35.29%)	14 (48.28%)	11 (21.57%)	1 (4.17%)	1, 2 > 4 2 > 3
3-weeks postnatal (*n* = 133)	6 (33.33%)	19 (52.78)	17 (30.36%)	1 (4.35%)	1, 2, 3 > 4 2 > 3
Coresidence with parent figure					
Baseline	15 (71.43%)	31 (79.49%)	48 (78.69%)	22 (84.62%)	
37-weeks prenatal (*n* = 121)	13 (76.47%)	20 (68.97%)	38 (74.51%)	21 (87.5%)	
3-weeks postnatal (*n* = 133)	14 (77.78%)	31 (83.78%)	42 (76.36%)	20 (86.96%)	
Program sites					
Site 1	10 (47.62%)	10 (25.64%)	21 (34.43%)	7 (26.92%)	
Site 2	7 (33.33%)	11 (28.21%)	17 (27.87%)	6 (23.08%)	
Site 3	3 (14.29%)	9 (23.08%)	19 (31.15%)	11 (42.31%)	
Site 4	1 (4.76%)	9 (23.08%)	4 (6.56%)	2 (7.69%)	

Differential Service Involvement with Doulas across the Four Latent Classes

Regression analyses were conducted to examine the associations between latent class membership and eight outcomes of service involvement with doulas. Latent class membership was not associated with bonding with the doula at 37-weeks pregnancy or 3-weeks postpartum (Table 2.3), the number of postpartum visits (Table 2.5), or dropping out of services before 6-weeks postpartum (Table 2.6). However, it was significantly associated with agreement on

tasks/goals with the doula at both 37-weeks pregnancy and 3-weeks postpartum (Table 2.3), doula birth attendance (Table 2.4), and the total number of prenatal visits (Table 2.5).

Table 2.3 Differences in Bonding and Agreement on Tasks/Goals with the Doula across Latent Classes

	Class 1 15% Moderate support from FOB but alienation with PF	Class 2 27% Strong support	Class 3 40% Moderate support	Class 4 18% Moderate support from PF but alienation with FOB	Significant comparisons
Bonding					
37-weeks pregnancy (n = 117)					
Observed scores	14.53	15.00	14.94	14.70	
3-weeks postpartum (n = 124)					
Observed scores	14.25	15.00	14.72	14.25	
Agreement on tasks/goals					
37-weeks pregnancy (n = 117)					
Observed scores	28.53	30.11	28.16	28.22	
Without controlling for program site					2 > 3 ($p < 0.01$) 2 > 4 ($p < 0.05$)
Controlling for program site					2 > 3 ($p < 0.05$) 2 > 4 ($p < 0.05$)
3-weeks postpartum (n = 124)					
Observed scores	26.13	28.77	27.55	26.85	
Without controlling for program site					2 > 1 ($p < 0.01$)
Controlling for program site					2 > 1 ($p < 0.05$)
Changes in agreement on tasks/goals from 37-weeks pregnancy to 3-weeks postpartum					
	decreased $p < 0.05$	decreased $p < 0.05$	n.s.	n.s.	

Note. Outcomes were transformed to reduce skewness. Regression results are not directly interpretable, therefore not presented but are available upon request.

n.s. : Not significant.

Table 2.4 Odds Ratios and 95% Confidence Interval of Doula Birth Attendance across Latent Classes (N = 138)

	Class 1 Moderate support from FOB but alienation with PF	Class 2 Strong support	Class 3 Moderate support	Class 4 Moderate support from PF but alienation with FOB
Observed percentage of doula birth attendance	73.68%	86.84%	93.10%	91.30%
Odds ratio				
Not controlling for site	Reference class	2.38 [0.59, 9.59]	4.73* [1.12, 20.10]	3.85 [0.65, 22.86]
Controlling for site	Reference class	2.65 [0.65, 10.92]	5.93* [1.39, 25.35]	5.22† [0.80, 34.26]
Predicted probability	72.82%	86.82%	92.84%	91.22%

Note. † $p<0.1$; * $p<0.05$.

Table 2.5 Incidence Rate Ratios and 95% Confidence Intervals of Prenatal and Postnatal Doula Visits from the Binomial Negative Regressions

	Class 1 Moderate support from FOB but alienation with PF	Class 2 Strong support	Class 3 Moderate support	Class 4 Moderate support from PF but alienation with FOB
Prenatal visits *(n = 130)*				
Observed mean number of visits	7.00	7.13	8.62	8.76
Incidence rate ratio				
Not controlling for site	Reference class	1.40** [1.09, 1.79]	1.26* [1.01, 1.57]	1.55** [1.16, 2.08]
Controlling for site	Reference class	1.33* [1.04, 1.69]	1.24* [1.02, 1.51]	1.47** [1.13, 1.91]
Postnatal visits *(n = 139)*				
Observed mean number of visits	5.50	4.76	5.22	5.20
Incidence rate ratio				
Not controlling for site	Reference class	0.87 [0.63, 1.20]	0.95 [0.71, 1.29]	0.95 [0.68, 1.35]
Controlling for site	Reference class	0.95 [0.70, 1.30]	1.01 [0.75, 1.35]	1.04 [0.75, 1.44]
Changes from prenatal to postnatal visits				
	n.s.	decreased $p < 0.001$	decreased $p < 0.001$	decreased $p < 0.01$

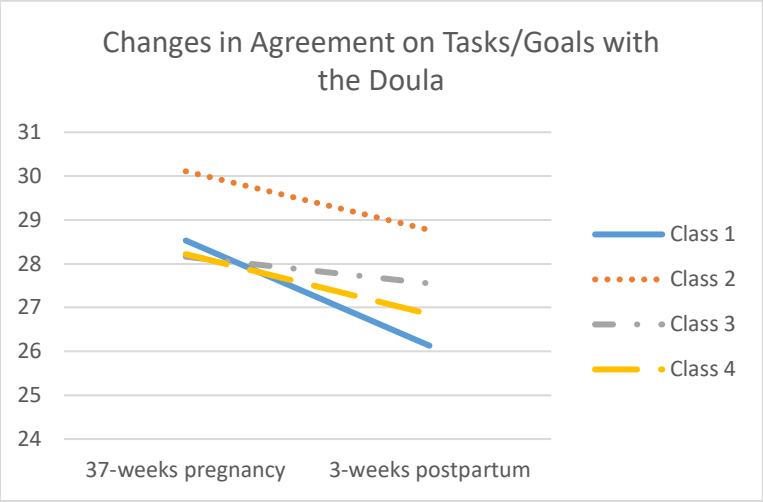
Note. * $p<0.05$, ** $p<0.01$.
n.s. : Not significant.

Table 2.6 Early discontinuation of services by latent class membership

	Class 1 Moderate support from FOB but alienation with PF	Class 2 Strong support	Class 3 Moderate support	Class 4 Moderate support from PF but alienation with FOB
dropping out of services before 6 weeks postpartum	2 (11.11%)	7 (20.00%)	8 (13.79%)	4 (16.67%)
Odds ratio				
Not controlling for site	Reference class	1.91 [0.35, 10.40]	1.29 [0.25, 6.75]	1.56 [0.25, 9.73]
Controlling for site	Reference class	0.94 [0.17, 5.30]	1.05 [0.19, 5.64]	1.09 [0.18, 6.78]

Agreement on tasks/goals with the doula (engagement). Figure 2.1 shows the longitudinal changes in agreement on tasks/goals with the doula from 37-weeks pregnancy to 3-weeks postpartum for each of the four latent classes. There was a decreasing trend from 37-weeks pregnancy to 3-weeks postpartum in general for all four classes, but a paired *t*-test showed that only the decrease for *alienation with PF* (Class 1) and *strong support* (Class 2) were significant ($p < 0.05$). Table 3 shows significant pairwise comparisons in regression models where the outcome was regressed on latent class membership both with and without controlling for program site. Mothers in the *strong support* (Class 2) reported higher agreement on tasks/goals with the doula than mothers in *moderate support* (Class 3) and *alienation with FOB* (Class 4) at 37-weeks pregnancy, and mothers in *alienation with PF* (Class 1) at 3-weeks pregnancy.

Figure 2.1 Changes in Agreement on Tasks/Goals with the Doula from Pregnancy to Postpartum



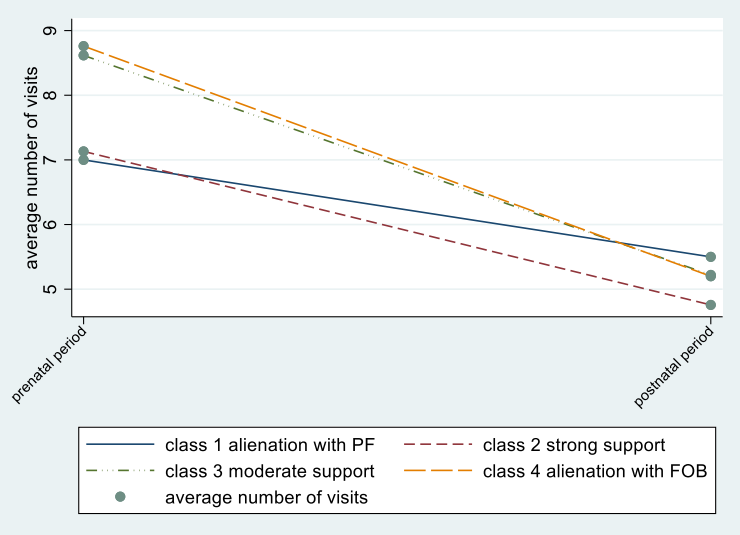
Doula birth attendance (participation). Table 4 presents the odds ratios and 95% confidence intervals (CI) of having a doula attend the birth when *alienation with PF* (Class 1) was used as the reference group. Logistic regressions showed that compared to mothers in the reference group, those in *moderate support* (Class 3) were more likely to have doula attending their birth or visiting them in the hospital immediately after birth (OR = 5.93, 95% CI [1.39, 25.35]). The estimated probability of doula birth attendance was above 0.9 for mothers in *moderate support* (Class 3) and *alienation with FOB* (Class 4), while it was around 0.7 for *alienation with PF* (Class 1).

Total number of prenatal visits (participation). Poisson and negative binomial regression models were used to examine the associations between the total number of prenatal visits and latent class membership. Due to evidence of overdispersion (i.e., standard deviations were bigger than means of the outcome), the negative binomial regression model was chosen as the final model. Table 5 shows the incidence rate ratios of prenatal doula visits. Mothers in *strong support*, *moderate support*, and *alienation with FOB* (Class 2, 3, and 4) did not differ on the number of prenatal doula visits, but all three classes had significantly more prenatal doula visits

than mothers in *alienation with PF* (Class 1) (IRR = 1.33, 95% CI [1.04, 1.69] for Class 2 vs Class 1; IRR = 1.24, 95% CI [1.02, 1.51] for Class 3 vs Class 1; IRR = 1.47, 95% CI [1.13, 1.91] for Class 4 vs Class 1).

Changes of the number of visits from prenatal to postnatal visits by class. Table 5 also shows that the average number of visits from prenatal to postnatal of each class decreased (Class 1 *alienation with PF*: 7.00 to 5.50; Class 2 *strong support* 7.13 to 4.76; Class 3 *moderate support* 8.62 to 5.22; Class 4 *alienation with FOB* 8.76 to 5.20). The decreasing trend is within expectation because the exposure time (i.e., length of time in which visits can be conducted) was longer for prenatal visits (e.g., about 11.5 weeks) than for postnatal visits (e.g., 6 weeks). However, *t*-tests show that only the decreases in *strong support*, *moderate support*, and *alienation with FOB* (Class 2, 3, and 4) were significant, but not the decrease in *alienation with PF* (Class 1). Figure 2.2 shows the changes of the number of home visits from prenatal to postnatal by class. The trend of *alienation with PF* (Class 1) is much flatter than that of the other three classes.

Figure 2.2 Changes of the Number of Visits from Prenatal to Postnatal Visits by Class



Discussion

This study identified four patterns of supportive relationships of young, low-income mothers enrolled in doula-enhanced home visiting services: *Strong support, moderate support, moderate support from the father of the baby but alienation with parent figure*, and *moderate support from parent figure but alienation with the father of the baby*. The identification of these four very different relationship profiles further supports the idea that young mothers are a heterogeneous group. Mothers in the four subgroups differed in terms of age, depressive symptoms and living arrangement with the father of the baby over time.

Evaluation of the Relationship-driven Hypothesis

Mothers of all four classes reported similarly high levels of bonding with their doulas both during pregnancy and at 3-weeks postpartum. However, mothers in the *strong support* class demonstrated the highest level of agreement on tasks and goals. These findings suggest that, on average, mothers across the four classes liked their doulas, but mothers in the *strong support* perceived their desired outcomes and approaches to achieve these goals to be more aligned with their doulas' than mothers in the other three classes. It is possible that mothers in the *strong support* class, who may have developed a secure adult attachment style from past strong and supportive relationships in their social network, may tend be more trusting of their doulas, perceive the doulas' goals to be more aligned with theirs, find it easier to negotiate and work out differences with their doulas, thus reported higher levels of agreement on tasks and goals. This mechanism may suggest that the ability to trust and work with others—cultivated from interacting with family and friends in a strong supportive network—may become the scaffold on which mothers develop the capacity to better negotiate with and use support from doulas.

Mothers in the *alienation with PF* class reported the highest level of rejection in childhood and lowest support from current parent figures. They were less likely to have their doula attend the birth at the hospital and received fewer home visits prenatally. Unlike mothers in the *strong support* class, mothers in the *alienation with PF class* may face challenges in forming an attachment and working with doulas since the mental representations they developed out of their relationship histories may prime them to distrust new relationships. The time of labor and delivery may be a moment in life when mothers feel particularly vulnerable, and it is possible that mothers in the *alienation with PF* class may worry that the doula, like their own mother, will not provide them with the needed comfort and understanding.

The above findings regarding the working alliance with doulas and use of doula services among the *strong support* and *alienation with PF* classes lend support to the relationship-driven hypothesis in the literature: Young mothers' home visiting service involvement is strongly shaped by experiences in prior relationships, especially those with parent figures, and clients with strong history of social support and attachment security tend to engage more in services (Korfmacher et al., 1997).

Evaluation of the Needs-driven Hypothesis

What is somewhat surprising in the results is that mothers in the *alienation with PF* class received a similar number of postnatal visits as mothers in the other classes, and that they were not at any higher risk to discontinue services before six weeks postpartum. Furthermore, there was a decrease in the number of doula visits from the prenatal to postnatal period among mothers in the other three classes, which may partly be a function of the shorter time frame (i.e., about 11.5 weeks prenatally versus only 6 weeks postpartum) , but the number of visits remained relatively stable among mothers in the *alienation with PF* class. In other words, mothers in the

alienation with PF class showed a tendency to be more involved in doula services postpartum than prenatally.

The relatively strong postpartum participation in doula service among the *alienation with PF* class lends support to the needs-driven hypothesis that mothers with lower social support engage more and is consistent with evidence showing that more disadvantaged parents utilized services more in a parenting intervention beginning postpartum (Miller et al., 2019). Postpartum period is an especially challenging time for young mothers due to the physical and psychological adjustment to motherhood, such as the lack of sleep and increased fatigue, the need to be constantly taking full responsibility for the newborn, and the little time left for anything else (Clemmens, 2003). Mothers experienced a loss of control during the postpartum period and a need for help after having a child (Sauer-Sargent, 2016) and they usually overestimated the help available when they were in pregnancy (Quinlivan et al., 2004). Evidence suggests that young mothers usually rely on their own mothers as a source of primary social support to deal with these challenges (DeVito, 2007), those experiencing difficult relationships with their own mother instead seek help from the father of the baby, whose support is not reliable or limited at the best (Gee & Rhodes, 2003; Thullen et al., 2012). It is possible that for mothers in the *alienation with PF* class, the availability of doula support may be experienced as more needed. The reliance on their own mothers can also help explain the very similar levels of service participation and engagement of mothers in the *moderate support* class and the *alienation with FOB* class: Mothers in these two classes had very similar levels of support from their parent figure and they demonstrated very similar patterns in both prenatal and postnatal periods in service involvement regardless of whether the support from the father of the baby was high or low.

In addition to needing more help in the postnatal period, another possible explanation for the enhanced postnatal service involvement of mothers in the *alienation with PF* class may be that they are finally developing a close, trusting relationship with their doula. Given their history of difficult relationships, they may be highly guarded of doulas during pregnancy, but the relationship-based interventions may enable them to gradually reevaluate and modify their initial distrust of doulas to some extent, develop a closer relationship—a process that may take them longer time than for mothers in other classes.

This explanation may be counterintuitive since during the postnatal period, both mothers in the *strong support* class and the *alienation with PF* class reported a decreased level of agreement on tasks and goals compared to that in the prenatal period. However, this decrease could be partly attributed to the change in service content after the birth. With the baby present, there were possibly more issues for mothers and doulas to disagree on, such as newborn care, breastfeeding, infant sleep and other aspects of early parenting. The decrease in agreement on tasks/goals among mothers in the *alienation with PF* class might not represent a weakening in the strength of their working alliance, but instead indicate that they gradually let down their guard and were seriously evaluating their relationships with doulas and discrepancies they perceived in many aspects when working with doulas postpartum. There is emerging evidence within the psychotherapy literature that a decrease of alliance scores after initially high scores may mean that clients are psychologically invested in the working alliances and need not be viewed as an alarming sign (Castonguay et al., 2006) and that clients who experience a U-shape (i.e., quadratic alliance growth) or V-shape (i.e., rupture-repair) tend to gain more from treatment (Kivlighan Jr. & Shaughnessy, 2000; Stiles et al., 2004). It is suggested that a good working alliance usually fades into the background as the therapist and the client work through and

resolve crises and then rise again in the last phase of therapy (Gelso & Carter, 1994). In addition, it is worth noting that the average score of agreement on tasks/goals for mothers in *alienation with PF* class still indicated a relatively good relationship at 3-weeks postpartum (3.3 out of 4). Future research is needed to collect more data points of working alliance over the course of home visiting and examine whether mothers in the *alienation with PF* class benefit more from services, as suggested by the psychotherapy literature.

In sum, this study provides evidence to both the relationship-driven hypothesis and the needs-driven hypothesis (Table 2.7). Both of these two hypotheses could be underpinning the service process, but the relationship-driven mechanism may play a more significant role during the prenatal period when initial service involvement could be strongly shaped by (dis)trust formed out of past/current social relationships. As the relationship-based interventions fostered better trust of doulas and the needs to cope with the challenging adjustment to motherhood increased, especially in face of lack of support from parent figures, the needs-driven mechanism may become more relevant postpartum.

Table 2.7 Process of Service Involvement in Relation to the Two Alternative Hypotheses

	Prenatal period	Postnatal period
The role of supportive relationships (relationship-driven)	Very important, particularly with respect to supportive relationships from parent figure. (1) Mothers in *strong support* class trust and work with doula better (2) Mothers in the *alienation with PF* class received fewer prenatal visits and were less likely to have doula attend birth	May be less important for service utilization and relationship with the doula after the birth; trust of doulas may be fostered through the relationship-based intervention, especially for mothers in the *alienation with PF* class
Needs for support of caring for newborn (needs-driven)	Moderate; baby is not born yet	Very high, especially for mothers with high alienation and low support from parent figure. (1) Mothers in the *alienation with PF* class showed increased service involvement compared to the prenatal period

Limitations

Interpretations of the findings need to take into consideration the limitations of this study. First, the four profiles were generated using a sample of young, low-income mothers participating in home visiting services provided by doulas in four urban home visiting agencies. Applying these four profiles to home visiting participants in other programs needs to be cautioned and future studies need to check whether these profiles can be replicated using different samples or with more typical non-doula home visitors. Second, there are variables beyond mothers' characteristics that can shape mothers' service involvement, such as home visitors' attachment, organizational-level funding, rate of staff turnover, and levels of supervision (McFarlane et al., 2010; McGuigan & Gassner, 2016). Despite robustness checks accounting for

the variable of program site, this study did not control for other provider-level and program-level characteristics. Future studies can examine whether the associations between mothers' relationship profiles and service involvement identified in this study are still significant after controlling for these important variables and the match between mothers' relationship profiles and provider- and program-level characteristics (see e.g., McFarlane et al., 2010). Future studies can also benefit from including the measurement of adult attachment and mothers' perception of their needs of services and testing their mediational roles in the process from supportive relationships to service involvement.

Conclusions

Despite these limitations, this study provides early childhood home visiting program designers and service providers with useful tools to appreciate the important variability in the relationship history of participating mothers. When designing or providing home visiting services, it is important for program designers and service providers to understand that young mothers have different relationship histories, and that different backgrounds may be associated with varying levels of proclivity to engage with services involvement. Programs may be more effective if they are designed to be responsive to mothers' relationship histories and needs. Special attention needs to be given to mothers with difficult relationships with their caregivers in childhood and current parent figures. It is important for home visitors to have ongoing training, supervision, and support to understand mothers' relationship history and social network and how these factors influence mothers' service involvement. It is not uncommon that home visitors feel frustrated with mothers that are hard to work with at first, but given time, patience, and support, these mothers may open up and benefit significantly from services. Research also suggests that

mothers appreciate home visitors more than they think (Hans et al., 2017), even when they are working on challenging issues and are going through fluctuations in the working alliance.

Home visitors cannot rewrite the history of dysfunctional parental bonds for these mothers, but they can provide a safe, secure and "holding" environment to scaffold the development of parenting skills. To achieve this goal, program designers may need to go beyond the standard service protocol, tailor the service content based on the relationship background and needs of mothers, and use an individualized intervention approach, as Culp and colleagues suggested three decades ago (1983).

References

Adirim, T., & Supplee, L. (2013). Overview of the federal home visiting program. *Pediatrics*, *132*(Supplement 2), S59–S64. https://doi.org/10.1542/peds.2013-1021C

Alonso-Marsden, S., Dodge, K. A., O'Donnell, K. J., Murphy, R. A., Sato, J. M., & Christopoulos, C. (2013). Family risk as a predictor of initial engagement and follow-through in a universal nurse home visiting program to prevent child maltreatment. *Child Abuse & Neglect*, *37*(8), 555–565. https://doi.org/10.1016/j.chiabu.2013.03.012

Ammerman, R. T., Stevens, J., Putnam, F. W., Altaye, M., Hulsmann, J. E., Lehmkuhl, H. D., Monroe, J. C., Gannon, T. A., & Van Ginkel, J. B. (2006). Predictors of early engagement in home visitation. *Journal of Family Violence*, *21*(2), 105–115. https://doi.org/10.1007/s10896-005-9009-8

Armsden, G. C., & Greenberg, M. T. (1987). The inventory of parent and peer attachment: Individual differences and their relationship to psychological well-being in adolescence. *Journal of Youth and Adolescence*, *16*(5), 427–454.

Beasley, L. O., Ridings, L. E., Smith, T. J., Shields, J. D., Silovsky, J. F., Beasley, W., & Bard, D. (2018). A Qualitative evaluation of engagement and attrition in a nurse home visiting program: From the participant and provider perspective. *Prevention Science*, *19*(4), 528–537. https://doi.org/10.1007/s11121-017-0846-5

Bernecker, S. L., Levy, K. N., & Ellison, W. D. (2014). A meta-analysis of the relation between patient adult attachment style and the working alliance. *Psychotherapy Research*, *24*(1), 12–24. https://doi.org/10.1080/10503307.2013.809561

Bernstein, V. (2002). Strengthening families through strengthening relationships: Supporting the parent-child relationship through home visiting. *Newsletter of the Infant Mental Health Promotion Project*, *35*, 1–5.

Birkel, R. C., & Reppucci, N. D. (1983). Social networks, information-seeking, and the utilization of services. *American Journal of Community Psychology*, *11*(2), 185–205. https://doi.org/10.1007/bf00894366

Bordin, E. S. (1975). *The working alliance: Basis for a general theory of psychotherapy*. Annual Meeting of the American Psychological Association, Washington, D.C.

Bosquet, M., & Egeland, B. (2001). Associations among maternal depressive symptomatology, state of mind and parent and child behaviors: Implications for attachment-based interventions. *Attachment & Human Development*, *3*(2), 173–199. https://doi.org/10.1080/14616730010058007

Bower, K. M., Nimer, M., West, A. L., & Gross, D. (2020). Parent involvement in Maternal, Infant, and Early Childhood Home Visiting programs: An integrative review. *Prevention Science*. https://doi.org/10.1007/s11121-020-01129-z

Bowlby, J. (1988). *A secure base: Clinical applications of attachment theory* (Vol. 153). Routledge & Kegan Paul.

Brady-Smith, C., Brooks-Gunn, J., Tamis-LeMonda, C. S., Ispa, J. M., Fuligni, A. S., Chazan-Cohen, R., & Fine, M. A. (2013). Mother–infant interactions in Early Head Start: A

person-oriented within-ethnic group approach. *Parenting: Science and Practice*, *13*(1), 27–43. https://doi.org/10.1080/15295192.2013.732430

Brookes, S. J., Summers, J. A., Thornburg, K. R., Ispa, J. M., & Lane, V. J. (2006). Building successful home visitor–mother relationships and reaching program goals in two Early Head Start programs: A qualitative look at contributing factors. *Early Childhood Research Quarterly*, *21*(1), 25–45. https://doi.org/10.1016/j.ecresq.2006.01.005

Castonguay, L. G., Constantino, M. J., & Holtforth, M. G. (2006). The working alliance: Where are we and where should we go? *Psychotherapy: Theory, Research, Practice, Training*, *43*(3), 271–279. https://doi.org/10.1037/0033-3204.43.3.271

Chase-Lansdale, P. L., Brooks-Gunn, J., & Zamsky, E. S. (1994). Young African-American multigenerational families in poverty: Quality of mothering and grandmothering. *Child Development*, *65*(2), 373–393. https://doi.org/10.1111/j.1467-8624.1994.tb00757.x

Chatterjee, S., & Hadi, A. S. (2015). *Regression analysis by example*. John Wiley & Sons.

Cheng, Z. (2012). *The relation between uncertainty in latent class membership and outcomes in a latent class signal detection model* [Unpublished doctoral dissertation, Columbia University]. https://doi.org/10.7916/D8ZP4D6S

Clemmens, D. (2003). Adolescent motherhood: A meta-synthesis of qualitative studies. *MCN: The American Journal of Maternal/Child Nursing*, *28*(2), 93.

Cluxton-Keller, F., Burrell, L., Crowne, S. S., McFarlane, E., Tandon, S. D., Leaf, P. J., & Duggan, A. K. (2014). Maternal relationship insecurity and depressive symptoms as moderators of home visiting impacts on child outcomes. *Journal of Child and Family Studies*, *23*(8), 1430–1443. https://doi.org/10.1007/s10826-013-9799-x

Cox, A. D., Pound, A., Mills, M., Puckering, C., & Owen, A. L. (1991). Evaluation of a home visiting and befriending scheme for young mothers: Newpin. *Journal of the Royal Society of Medicine*, *84*(4), 217–220. https://doi.org/10.1177/014107689108400411

Cullen, J. P., Ownbey, J. B., & Ownbey, M. A. (2010). The effects of the Healthy Families America home visitation program on parenting attitudes and practices and child social and emotional competence. *Child and Adolescent Social Work Journal*, *27*(5), 335–354. https://doi.org/10.1007/s10560-010-0206-9

Culp, R. E., Appelbaum, M. I., Osofsky, J. D., & Levy, J. A. (1988). Adolescent and older mothers: Comparison between prenatal maternal variables and newborn interaction measures. *Infant Behavior and Development*, *11*(3), 353–362. https://doi.org/10.1016/0163-6383(88)90019-7

Cutrona, C. E., & Russell, D. W. (1987). The provisions of social relationships and adaptation to stress. *Advances in Personal Relationships*, *1*(1), 37–67.

Daro, D. A., & Harding, K. A. (1999). Healthy Families America: Using research to enhance practice. *Future of Children*, *9*, 152–176.

DeVito, J. (2007). Self-perceptions of parenting among adolescent mothers. *The Journal of Perinatal Education*, *16*(1), 16–23. https://doi.org/10.1624/105812407X170680

Diener, M. J., & Monroe, J. M. (2011). The relationship between adult attachment style and therapeutic alliance in individual psychotherapy: A meta-analytic review. *Psychotherapy*, *48*(3), 237–248. https://doi.org/10.1037/a0022425

Driscoll, J. R., & Easterbrooks, M. A. (2007). Young mothers' play with their toddlers: Individual variability as a function of psychosocial factors. *Infant and Child Development*, *16*(6), 649–670. https://doi.org/10.1002/icd.515

Duggan, A., Windham, A., McFarlane, E., Fuddy, L., Lcsw, M., Rohde, C., Buchbinder, S., & Sia, C. (2000). Hawaii's Healthy Start program of home visiting for at-risk families: Evaluation of family identification, family engagement, and service delivery. *Pediatrics*, *105*(Supplement 2), 250–259.

DuMont, K., Mitchell-Herzfeld, S., Greene, R., Lee, E., Lowenfels, A., Rodriguez, M., & Dorabawila, V. (2008). Healthy Families New York (HFNY) randomized trial: Effects on early child abuse and neglect. *Child Abuse & Neglect*, *32*(3), 295–315. https://doi.org/10.1016/j.chiabu.2007.07.007

Dunifon, R. (2013). The influence of grandparents on the lives of children and adolescents. *Child Development Perspectives*, *7*(1), 55–60. https://doi.org/10.1111/cdep.12016

Edwards, R. C., Thullen, M. J., Isarowong, N., Shiu, C.-S., Henson, L., & Hans, S. L. (2012). Supportive relationships and the trajectory of depressive symptoms among young, African American mothers. *Journal of Family Psychology*, *26*(4), 585–594. https://doi.org/10.1037/a0029053

Fraser, M. W., Galinsky, M. J., & Richman, J. M. (1999). Risk, protection, and resilience: Toward a conceptual framework for social work practice. *Social Work Research*, *23*(3), 131–143.

Gee, C. B., & Rhodes, J. E. (2003). Adolescent mothers' relationship with their children's biological fathers: Social support, social strain and relationship continuity. *Journal of Family Psychology*, *17*(3), 370.

Gelso, C. J., & Carter, J. A. (1985). The relationship in counseling and psychotherapy: Components, consequences, and theoretical antecedents. *The Counseling Psychologist*, *13*(2), 155–243. https://doi.org/10.1177/0011000085132001

Gelso, C. J., & Carter, J. A. (1994). Components of the psychotherapy relationship: Their interaction and unfolding during treatment. *Journal of Counseling Psychology*, *41*(3), 296.

Gessnitzer, S., & Kauffeld, S. (2015). The working alliance in coaching: Why behavior is the key to success. *The Journal of Applied Behavioral Science*, *51*(2), 177–197.

Gomby, D. S., Culross, P. L., & Behrman, R. E. (1999). Home visiting: Recent program evaluations--Analysis and recommendations. *The Future of Children*, *9*(1), 4–26. https://doi.org/10.2307/1602719

Hans, S. L., Edwards, R. C., & Zhang, Y. (2018). Randomized controlled trial of doula-home-visiting services: Impact on maternal and infant health. *Maternal and Child Health Journal*, *22*(1), 105–113. https://doi.org/10.1007/s10995-018-2537-7

Hans, S., Wen, X., & Korfmacher, J. (2017). *Helping relationships in a doula home visiting program: Perspectives from young mothers and home visitors*. Society for Social Work and Research 21st Annual Conference, New Orleans, LA. https://sswr.confex.com/sswr/2017/webprogram/Paper29168.html

Holland, M. L., Olds, D. L., Dozier, A. M., & Kitzman, H. J. (2018). Visit attendance patterns in Nurse-Family Partnership community sites. *Prevention Science*, *19*(4), 516–527.

Horvath, A. O. (2000). The therapeutic relationship: From transference to alliance. *Journal of Clinical Psychology*, *56*(2), 163–173. https://doi.org/10.1002/(SICI)1097-4679(200002)56:2<163::AID-JCLP3>3.0.CO;2-D

Humphries, M. L., & Korfmacher, J. (2012). The good, the bad, and the ambivalent: Quality of alliance in a support program for young mothers. *Infant Mental Health Journal*, *33*(1), 22–33.

Kamata, A., Kara, Y., Patarapichayatham, C., & Lan, P. (2018). Evaluation of analysis approaches for latent class analysis with auxiliary linear growth model. *Frontiers in Psychology*, *9*. https://doi.org/10.3389/fpsyg.2018.00130

Keller, S. M., Zoellner, L. A., & Feeny, N. C. (2010). Understanding factors associated with early therapeutic alliance in PTSD treatment: Adherence, childhood sexual abuse history, and social support. *Journal of Consulting and Clinical Psychology*, *78*(6), 974–979. https://doi.org/10.1037/a0020758

Kelly, J. F., & Barnard, K. E. (1999). Parent education within a relationship-focused model. *Topics in Early Childhood Special Education*, *19*(3), 151–157.

Kirkland, K., & Mitchell-Herzfeld, S. (2012). Evaluating the effectiveness of home visiting services in promoting children's adjustment to school. *New York State Office of Children and Family Services, Bureau of Evaluation and Research*.

Kivlighan Jr., D. M., & Shaughnessy, P. (2000). Patterns of working alliance development: A typology of client's working alliance ratings. *Journal of Counseling Psychology*, *47*(3), 362–371. https://doi.org/10.1037/0022-0167.47.3.362

Knudsen, E. I., Heckman, J. J., Cameron, J. L., & Shonkoff, J. P. (2006). Economic, neurobiological, and behavioral perspectives on building America's future workforce. *Proceedings of the National Academy of Sciences*, *103*(27), 10155–10162. https://doi.org/10.1073/pnas.0600888103

Kokotovic, A. M., & Tracey, T. J. (1990). Working alliance in the early phase of counseling. *Journal of Counseling Psychology*, *37*(1), 16–21. https://doi.org/10.1037/0022-0167.37.1.16

Korfmacher, J., Adam, E., Ogawa, J., & Egeland, B. (1997). Adult attachment: Implications for the therapeutic process in a home visitation intervention. *Applied Developmental Science*, *1*(1), 43–52. https://doi.org/10.1207/s1532480xads0101_5

Korfmacher, J., Green, B., Staerkel, F., Peterson, C., Cook, G., Roggman, L., Faldowski, R. A., & Schiffman, R. (2008). Parent involvement in early childhood home visiting. *Child & Youth Care Forum*, *37*(4), 171–196. https://doi.org/10.1007/s10566-008-9057-3

Korfmacher, J., Kitzman, H., & Olds, D. (1998). Intervention processes as predictors of outcomes in a preventive home-visitation program. *Journal of Community Psychology*, *26*(1), 49–64.

LeCroy, C. W., & Krysik, J. (2011). Randomized trial of the healthy families Arizona home visiting program. *Children and Youth Services Review*, *33*(10), 1761–1766. https://doi.org/10.1016/j.childyouth.2011.04.036

Love, J. M., Kisker, E. E., Ross, C., Raikes, H., Constantine, J., Boller, K., Brooks-Gunn, J., Chazan-Cohen, R., Tarullo, L. B., Brady-Smith, C., Fuligni, A. S., Schochet, P. Z., Paulsell, D., & Vogel, C. (2005). The effectiveness of Early Head Start for 3-year-old children and their parents: Lessons for policy and programs. *Developmental Psychology*, *41*(6), 885–901. https://doi.org/10.1037/0012-1649.41.6.885

Lucio, R., Rapp-Paglicci, L., & Rowe, W. (2011). Developing an additive risk model for predicting academic index: School factors and academic achievement. *Child and Adolescent Social Work Journal*, *28*(2), 153–173. https://doi.org/10.1007/s10560-010-0222-9

Mallinckrodt, B. (1991). Clients' representations of childhood emotional bonds with parents, social support, and formation of the working alliance. *Journal of Counseling Psychology*, *38*(4), 401–409. https://doi.org/10.1037/0022-0167.38.4.401

Mallinckrodt, B., Coble, H. M., & Gantt, D. L. (1995). Working alliance, attachment memories, and social competencies of women in brief therapy. *Journal of Counseling Psychology*, *42*(1), 79–84. https://doi.org/10.1037/0022-0167.42.1.79

Marsh, J. C., Angell, B., Andrews, C. M., & Curry, A. (2012). Client-provider relationship and treatment outcome: A systematic review of substance abuse, child welfare, and mental health services research. *Journal of the Society for Social Work and Research*, *3*(4), 233–267. https://doi.org/10.5243/jsswr.2012.15

McFarlane, E., Burrell, L., Fuddy, L., Tandon, D., Derauf, D. C., Leaf, P., & Duggan, A. (2010). Association of home visitors' and mothers' attachment style with family engagement. *Journal of Community Psychology*, *38*(5), 541–556. https://doi.org/10.1002/jcop.20380

McGuigan, W. M., & Gassner, B. (2016). Engagement and retention in home visiting child abuse prevention programs. In L. Roggman & N. Cardia (Eds.), *Home visitation programs: Preventing violence and promoting healthy early child development* (pp. 101–117). Springer International Publishing. https://doi.org/10.1007/978-3-319-17984-1_7

McNaughton, D. B. (2000). A synthesis of qualitative home visiting research. *Public Health Nursing*, *17*(6), 405–414. https://doi.org/10.1046/j.1525-1446.2000.00405.x

Miller, E. B., Canfield, C. F., Morris, P. A., Shaw, D. S., Cates, C. B., & Mendelsohn, A. L. (2019). Sociodemographic and psychosocial predictors of VIP attendance in Smart Beginnings through 6 months: Effectively targeting at-risk mothers in early visits. *Prevention Science*. https://doi.org/10.1007/s11121-019-01044-y

Miller, T. R. (2015). Projected outcomes of Nurse-Family Partnership home visitation during 1996–2013, USA. *Prevention Science*, *16*(6), 765–777. https://doi.org/10.1007/s11121-015-0572-9

Mistry, J., Easterbrooks, M. A., Fauth, R. C., Raskin, M., Jacobs, F., & Goldberg, J. (2016). Heterogeneity among adolescent mothers and home visiting program outcomes. *Children and Youth Services Review*, *65*, 86–93. https://doi.org/10.1016/j.childyouth.2016.04.002

Moras, K., & Strupp, H. H. (1982). Pretherapy interpersonal relations, patients' alliance, and outcome in brief therapy. *Archives of General Psychiatry*, *39*(4), 405–409. https://doi.org/10.1001/archpsyc.1982.04290040019003

Muthén, L. K., & Muthén, B. O. (2017). *Mplus User's Guide. Eighth Edition*. Muthén & Muthén.

Nese, J. F. T., Kamata, A., & Tindal, G. (2017). A two-step sampling weight approach to growth mixture modeling for emergent and developing skills with distributional changes over time. *Journal of School Psychology*, *61*, 55–74. https://doi.org/10.1016/j.jsp.2016.12.001

Olds, D. L. (2002). Prenatal and infancy home visiting by nurses: From randomized trials to community replication. *Prevention Science*, *3*(3), 153–172. https://doi.org/10.1023/A:1019990432161

Olds, D. L. (2006). The Nurse–Family Partnership: An evidence-based preventive intervention. *Infant Mental Health Journal*, *27*(1), 5–25. https://doi.org/10.1002/imhj.20077

Olds, D. L., Robinson, J., O'Brien, R., Luckey, D. W., Pettitt, L. M., Henderson, C. R., Ng, R. K., Sheff, K. L., Korfmacher, J., Hiatt, S., & Talmi, A. (2002). Home visiting by paraprofessionals and by nurses: A randomized, controlled trial. *Pediatrics*, *110*(3), 486–496. https://doi.org/10.1542/peds.110.3.486

Pistole, M. C. (1989). Attachment: Implications for counselors. *Journal of Counseling & Development*, *68*(2), 190–193.

Quinlivan, J. A., Luehr, B., & Evans, S. F. (2004). Teenage mother's predictions of their support levels before and actual support levels after having a child. *Journal of Pediatric and Adolescent Gynecology*, *17*(4), 273–278. https://doi.org/10.1016/j.jpag.2004.05.001

Raskin, M., Fosse, N. E., Fauth, R. C., Bumgarner, E., & Easterbrooks, M. A. (2016). Relationship types among adolescent parents participating in a home-visiting program: A latent-transition analysis. *Journal of Family Psychology*, *30*(3), 375–385. https://doi.org/10.1037/fam0000164

Rohner, R. P. (2005). Parental Acceptance–Rejection Questionnaire (PARQ): Test manual. In R. P. Rohner & A. Khaleque (Eds.), *Handbook for the study of parental acceptance and rejection* (4th ed., pp. 43–106). Rohner Research Publications.

Rohner, R. P., & Ali, S. (2016). Parental acceptance-rejection questionnaire (PARQ). *Encyclopedia of Personality and Individual Differences*, 1–4.

StataCorp. (2017). *Stata statistical software: Release 15*. StataCorp LLC.

Sterba, S. K., & Bauer, D. J. (2010). Matching method with theory in person-oriented developmental psychopathology research. *Development and Psychopathology*, *22*(2), 239–254. https://doi.org/10.1017/S0954579410000015

Stiles, W. B., Glick, M. J., Osatuke, K., Hardy, G. E., Shapiro, D. A., Agnew-Davies, R., Rees, A., & Barkham, M. (2004). Patterns of alliance development and the rupture-repair

hypothesis: Are productive relationships U-Shaped or V-Shaped? *Journal of Counseling Psychology*, *51*(1), 81–92. https://doi.org/10.1037/0022-0167.51.1.81

Styron, T., & Janoff-Bulman, R. (1997). Childhood attachment and abuse: Long-term effects on adult attachment, depression, and conflict resolution. *Child Abuse & Neglect*, *21*(10), 1015–1023. https://doi.org/10.1016/S0145-2134(97)00062-8

Thullen, M., Henly, J., & Hans, S. (2012). Domain-specific trajectories of involvement among fathers of children born to young, low-income, African American mothers. *Journal of the Society for Social Work and Research*, *3*(3), 129–144. https://doi.org/10.5243/jsswr.2012.9

Voight, J. D., Hans, S. L., & Bernstein, V. J. (1996). Support networks of adolescent mothers: Effects on parenting experience and behavior. *Infant Mental Health Journal*, *17*(1), 58–73. https://doi.org/10.1002/(SICI)1097-0355(199621)17:1<58::AID-IMHJ5>3.0.CO;2-Y

Wagner, M., Spiker, D., Linn, M. I., & Hernandez, F. (2003). Dimensions of parental engagement in home visiting programs: Exploratory study. *Topics in Early Childhood Special Education*, *23*(4), 171–187. https://doi.org/10.1177/02711214030230040101

Wen, X., Korfmacher, J., Hans, S. L., & Henson, L. G. (2010). Young mothers' involvement in a prenatal and postpartum support program. *Journal of Community Psychology*, *38*(2), 172–190. https://doi.org/10.1002/jcop.20358

Zhang, Y., Edwards, R. C., & Hans, S. L. (2019). Parenting profiles of young low-income African American and Latina mothers and infant socioemotional development. *Parenting: Science and Practice*. https://www.tandfonline.com/doi/abs/10.1080/15295192.2019.1642088

CHAPTER 3
FACTORS ASSOCIATED WITH YOUNG MOTHERS' SERVICE DURATION IN DOULA HOME VISITATION

Abstract

Background: Families participating in early childhood home visiting programs often discontinue services while they are still eligible, and understanding factors related to early service discontinuation can generate insights for optimal service design and family engagement. Existing studies show that service attrition is shaped by factors at multiple levels, but have produced inconsistent findings regarding roles of participant- and family-level factors. This study aims to explore how mothers' depressive symptoms, risk-taking behavior, and demographic characteristics are associated with service duration.

Method: Data were drawn from 156 young, low-income mothers in the intervention group of a randomized controlled trial of doula-enhanced home visiting services (48.1% African American, 42.3% Latina, 8.3% European American, and 1.3% other). Mother and family variables were collected before services were started at the baseline interview during pregnancy. Information of mothers' service duration was retrieved from the administrative systems used by home visiting programs. Kaplan-Meier method and Cox proportional hazard models were used to explore the timing of service attrition and associations between mother and family characteristics and service duration.

Results: Three mothers assigned to the intervention group did not receive any services. Half of mothers remained in services by one year postpartum. The second and third months postpartum witnessed the largest and second largest percentages of attrition. On average, mothers remained in services for 15 months. Mothers who reported higher levels of risk-taking behavior and were at educational risk, who used only English at home, and who were in later months of pregnancy

at service initiation discontinued services more rapidly. Mothers' depressive symptoms were not associated with service duration.

Conclusion/Implication: Mothers' risk-taking behavior, educational risk, family's immigration status, and the timing of service initiation are important factors shaping service attrition. Home visiting services may be a promising venue to support immigrant mothers in facilitating their navigation of the healthcare system and community resources. Home visitors may need ongoing training and supervision when working with families with complex needs or risks in order to involve families for adequate duration and benefit from parenting-focused content. More research is needed to understand how to effectively address issues such as mothers' risk-taking behavior and connect mothers to community resources.

Keywords: attrition, service duration, adolescent mothers, survival analysis

Factors Associated with Young Mothers' Service Duration in Doula Home Visitation

Introduction

Home visitation has become a primary service approach to promote early childhood development in low-income families, especially with its national scaling up under the Maternal, Infant and Early Childhood Home Visiting Programs (MIECHV)—a federal initiative that funds states to develop and implement evidence-based home visiting programs (Michalopoulos et al., 2015). A growing number of home visiting program models have been shown to be effective at supporting child health and development and parenting through randomized controlled trials and other rigorous study designs (Adirim & Supplee, 2013). As home visiting services have been scaled up nationally, researchers have moved beyond the traditional intent-to-treat (ITT) analysis and delved into examining issues such as model fidelity and variability in service delivery and participation processes (Duggan et al., 2013; Supplee & Duggan, 2019).

One of the dimensions of service participation that has received attention from both researchers and service providers is service duration. Even though families are usually eligible for home visiting services for three to five years after the child is born, it is very common that services end while families are still eligible. In the literature, this is referred to as attrition or early discontinuation (MIECHV Technical Assistance Coordinating Center, 2015). Although variation in service duration is to be expected since home visiting services are usually voluntary (Brookes et al., 2006), attrition can be a concerning issue since adequate service duration is presumed to be critical to achieving intended outcomes (Guterman, 2001). Many home visiting programs rely on the premise that promotion of child development is achieved through positive attitudinal and behavioral changes in parents, and the full benefits of the program may not be garnered by early leavers whose amount of exposure is reduced (Caronongan et al., 2014;

Hebbeler & Gerlach-Downie, 2002; O'Brien et al., 2012). Leaving through attrition may be more of an issue in programs that have been taken to scale than in programs implemented on a small scale for research purposes (Duggan et al., 2000; Wagner et al., 2003).

Early Service Discontinuation: Prevalence and Multi-Level Determinants

The prevalence of early service discontinuation is generally believed to be high, but difficult to pinpoint, since early discontinuation has been defined differently in existing studies. Some researchers examined whether families were still receiving services at a specific age of the child (e.g., at the child's first year birthday, McGuigan et al., 2003; or when the child is 30 months old, Roggman et al., 2008), while others looked at whether the total service duration was below a certain threshold (e.g., 18 months from enrollment, Roggman et al., 2008) or whether families completed the full duration of services (e.g., Caronongan et al., 2014; Fifolt et al., 2017). Two studies using the 1.5 years duration as cutoff reported attrition rates over a third: 38% in the nurse-visited group in Nurse-Family Partnership (NFP) in Denver (Korfmacher et al., 1999) and 36% in Early Head Start Research and Evaluation Project (Roggman et al., 2008). However, even higher rates of early discontinuation has been reported in other programs: 60%-70% in NFP community replication sites (attrition defined as discontinuation before the end of the child's second birthday; O'Brien et al., 2012), 65.4% in Parents as Teachers (PAT) (attrition defined as discontinuation by the child's first birthday; Wagner et al., 2003). The wide range of attrition rates were also revealed by a review of six large home visiting programs (including PAT, Comprehensive Child Development Program (CCDP), and Healthy Families America (HFA) models) showing that 20%-67% of families left before receiving the full duration of services (Gomby et al., 1999). Percentage of attrition has been commonly used by researchers while very few studies have reported the average number of months families enrolled in

programs varying from 10 to 28 months in HFA (Daro et al., 2003) and 8 to 10 months in the Mother and Infant Home Visiting Program Evaluation (MIHOPE), a randomized controlled trial of 5100 mothers from 85 local agencies in 12 states funded through the MIECHV federal initiative (Duggan et al., 2018).

Understanding the characteristics of early leavers is important for program administrators to design optimal services and for home visitors to strategize about engaging families for a longer duration in order to create positive change (Caronongan et al., 2014; Korfmacher et al., 2008). A wide array of factors are theorized to be associated with program retention at multiple levels, namely, the parent-level (e.g., demographics and subjective program experience), the provider-level (e.g., cultural competence, caseload, and training), the program-level (e.g., funding and staff turnover), and the neighborhood-level (e.g., social cohesion and concrete resources) (Korfmacher et al., 2008; McCurdy & Daro, 2001; McGuigan et al., 2003). Despite the theoretical advances, empirical studies have fallen short in explaining attrition. In a comprehensive literature review, fewer than 15 publications from 2007 to 2018 were identified that explored retention in early childhood home visiting services (Bower et al., 2020).

Mother- and family-level Characteristics Associated with Early Service Discontinuation

Across the few empirical studies examining home visiting program retention, findings regarding the roles of provider- and program-level features are quite consistent: Unstable funding, high staff turnover, and low levels of supervision are associated with low program retention (McGuigan et al., 2003; O'Brien et al., 2012). However, the literature is less consistent on roles of mother- and family-level factors such as psychological, behavioral, and demographic characteristics (Bower et al., 2020; McGuigan et al., 2003). MIHOPE showed that mother- and family-level characteristics are of key importance and mattered more than home visitor- or

program-level characteristics in relation to service duration (Duggan et al., 2018). The present study aims to explore the association between mother- and family-level characteristics and service duration. Following is what is known in the existing literature.

Psychological and behavioral characteristics. Depression and risk-taking behavior are common in mothers participating in early childhood home visiting services and there is some evidence regarding their associations with service duration.

Depressive symptoms. Mothers participating in home visiting services may face a variety of mental health challenges, which can have important implications for service participation (Zeanah & Korfmacher, 2018). Rates of clinically significant depressive symptoms are high among home visiting participants, ranging from about a quarter to over half of mothers, and maternal depression has been identified as "the most prevalent of the common challenges in home visitation" (Ammerman et al., 2010). Home visitors find it challenging to work with parents with mental health issues (Brookes et al., 2006; LeCroy & Whitaker, 2005) and they are usually not well prepared in their skills to address mental health issues in home visits, despite some preparation in knowledge (Tandon et al., 2008). Therefore, it is possible that mothers with more depressive symptoms may be less involved and possibly discontinue services early. However, there are mixed findings regarding mothers' depressive symptoms and service utilization. Stevens and colleagues (2002) found that depressive symptoms were not associated with completed or attempted home visits but were positively associated with more phone contact. Olds and Korfmacher (1998) found that *psychological resources* (a construct composed of mental health, intelligence, coping skills, self-efficacy and active coping) had a U-shape relation to the number of home visits in the Memphis New Mothers' Program: The amount of contact was highest for mothers with lowest levels of psychological resources, it then decreased as

psychological resources increased, and increased at the very high levels of resources. Despite the theoretical interest, there are only a few studies that specifically explored the relation between depression and service duration or completion, and they all found that these two variables were not associated (Damashek et al., 2011; Duggan et al., 2018; O'Brien et al., 2012; Roggman et al., 2008).

Risk-taking behavior. Because home visiting services target at-risk families, it is not surprising that mothers participating in home visiting programs, particularly young mothers, engage in risk-taking behaviors such as substance use, unprotected sexual activities with multiple partners, school dropout, and involvement with juvenile justice system (Kissman, 1998; Koniak-Griffin et al., 1994; Leve & Chamberlain, 2005; Saewyc et al., 2004; Zoccolillo et al., 1997). The MIHOPE study found that more than a third of participants reported using tobacco and a third reported binge drinking in the three months before pregnancy or using illegal drugs in the month before pregnancy (Michalopoulos et al., 2015). Another study of mothers in the NFP found that mothers on average smoked about 6.5 cigarettes per day during pregnancy (Shlafer et al., 2012). Given the high prevalence of tobacco and substance use, the MIECHV legislation prioritized serving families "with potential substance abuse" and "with smokers in the home" (Duggan et al., 2018; MIECHV Technical Assistance Coordinating Center, 2015). The percentage of mothers with a history of sexually transmitted infection enrolled in HFA home visitation in a Ohio county was 15% (Goyal et al., 2013). Involvement with the justice system has been less studied in home visiting research but two studies found the percentage of mothers ever arrested was 6.5% and 8.1% (Duggan et al., 2018; Shlafer et al., 2012). Experience of being suspended or expelled from school for home visiting participants has not been documented in the U.S., but findings from the Family Nurse Partnership in UK revealed that 46% of the mothers had

histories of having been suspended, expelled or excluded from school at the time of joining the programs (Hadley et al., 2017).

The literature on healthcare utilization suggests that risk-taking behavior may play an important role in shaping service utilization among young people (mainly focused on drinking, smoking, sexual behaviors), although there are mixed findings on the direction of the association, with it being positive in some studies (Aten et al., 1996; Newcomb & Bentler, 1987; Vingilis et al., 2007) but negative in others (Ford et al., 1999). However, despite the relatively high prevalence of risk-taking behavior among mothers participating in home visitation, the role of behavioral risks in home visiting service delivery has received limited attention. A few studies have examined substance use and service involvement. Some studies found a positive association between maternal problem substance use and service intensity (i.e., whether received 12 or more visits during the first year) (Duggan et al., 2000) or service duration (Ammerman et al., 2006) while others found a negative association between maternal alcohol or drug symptoms and service completion (Damashek et al., 2011).

Home visiting scholars tend to conceptualize risk-taking behavior, including substance use, as one dimension of family risks, and argue that mothers with higher levels of risk-taking behavior have more psychosocial stress and have to juggle more life challenges in addition to parenting, which may distract them from being focused on their infant and create barriers for seeking and maintaining involved in home visiting services (Damashek et al., 2011). Scholars who found a positive association argue that since home visiting services are delivered at home, eliminating the need for transportation on the family's end, increased family adversity, as proxied by risk-taking behavior, may promote engagement due to their increased need (Ammerman et al., 2006).

The literature on adolescent risk-taking and social support suggests that a different way to conceptualize young mothers' risk-taking behavior is to place it in relation to their systems of social support from adults versus peers. Evidence suggests that adolescents with more risk-taking behavior tend to only rely on peer support or have no one to access for support (Abbott-Chapman et al., 2008; Steinberg, 2008). It is possible that mothers with higher levels of risk-taking behavior may be prone to distrusting home visitors, thus quickly discontinuing services, given that they are not used to accessing support from adults in the face of life challenges. Despite the varying ways to conceptualize risk-taking behavior, more research is needed to examine the role of young mothers' risk-taking behavior in shaping service duration.

Demographic characteristics. Existing studies have examined demographic characteristics factors associated with service duration such as mothers' age, education, employment, race and ethnicity, and family income and have produced inconsistent findings.

Mother's age. A large number of studies reported that older mothers participated for longer times (Brand & Jungmann, 2014; Damashek et al., 2011; Daro et al., 2003; Duggan et al., 2018; Fifolt et al., 2017; McGuigan et al., 2003) with the exception of one study indicating the opposite (Holland et al., 2014). There were also studies that did not find an association between mother age and service attrition (Holland et al., 2018; Roggman et al., 2008).

Race, ethnicity and language. Mothers of a minority race or ethnicity were found to be more likely to remain in services longer than White mothers in multiple studies (Daro et al., 2003; Fifolt et al., 2017; McGuigan et al., 2003), and Hispanic mothers were more likely to remain in services than African American mothers (O'Brien et al., 2012). However, one study found that African American mothers were more likely to leave services early than White mothers (O'Brien et al., 2012). Others found that race/ethnicity was not predictive of program

retention (Caronongan et al., 2014, 2014; Duggan et al., 2018). Mothers who left services early were more likely to use English as their primary language or had a higher level of English fluency (Holland et al., 2018; Roggman et al., 2008). But the household language was found to be not predictive in the home visiting services in Early Head Start (Caronongan et al., 2014).

Residential mobility, living arrangement and marital status. Some studies found that residential mobility was associated with service attrition (Caronongan et al., 2014; Duggan et al., 2018; Raikes et al., 2006). Living with the biological father of the child/boyfriend/husband or her own mother was association with longer service duration (Duggan et al., 2018; O'Brien et al., 2012; Roggman et al., 2008), compared to living alone with children. Unmarried mothers were more likely to leave services early (O'Brien et al., 2012; Roggman et al., 2008).

Employment and education. One study found that unemployment was related to longer service duration (Daro et al., 2003) but others suggested these two were not associated (O'Brien et al., 2012). Two studies found that education was not significantly associated with service attrition (Duggan et al., 2018; Roggman et al., 2008), although more education was found to be associated with longer service duration in bivariate analyses (Roggman et al., 2008).

Child's health condition and pregnancy characteristics. Families who had a child of low birth weight were likely to discontinue services early (Holland et al., 2018). Higher gestational age at delivery was associated with earlier service discontinuation (Holland et al., 2018). One study suggested that mothers who enrolled in programs during early pregnancy were more likely to remain in services longer (Daro et al., 2003) while others found that enrollment time in programs was not predictive of program retention (Caronongan et al., 2014; O'Brien et al., 2012).

The differential findings regarding the roles of mother and family demographic characteristics may be due to the differences in service models, definition of attrition, and what covariates were included in statistical models. For the factors with relatively consistent findings such as residential mobility and living arrangement, future replications are warranted given the small number of studies.

Methods

Sample and Procedure

Three hundred and twelve mothers were recruited into a randomized controlled trial (RCT) of doula home visiting services. At the end of interview at study enrollment (i.e., baseline), half (n = 156) were randomized into the intervention group and half into the control group. (For a detailed description of the RCT study, please refer to Hans et al., 2018). Mothers in the control group received case management services. Mothers in the intervention group were contacted by one of four doula-enhanced home visiting programs of Healthy Families America (2020) or Parents as Teachers (2020) and were assigned a community doula and a home visitor. Community doulas and home visitors had deep roots in the communities, and they conducted home visits, sometimes jointly, with the mother. Doulas worked intensively with the mother during pregnancy and first weeks postpartum and focused on issues such as preparing for labor, breastfeeding, and caring for and bonding with the newborn infant. Doulas also supported the mother during labor and delivery at the hospital by providing physical and emotional support. By six weeks postpartum, home visitors became the primary service provider and worked with the mother on issues such as child development and learning and mother-infant relationship. Mothers were eligible for services up through the first few years of the child's life. Only data from the intervention group were used for this study (n = 156).

Table 3.1 shows the descriptive statistics for the 156 mothers at study enrollment who were randomized into the intervention group. About half of them were African American mothers (*n* = 75, 48.1%), 42.3% Latina mothers (*n* = 66), 8.3% European American (*n* = 13) and 1.3% other ethnicity (*n* = 2). Over half of the mothers' educational level was less than high school or GED (*n* = 96, 61.5%) and among them, 62 were enrolled in high school and 34 were not attending school. For the purposes of the analysis, mothers were considered to be at "educational risk" if they did not have a high school degree and were not attending school (*n* = 34, 21.8%). This measure takes into account of both mothers' age and education status and is similar to the "education on track for age" in a NFP study (Holland et al., 2018). About three quarters lived with their own mother or other parent figure (*n* = 120, 76.9%) and just under three quarters were in a relationship (i.e., married, engaged, or in a couple/boyfriend/partner relationship; *n* = 113, 72.4%) with the father of the baby. Over half spoke only English at home (*n* = 120, 62.2%), and the remaining spoke either Spanish and English, Spanish only, or another language at home (*n* = 59, 37.8%).

Table 3.1 Descriptive Statistics of Mothers Randomized to the Doula Home Visiting Service (N = 156)

	Mean (SD) or *n* (%)
Categorical variables	
Program site	
Site 1	50 (32.1%)
Site 2	44 (28.2%)
Site 3	43 (27.6%)
Site 4	19 (12.2%)
Ethnicity	
African American	75 (48.1%)
Latina	66 (42.3%)
European American	13 (8.3%)
Other	2 (1.3%)
Education	
Less than HS	96 (61.5%)
HS or GED	47 (30.1%)
Some college	13 (8.3%)
Educational risk	34 (21.8%)
Currently employed	31 (19.9%)
Co-residence with parent figure	120 (76.9%)
Co-residence with father of the baby	39 (25.0%)
In a relationship with father of the baby	113 (72.4%)
Language spoken at home	
English only	97 (62.2%)
Spanish only; both Spanish and English; other [a]	59 (37.8%)
Low birth weight (< 5.5 lbs)	9 (6.4%)
Preterm baby	10 (6.7%)
Residential mobility (1=if lived in more than one homes last year)	71 (45.5%)
Continuous variables	
Age	18.55 (1.97)
Risk-taking behavior scores	50.26 (10.08)
Gestational age of baby at birth	39.4 (1.60)

Note. Educational risk is a binary variable. It equals 1 if a mother did not have a high school degree and was not attending school at baseline interview. It equals 0 if a mother was enrolled in high school or graduated with a high school diploma/GED.

[a] Other refers to the one mother who reported speaking Russian at home.

Psychological, behavioral, and demographic information were gathered from baseline interviews with the mothers at study enrollment. Interviews were usually conducted at the

mother's home and administered in the mother's preferred language—English or Spanish. The dates of each completed service were retrieved from the administrative systems used by home visiting programs—management information systems (MIS). Mothers were followed longitudinally in the study and interviewed at 37 weeks pregnancy, 3 weeks postpartum, and when their child was 3 months, 13 months, 30 months, and 4 years old. Mothers reported information related to their service use such as whether they were still enrolled in services and the age of the child when they stopped receiving services. Data from the MIS systems were cross checked against mother report for accuracy.

Measures

Service Duration. Korfmacher and colleagues (2008) conceptualized duration as "the entire length of the family's participation in program, defined by beginning and ending dates of contact." Some studies use the date when the family was recruited into the program and randomly assigned to participate in home visiting services (Raikes et al., 2006). In this study, mothers were first recruited to the RCT and then randomized to either home visiting services or case management services at the end of the baseline interview. Because the window between service randomization and service initiation could vary between mothers, though in most cases the time frame was very short (e.g., half of mothers were contacted within eight days, 80% within 18 days), to be more rigorous, the date of first completed service was used as the date of service initiation.

Researchers have noted that home visiting programs usually have different practices for exiting participants, for example, some programs immediately exit a mother after a few unsuccessful attempts to deliver services but others may maintain families in the system for a long time in case they return to services (Raikes et al., 2006). Such inconsistency also existed in

this study: Some participants were noted to leave services in the MIS two days after their last completed service and others were noted after two months. To avoid the problem of miscalculating duration using the recorded exit date in the MIS, the date of the last completed service was used.

The duration was the time in months from the date of service initiation to the date of last completed service. The duration of six mothers was censored, which means their true service discontinuation date was not observed and was after the last recorded service date. At the end of the data collection of this study (i.e., when the child was four years old), three mothers were still enrolled in services and their last service date was imputed as 48 months and coded as censored. The last service date of three other mothers was not successfully retrieved from the administrative system and was calculated based on the last available wave of mothers' self-report data. For example, if a mother's last available interview was the 3-month interview and she reported still receiving services at that time, then her last completed service date was imputed as 3 months and coded as censored.

Service initiation and discontinuation relative to birth. To facilitate understanding of the timing of service initiation and discontinuation relative to birth, the child's birthdate was coded as zero and two variables--service initiation month and discontinuation month--were calculated respectively by subtracting the baby's birthdate from the date of service initiation or the date of last completed service, indicating how far service initiation or discontinuation occurred relative to the birth (in months). For both the service initiation and discontinuation months, a negative number indicates it occurred during the pregnancy and a positive number indicates it occurred after birth.

Depressive symptoms. The Center for Epidemiological Studies-Depression scale (CES-D; Radloff, 1977) was used to measure participants' depressive symptoms at the baseline interview. Evidence demonstrates good psychometric properties of the CES-D scale for low-income mothers (Atkins, 2014). This 4-point scale contains 20 items (4 = *most of the time (5-7 days)*; 1 = *rarely or none of the time (less than 1 day)*) about mothers' depressive symptoms in the past week. Sum scores were used with higher scores indicating more depressive symptoms. Sample statements included "During the past week I was bothered by things that usually don't bother me" and "I felt that I could not shake off the blues even with help from my family and friends." Cronbach's alpha of the 20 items was 0.83.

Behavioral risk indicators. At the baseline interview, mothers were asked about their engagement in three risk-taking behaviors (i.e., smoking, drinking, and multiple sex partners), the number of times that they experienced school suspensions or expulsions, and involvement with the justice system. Each of the five indicators was an ordinal variable ranging from 1 to 3 or 5 indicating the highest level for this indicator. For example, school suspensions and expulsions were coded as 1 = never, 2 = one to two times, 3 = three to five times, 4 = six or more times and smoking was coded as 1 = never smoked, 2 = smoked less than daily pre-pregnancy, 3 = smoked daily pre-pregnancy and/or currently smoking. (Details can be found in Appendix B.) A composite risk-taking behavior score was created by summing the standardized score of each indicator (i.e., $standardized\ score\ of\ indicator\ i = \frac{raw\ score\ of\ indicator\ i - mean\ of\ indicator\ i}{standard\ deviation\ of\ indicator\ i}$). To improve interpretability, these composite scores were then standardized with a mean of 50 and standard deviation of 10 (i.e., $standardized\ risk\ behavior\ score = \frac{raw\ risk\ behavior\ score - 50}{10}$). Cronbach's alpha of the 5 items was 0.63.

Analysis Methods

This study followed three steps and analyses were conducted in Stata 15.0 (StataCorp, 2017) and *R* (RStudio Team, 2015). First, descriptive statistics related to months of service initiation and discontinuation, duration, and mothers' months of pregnancy at service initiation were examined. Second, the dataset was prepared for survival analysis and the event of interest was service discontinuation: Service initiation (not birth) was deemed zero in analysis time. Kaplan-Meier method, a non-parametric procedure (Kaplan & Meier, 1958) was used to examine estimate of the survivor function *S(t)*--the probability of continuing services past time *t*. It is calculated as $\hat{S}(t) = \prod_{j|t_j \leq t}(\frac{n_j - d_j}{n_j})$ where n_j is the number of mothers at risk of discontinuing services at time t_j and d_j is the number of mothers who discontinued at time t_j.

Despite the popularity of using a cutoff to define attrition, either using the child's age or a certain service window, this study used service duration since two home visiting models (i.e., Healthy Families America and Parents as Teachers) were used and a cutoff meaningful in one home visiting model may not be useful in the other. Additionally, this approach can reveal timing of attrition, providing richer information than the dichotomous attrition outcome. Existing studies of program retention using this approach typically used least-squares regressions and assumed normality in the distribution of service duration (e.g., Raikes et al., 2006). However, evidence suggested that the normality assumption may not hold true (Duggan et al., 2000), thus the OLS modeling approach may generate biased estimates. Survival analysis can preserve the rich information in keeping the original time format which is usually lost in dichotomizing a variable and account for the skewed distribution of service duration (Harrell, 2015).

Third, associations between baseline maternal factors and service duration were examined. These baseline variables were collected before service initiation and could not have been affected by the service. Variables collected from later interviews waves were not used in

analytic models since some mothers discontinued services before any follow-up data collection. Univariable prefiltering/screening (i.e., bivariate associations) was used: Log-rank tests were conducted for categorical variables and univariate Cox proportional hazard regressions for continuous variables. If the statistical test had a *p*-value of 0.2 or less, this variable was then considered to be retained for multivariate analyses (UCLA: Statistical Consulting Group). Although univariable prefiltering has been a popular approach of variable selection, recent studies have pointed out that it may overlook important predictors because some variables that are insignificant in univariable models can become significant in multivariable analysis (Dunkler et al., 2014; Heinze & Dunkler, 2017; Wang et al., 2017). To avoid this problem, an augmented backward selection procedure with a standardized change-in-estimate criterion (Heinze & Dunkler, 2017) was conducted in *R*. Variables suggested to be included by this procedure were also considered for multivariate analyses. Subject-matter knowledge was used to guide variable selection in addition to evidence from the univariable prefiltering and augmented backward selection procedure.

After deciding on variables for multivariate analyses, Cox semiparametric models were used. The hazard rate *h(t)* is the instantaneous rate of service discontinuation, in other words, the probability that service discontinuation occurs in a given interval, conditional upon mothers having remained in services to the beginning of that interval (Cleves et al. textbook p.7). The hazard rate *h(t)* for mother j was modeled as $h(t|\mathbf{x}_j) = h_0(t)\exp(\mathbf{x}_j\boldsymbol{\beta}_x)$. The Cox model does not assume a parametric form of the baseline hazard, $h_0(t)$, but parametrizes the effects of the covariates ($\boldsymbol{\beta}_x$). Exponentiated coefficients, $\exp(\boldsymbol{\beta}_x)$, gives the ratio of the hazards for a one-unit change in the covariates (i.e., hazard ratio). A hazard ratio bigger than one indicates the

higher value of a covariate is associated with more number of mothers discontinuing services at any point in time and a hazard ratio smaller than one indicates the opposite (Cleves et al., 2016).

Cox models assume the proportional-hazards (PH) assumption, which means the effects of covariates ($\boldsymbol{\beta}_x$) do not change with time, in other words, the coefficient of the interaction term between time and covariates would not be different from zero (Cleves et al., 2016). To check the PH assumption, a test based on Schoenfeld residuals (Harrell, 2015) was conducted using Stata's *estat phtest, detail* command. For robustness check, discrete-time models using complementary log-log function were conducted (Singer & Willett, 1993).

Results

Descriptive Statistics of Service Duration

Out of the 156 mothers, three mothers did not connect with a home visiting program and did not receive any service. Table 3.2 shows the mean, median, and range of four variables related to services. Because the mean can be easily influenced by extreme values (e.g., three mothers continued services at 48 months postpartum), the median is a better indicator of the average trend (Rosenthal, 2011) and used below. Among the 153 mothers who received services, on average, they were six months pregnant (i.e., the end of second trimester) at service initiation, and discontinued services at 12 months postpartum. The standard deviation of months at service initiation (*SD* = 1.48) was much smaller compared to that of the months of service discontinuation (*SD* = 13.52), indicating greater variability of the timing of mothers stopped services. For example, 11 mothers stopped services before they gave birth while three mothers were still receiving home visiting services when their child was four years old. The median duration for services was 15 months. The range of the service duration was large (*SD* = 13.83), with the shortest duration being a week and the longest being at least 52 months (e.g., 3 mothers

were still enrolled at the 4-year interview). By the child's first birthday, half of mothers were still enrolled in services (*n* = 77, 50.3%).

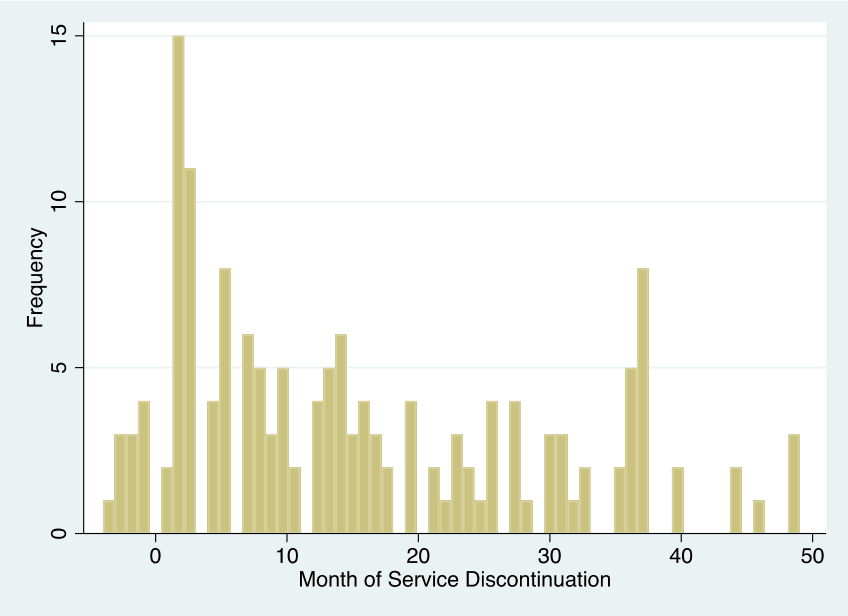
Table 3.2 Service Participation (N = 153)

Service participation variables	
Month in pregnancy at service initiation	
Mean (SD)	6.27 (1.43)
Range	[2.63, 10.02]
Median	6.00
Month of service initiation (relative to birth 0) [a]	
Mean (SD)	-2.82 (1.48)
Range	[-6.67, 1.45]
Median	-2.83
Month of service discontinuation (relative to birth 0) [b]	
Mean (SD)	15.05 (13.52)
Range	[-3.42, 48]
Median	12
Service duration from enrollment to discontinuation [c]	
Mean (SD)	17.87 (13.83)
Range	[0.13, 52.50]
Median	14.77

Note. [a] There were four mothers who started services after birth, thus they had positive scores of month of service initiation.
[b c] This variables is calculated by treating the observed censoring month of the six mothers who were censored as if it was the true discontinuation month (which was longer the observed censoring month and was not observed), ignoring the censoring.

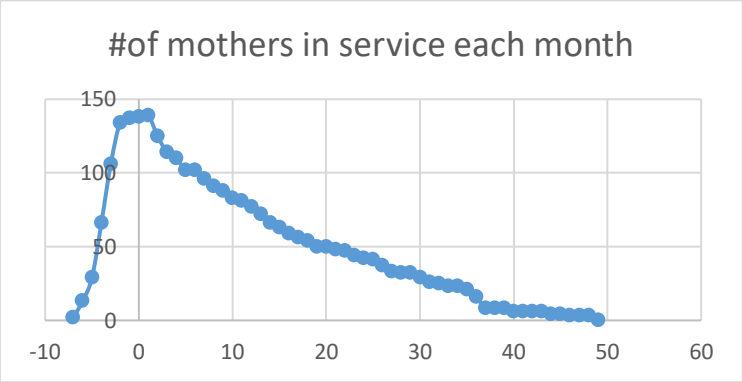
Figure 3.1 shows the distribution of the discontinuation months over time, with zero indicating the birth of the child. The second (*n* = 15) and the third (*n* = 11) months postpartum witnessed the largest and the second largest number of mothers discontinuing services. Figure 3.2 shows the number of mothers enrolled in services each month.

Figure 3.1 Distribution of the Discontinuation Months



Note. Zero indicates the birth of the child.

Figure 3.2 Number of Mothers Enrolled in Services over Time



Note. Zero indicates the birth of the child.
Because mothers started and discontinued services at different time (e.g., some mothers stopped services before others started), in any given month, the number of mothers in services did not reach 153.

Nonparametric Kaplan-Meier

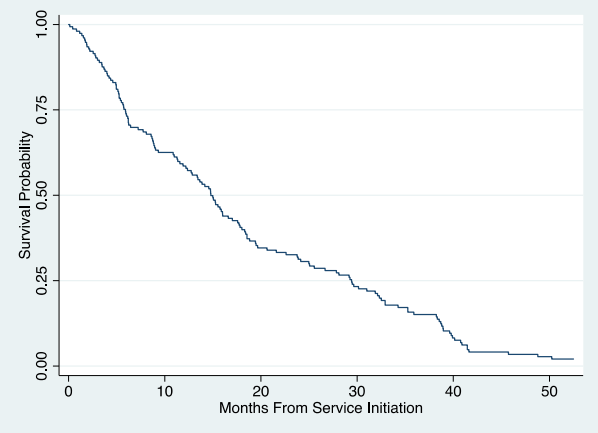
Nonparametric Kaplan-Meier analysis was conducted. Analysis time, the outcome used in survival analysis, was defined from service initiation (coded 0) to discontinuation. The median

service duration is about 14.79 months (95% CI [12.20, 17.59]) and the *restricted* mean service duration is 18.16 months (95% CI [15.94, 20.38]). (The mean is restricted because Kaplan-Meier estimator is not defined beyond 48 months postpartum. Since the last observed analysis time is censored, the restricted mean underestimates the true mean.) Table 3.3 shows the estimated Kaplan-Meier survivor function in six-month intervals. Because the average service initiation was 3 months before birth, the chosen time points in Table 3 roughly corresponded to birth, 6 months postpartum and when the child was 1, 1.5, 2, 2.5 and 3 years old. The probability of remaining in services past three months after enrollment is very high, 90%, while the probability of remaining in services past 15 months after enrollment is about 50%. Figure 3.3 shows the Kaplan-Meier estimate, indicating steeper decrease (i.e., leaving the programs more rapidly) during the window from the third to the ninth months in analysis time, which roughly corresponds to the time from birth to six months postpartum.

Table 3.3 Estimated Kaplan-Meier Survivor Function over Time

Enrollment Duration (in months)	Survivor Function	Standard Error	95% Confidence Interval
3	0.90	0.02	[0.84, 0.93]
9	0.64	0.04	[0.56, 0.71]
15	0.49	0.04	[0.41, 0.57]
21	0.34	0.04	[0.27, 0.42]
27	0.28	0.04	[0.21, 0.35]
33	0.18	0.03	[0.12, 0.24]
39	0.10	0.03	[0.06, 0.16]

Figure 3.3 Kaplan-Meier Survival Estimate



Note. Zero indicates service initiation, not the birth of the child.
Survival probability refer to the probability of continuing services past time *t*.

Factors Associated with the Hazard of Discontinuing Services

Next, the bivariate associations between each of the baseline sociodemographic, psychological-behavioral, and service variables and survivor function were examined (Table 3.4). Log-rank tests were conducted for categorical variables and univariate Cox proportional hazard regressions for continuous variables. The tests of four variables had a *p*-value of 0.2 or less: educational risk, partnered with father of the baby, risk-taking behavior scores, and months of pregnancy at service initiation. These four variables were chosen to be entered in the multivariate analysis. Because the association between depressive symptoms and service duration was of theoretical interest, it was entered into the model despite being non-significant in univariable prefiltering. Since the four program sites had different doulas, home visitors, institutional and supervision policies, and were located in different geographic regions, three dummy variables representing four program sites were included in the multivariate model (see e.g., O'Brien et al., 2012). An augmented backward selection was conducted (results available

upon request), suggesting to include the language used at home (English only versus Spanish only, both English and Spanish, or other) in the final model due to its significance.

Table 3.4 Bivariate Association between Baseline Covariates and Hazard of Discontinuing Services

Variables	χ^2/Hazard Ratio	*p*-value
Categorical variables	χ^2	(from log-rank test)
Ethnicity [a]	0.68 (df=2)	0.71
Coresidence with parent figure	0.13 (df=1)	0.72
Coresidence with father of the baby	0.08 (df=1)	0.78
Partnered with father of the baby	1.71 (df=1)	0.19
Education level	2.48 (df=2)	0.29
Educational risk (1=at risk 0 = not at risk)	4.45 (df=1)	0.04
Employed	0.07 (df=1)	0.80
Language used at home (1 = English only)	0.06 (df=1)	0.81
Residential mobility	0.04 (df=1)	0.84
Low birth weight	0.01 (df=1)	0.98
Preterm	0.07 (df=1)	0.79
Continuous variables (univariate Cox model)	Hazard ratio	(from z-test)
Depression	1.00	0.68
Risk-taking behavior scores	1.02	0.04
Months of pregnancy at service initiation	1.21	0.001
Age	0.97	0.50

Note. [a] Due to the small number in *Other* category (n = 2), it was combined with European American. Thus, there were three categories in Ethnicity in this analysis.

Factors chosen for the multivariate analyses included baseline depressive symptoms, risk-taking behavior scores, language used at home, whether partnered with father of the baby, whether at educational risk, months of pregnancy at service initiation, and program site. Table 3.5 shows the correlations across the baseline demographic, psychological and behavioral variables in the final model. Mothers who only used English at home had higher risk-taking behavior scores (51.8 versus 47.8) than their counterparts. Those who were partnered with the father of the baby at baseline had fewer depressive symptoms (12.6 versus 17.2). Figure 3.4

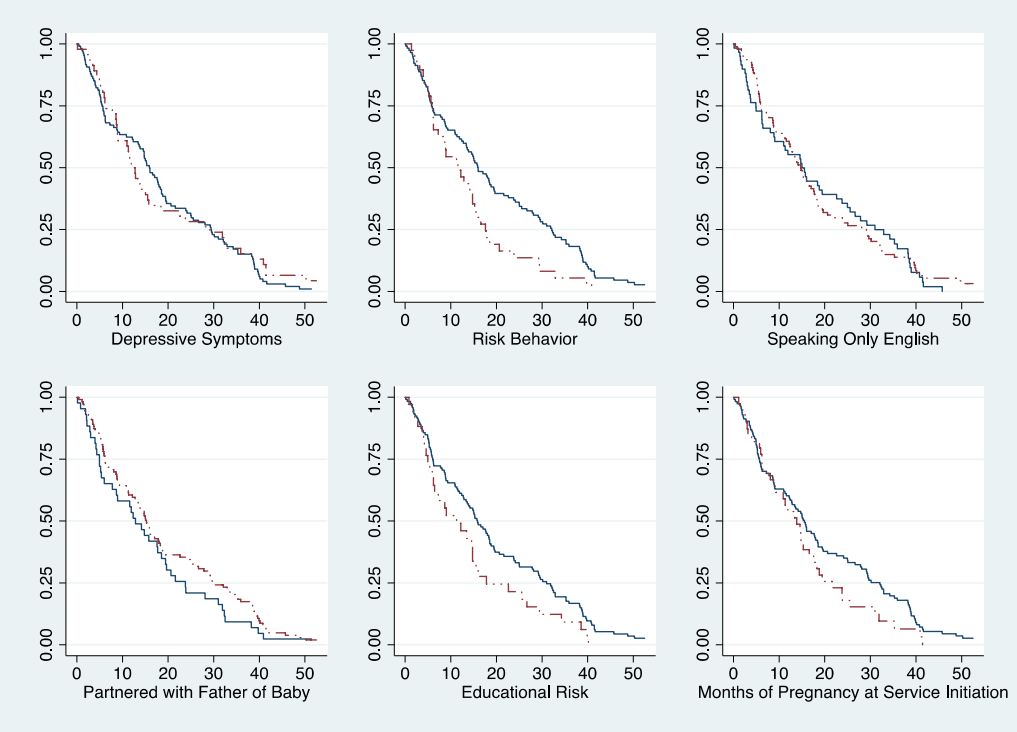
shows the Kaplan-Meier graph by each covariate. Continuous covariates were dichotomized for graphing purposes by either the cutoff used by the scale (e.g., CES-D depressive symptoms) or the upper 25% (e.g., risk-taking behavior scores and months of pregnancy at service initiation).

Table 3.5 Correlations across Baseline Covariates

	1	2	3	4	5
1 Depressive symptoms	-				
2 Risk-taking behavior scores	0.17*	-			
3 Language used at home	0.07	0.19*	-		
4 Partnered with father of the baby	-0.25**	-0.12	-0.16	-	
5 Educational risk	-0.11	0.06	-0.13	0.12	-

Note. *p<0.05, **p<0.01, ***p<0.001

Figure 3.4 Kaplan-Meier Survival Estimate by Each of the Six Covariate



Note. Red dotted lines represent the survival curve when the variable equals 1, meaning high depressive symptoms (i.e., CES-D equal or above the clinical cutoff 16), higher risk-taking behavior (i.e., the upper 25%), spoke only English at home, partnered with father of baby, at educational risk, and in later months of pregnancy at service initiation (i.e., in the upper 25%) X axis refers to the time in months since service initiation. Zero indicates service initiation, not the birth of the child. Y axis refers to the survival probability of continuing services past time *t*.

Cox proportional hazard model was used for multivariate analyses. Tests based on the Schoenfeld residuals showed that there was no evidence of the violation of the PH assumption (χ^2 = 11.04, df = 9, p = 0.27). Table 3.6 (Model 1) shows the estimated hazard ratios and 95% confidence intervals.

Psychological-behavioral characteristics. Baseline depressive symptoms was not associated with the hazard rate of discontinuing services. Mothers with higher levels of risk-taking behavior discontinued services more rapidly (hazard ratio = 1.02, 95% CI = [1.01, 1.04]).

Demographic characteristics. Partnered with father of the baby at baseline was not associated with risk of discontinuing services. Mothers were more likely to discontinue service faster if they used only English at home (hazard ratio = 4.41, 95% CI [1.30, 15.04]), were at educational risk (i.e., did not have a high school degree and were not attending school) (hazard ratio = 1.58, 95% CI [1.04, 2.40]), and were at later stages of pregnancy at service initiation (hazard ratio = 1.20, 95% CI [1.06, 1.37]).

Robustness Check

Two discrete-time survival models were conducted: One assuming that each person's hazard rate does not change autonomously over time (Model 2) and the other allowing the hazard rate to be different in each month (Model 3) (Allison, 1982). Interaction terms between time and each covariate were added and the larger model did not improve model fit, thus failing to show evidence of violating the PH assumption, which is consistent with the Cox models. The estimated hazard ratios were very similar to those estimated from the Cox models, except slightly different hazard ratio of the language used at home. Overall, models using different modeling methods demonstrated robust results.

Table 3.6 Estimated Hazard Ratios and 95% Confidence Intervals

	Model 1	Model 2	Model 3
Baseline depressive symptoms	1.00	1.00	1.00
	[0.98, 1.02]	[0.98, 1.02]	[0.98, 1.02]
Risk-taking behavior scores	1.02*	1.02*	1.02*
	[1.01, 1.04]	[1.01, 1.04]	[1.01, 1.04]
language (1=English only)	4.41**	5.00**	5.04*
	[1.30, 15.04]	[1.50, 16.61]	[1.45, 17.49]
Partnered with FOB at baseline	0.79	0.82	0.79
	[0.52, 1.18]	[0.54, 1.22]	[0.52, 1.18]
Educational risk	1.58*	1.57*	1.58*
	[1.04, 2.40]	[1.03, 2.38]	[1.03, 2.41]
Months in pregnancy	1.20**	1.21**	1.21**
	[1.06, 1.37]	[1.07, 1.38]	[1.06, 1.37]
Month (in analysis time)		1.03***	Results omitted
		[1.02, 1.05]	due to too many dummies for months in analysis time

Note. Model 1is the Cox proportional hazard model. Model 2 is a discrete-time survival model assuming that each person's hazard rate does not change autonomously over time. Model 3 is a discrete-time survival model assuming that the hazard rate is different in each month. Three dummy variables representing program sites were included in each model.
*$p<0.05$, **$p<0.01$, ***$p<0.001$

Discussion

Early childhood home visiting researchers have long acknowledged that the actual service delivery in scaled-up settings often falls short of program standards (Duggan et al., 2000). Home visiting program models expect multi-year involvement from families, and an area of concern has been program attrition before completion of the full program model. Using data from families participating in doula home visiting programs, this study examined program attrition and its associations with mother and family characteristics.

Consistent with other studies of early childhood home visiting, approximately half of families in this study discontinued services by the child's first birthday (Duggan et al., 2000; McGuigan et al., 2003). Additionally, the time frame from birth to six months postpartum, especially the second and third month after birth, witnessed the largest number of mothers leaving the programs. The only other study in the literature looking at timing of program attrition showed different findings. The Hawaii's Healthy Start evaluation (Fig. 1, p.255, Duggan et al., 2000) showed the most rapid attrition after the child was one year old. Discrepancies between these two studies could be related to a host of differences between the program models, such as the timing of service initiation (prenatally in this study versus postpartum in Hawaii's Healthy Start). Identifying periods during which mothers are vulnerable for service discontinuation within different models can be useful for service providers so that home visitors can adjust their program content during such time frames and develop strategies for retention, such as frequent check-ins during such times. For the doula home visiting model, the most rapid attrition in the second and third months postpartum corresponds to the shift of primary service provider from the community doula to the home visitor, as well as a shift from more health-focused content to content focused on promoting parent-child relationships and child development. Mothers may be less motivated to keep participating in services if they had a closer relationship with the doula than the home visitor or may be more highly motivated to participate in an intervention focused on the immediate health concerns of pregnancy and postpartum care. In addition, challenges associated with the transition to school or work may make it hard for mother to incorporate home visits into their schedule, especially when home visits only took place during standard working hours.

The present study also examined mother and family characteristics, measured before program enrollment, that were associated with program attrition. This study did not find evidence supporting the association between pregnancy depressive symptoms and service duration, which is consistent with findings from the few existing studies (Damashek et al., 2011; Duggan et al., 2018; Roggman et al., 2008). However, depressive symptoms may change over time, and it is possible postpartum depression may play a role in service discontinuation (Christensen et al., 2011; Ramos-Marcuse et al., 2010). Postnatal mother and family characteristics were not examined in this study. Future studies should use more dynamic measurement and data analysis strategies that interplay between changing levels of depressive symptoms and program engagement.

This study sheds light on the important role that mothers' risk-taking behavior can play in influencing service duration. Other studies of home visiting have largely overlooked this topic. It is not surprising that some of the young mothers in this sample, most of whom lived in economically and socially challenged communities, engaged in relatively high levels of risk-taking behavior (Michalopoulos et al., 2015), including alcohol and cigarette use, activities resulting in encounters with law enforcement, and high risk sexual behavior. The more risk-taking behavior mothers reported prior to enrolling in the program, the more rapidly mothers discontinued home visiting services. Similarly, mothers who were at educational risk (i.e., did not have a high school degree/GED and were not attending school) discontinued services more rapidly. Level of educational attainment itself was not predictive of service duration, which is consistent with existing studies (Duggan et al., 2018; Roggman et al., 2008).

There are multiple explanations for associations between risk-taking behavior and educational risk with program discontinuation. On the one hand, mothers with higher levels of

risk-taking behavior and/or educational risk may have experienced more conflict with and less support from teachers, police, or other adult authorities (Meeker et al., 2008) and may begin home visiting distrusting service providers (Ware et al., 1987). It may be more challenging and take a longer time for service providers to build a high quality relationship with mothers who engage in risk-taking behavior (Brookes et al., 2006). On the other hand, these mothers may have additional psychosocial needs that go beyond what paraprofessionals in community-based programs can usually address. Workers in the early childhood field usually face a lack of strong preparation or training in topics related to parent problem behavior and other sensitive topics such as family violence (Duggan et al., 2018), which may result in inadequate, inappropriate, or ineffective discussion of these issues in home visits. As a result, mothers may experience a mismatch between their greatest needs or challenges and the content of the program services.

Addressing these issues requires intensive training for home visitors to understand the roots of problems such as substance use, including roots that lie in structural and family factors. Home visitors need to understand best approaches for working around challenging behaviors and to learn techniques for having difficult conversations in ways that will not be perceived as punitive and judgmental and potentially drive young mothers away from program services. It is likely that home visitors may feel frustrated working with young mothers on these challenging issues and need strong reflective supervision in order to manage their feelings in dealing with challenging mothers and to think of resources that might be available to support such mothers. Professional development in the home visiting field has been catching up to provide better training in areas such as generational traumas and substance use (Dunham et al., 2020), addressing which may take a large percentage of time in home visits, thus leaving less time for child development-focused activities.

Additionally, in working with risk taking mothers and those who have left school before graduation, it may be important to not let home visits be distracted from the program's core focus on parenting and child development. Evidence suggests that a focus on the mother's issues in home visits, rather than on the relationship with the child, is related to less program engagement and shorter service duration (Duggan et al., 2018; Roggman et al., 2008; Wen et al., 2020). There is limited evidence regarding what strategies may be most effective when working with young mothers in home visiting programs, though researchers suggested that targeting environmental and systemic factors, such as access to mental health and contraceptive services, may be more relevant than targeting adolescents' knowledge of risk-taking behavior (Steinberg, 2008). Future studies can explore home visitors' strategies for addressing risk behavior and school engagement and how they may facilitate building a strong relationship with mothers and keeping them in services.

Mothers' race/ethnicity was not predictive of service duration, but the language used at home was. Even after controlling for ethnicity, mothers who spoke only English at home discontinued services more rapidly while those who spoke other languages (largely Spanish in the present sample) in the home, either with or without English, remained in services longer. This finding is contrary to observations that Latina immigrant mothers may avoid public programs or healthcare visits for their young children due to perceived discrimination, mistrust, or fear of deportation (Halim et al., 2013; Yoshikawa, 2011). However, at least one other home visiting study, examining the Nurse-Family Partnership home visiting model, showed that mothers who did not speak English as their primary language were more likely to remain longer in services (Holland et al., 2018). In the present study, it seems that Latina mothers who primarily spoke Spanish were comfortable using early childhood home visiting programs for

long periods of time. It is important to note that these programs offered services in family homes by bilingual Latina women who as paraprofessionals were familiar with cultural values and community resources. Although our study did not examine this issue specifically, it is possible that compared to non-immigrant mothers, immigrant mothers may rely more on home visitors to help them navigate the healthcare care system, public assistance, and child care, especially when their social support is limited (Park & Katsiaficas, 2019). Evidence suggests that other models of lay healthcare navigation have benefits for Latina immigrant women and can reduce communication, emotional, financial barriers to accessing healthcare resources (Freeman & Rodriguez, 2011; Meade et al., 2014; Percac-Lima et al., 2013). Future studies can further explore how Latina mothers' years of U.S. residency and ethnic-group attachment influence their utilization of home visiting services and how home visitors may play a role in facilitating their navigation of the healthcare and community resources.

Mothers who started services earlier in pregnancy were more likely to remain in services for longer durations, which is consistent with existing evidence (Daro et al., 2003). One possible explanation is that these mothers were different in their motivation at the time of enrollment, actively seeking out prevention services to prepare themselves for pregnancy and motherhood and therefore remained in services longer (Daro et al., 2003). It is also possible that the relatively longer exposure to services prenatally allowed mothers and service providers to build a stronger relationship before the focus shifted to issues of child development, which led to greater levels of participation (Korfmacher et al., 2007). Despite controlling for program sites in the model, this study was unable to explore important program-level factors affecting enrollment such as caseloads and policies and procedures of when to start services in pregnancy. Future studies can explore how mothers' motivation to get perinatal preventive services and program-level policies

of service initiation may influence service duration and examine whether the association between timing of service initiation and service duration still remain after controlling for these potential confounders.

The findings reported in this paper should be interpreted in the context of the limitations of this study. First, this study only included baseline characteristics, leaving out potentially important variables that were concurrent of service delivery such as the quality of mother-home visitor relationship (see e.g., Damashek et al., 2020), whether the mother had a second pregnancy, residential mobility during the services, and whether mother returned to school/work after she gave birth. Future studies can measure these concurrent covariates and include them as time-varying covariates in survival analysis. Second, this study aimed to explore only mother and family characteristics, and results need to be replicated when factors at the interpersonal-, home visitor-, program-, and neighborhood-levels are included, such as how much the mother's family members support the service. Third, the measure of risk-taking behavior was based on mothers' self-report. It may not accurately capture risk-taking behavior appropriately for racial minority mothers since under the current school disciplinary and juvenile justice policies and practices, minority students are disciplined more frequently for minor transgressions (Fabelo et al., 2011; Sullivan et al., 2010; Welch & Payne, 2018). Future studies can tap into data of different sources (e.g., Shlafer et al., 2012) and use measures that take contextual policies and practices into consideration. Additionally, this study did not collect data on some important family-level factors, such as exposure to familial alcoholism and family violence, which may underlie issues of substance use (Espelage et al., 2014; Ritter et al., 2002).

Despite these limitations, this study highlights the role that young mothers' risk-taking behavior plays in service involvement in home visiting services and adds important empirical evidence. In the home visiting literature, while some mother psychological resources –

particularly depression and intellectual functioning – have received attention (Korfmacher et al., 1998; Olds & Korfmacher, 1998) while their risk-taking behavior has not. For adolescent mothers, who are at a developmental period when they are particularly susceptible to engaging in risk-taking behavior (Steinberg, 2008), such as shift in focus may be important. This study also strengthens the evidence supporting home visiting services as a promising service approach to support immigrant parents. This study analyzed the fine-tuned month-to-month trend of service discontinuation, which can provide insights to service providers in terms of how to strategize their service content and scheduling routines during important time frames. In addition, the use of survival analysis can avoid making the normality assumption invoked in OLS regressions and appropriately handle skewed outcomes such as service duration, providing less biased estimates.

Research on early discontinuation of services can generate important insight of what kinds of mothers and families are hard to reach and engage. Mothers who face behavioral and education risks and enroll relatively late in pregnancy may benefit from additional services such as tailored feedback messages (see e.g., de Niet et al., 2012), the availability of a community coordinator or liaison between families and home visiting programs (see e.g., Folger et al., 2016). Home visitors may benefit from professional development training and supervision, online and/or in-person, on issues such as traumas and substance use to better support families (Dunham et al., 2020). Home visitation is in a unique position to serve immigrant and refugee families with young children who are usually dual language learners (DLLs). Its expansion among this population is called for given the rapid increase of the number of children who are DLLs (Hilado et al., 2019; Park & Katsiaficas, 2019). Parents with limited English proficiency may be highly motivated to engage in home visiting services, especially provided by home

visitors with strong cultural competence, an intimate knowledge of the community, and a focus on the unique needs and challenges faced by immigrant or refugee families.

References

Abbott-Chapman, J., Denholm, C., & Wyld, C. (2008). Social support as a factor inhibiting teenage risk-taking: Views of students, parents and professionals. *Journal of Youth Studies, 11*(6), 611-627.

Adirim, T., & Supplee, L. (2013). Overview of the federal home visiting program. *Pediatrics*, *132*(Supplement 2), S59–S64. https://doi.org/10.1542/peds.2013-1021C

Allison, P. D. (1982). Discrete-time methods for the analysis of event histories. *Sociological Methodology*, *13*, 61. https://doi.org/10.2307/270718

Ammerman, R. T., Putnam, F. W., Bosse, N. R., Teeters, A. R., & Van Ginkel, J. B. (2010). Maternal depression in home visitation: A systematic review. *Aggression and Violent Behavior*, *15*(3), 191–200. https://doi.org/10.1016/j.avb.2009.12.002

Aten, M. J., Siegel, D. M., & Roghmann, K. J. (1996). Use of health services by urban youth: A school-based survey to assess differences by grade level, gender, and risk behavior. *Journal of Adolescent Health*, *19*(4), 258–266.

Atkins, R. (2014). Validation of the Center for Epidemiologic Studies Depression scale in Black single mothers. *Journal of Nursing Measurement*, *22*(3), 511–524.

Bower, K. M., Nimer, M., West, A. L., & Gross, D. (2020). Parent involvement in Maternal, Infant, and Early Childhood Home Visiting programs: An integrative review. *Prevention Science*. https://doi.org/10.1007/s11121-020-01129-z

Brand, T., & Jungmann, T. (2014). Participant characteristics and process variables predict attrition from a home-based early intervention program. *Early Childhood Research Quarterly*, *29*(2), 155–167. https://doi.org/10.1016/j.ecresq.2013.12.001

Brookes, S. J., Summers, J. A., Thornburg, K. R., Ispa, J. M., & Lane, V. J. (2006). Building successful home visitor–mother relationships and reaching program goals in two Early Head Start programs: A qualitative look at contributing factors. *Early Childhood Research Quarterly*, *21*(1), 25–45. https://doi.org/10.1016/j.ecresq.2006.01.005

Caronongan, P., Moiduddin, E., West, J., & Vogel, C. A. (2014). *Children in Early Head Start and Head Start: A profile of early leavers. Baby FACES and FACES 2009 research brief.* (OPRE Report 2014-54; Mathematica Policy Research Reports). Office of Planning, Research, and Evaluation, Administration for Children and Families, U.S. Department of Health and Human Services. https://ideas.repec.org/p/mpr/mprres/9c272ceaee61450e8b43324a9e53c711.html

Christensen, A. L., Stuart, E. A., Perry, D. F., & Le, H.-N. (2011). Unintended pregnancy and perinatal depression trajectories in low-income, high-risk Hispanic immigrants. *Prevention Science*, *12*(3), 289–299. https://doi.org/10.1007/s11121-011-0213-x

Cleves, M., Gould, W. W., & Marchenko, Y. (2016). *An introduction to survival analysis using Stata* (Revised Third Edition). Stata press.

Damashek, A., Doughty, D., Ware, L., & Silovsky, J. (2011). Predictors of client engagement and attrition in home-based child maltreatment prevention services. *Child Maltreatment*, *16*(1), 9–20. https://doi.org/10.1177/1077559510388507

Damashek, A., Kothari, C., Berman, A., Chahin, S., Lutzker, J. R., Guastaferro, K., Whitaker, D. J., Shanley, J., & Self-Brown, S. (2020). Engagement in home visiting services during the transition from pregnancy to postpartum: A prospective mixed methods pilot study. *Journal of Child and Family Studies*, *29*(1), 11–28. https://doi.org/10.1007/s10826-019-01641-z

Daro, D., McCurdy, K., Falconnier, L., & Stojanovic, D. (2003). Sustaining new parents in home visitation services: Key participant and program factors. *Child Abuse & Neglect*, *27*(10), 1101–1125. https://doi.org/10.1016/j.chiabu.2003.09.007

de Niet, J., Timman, R., Bauer, S., van den Akker, E., de Klerk, C., Kordy, H., & Passchier, J. (2012). Short message service reduces dropout in childhood obesity treatment: A randomized controlled trial. *Health Psychology*, *31*(6), 797–805. https://doi.org/10.1037/a0027498

Duggan, A., Minkovitz, C. S., Chaffin, M., Korfmacher, J., Brooks-Gunn, J., Crowne, S., Filene, J., Gonsalves, K., Landsverk, J., & Harwood, R. (2013). Creating a national home visiting research network. *Pediatrics*, *132*(Supplement 2), S82–S89.

Duggan, A., Portilla, X. A., Filene, J. H., Crowne, S. S., Hill, C. J., Lee, H., & Knox, V. (2018). *Implementation of evidence-based early childhood home visiting: Results from the Mother and Infant Home Visiting Program Evaluation* (OPRE Report 2018–76A; p. 411). Office of Planning, Research, and Evaluation, Administration for Children and Families, U.S. Department of Health and Human Services.

Duggan, A., Windham, A., McFarlane, E., Fuddy, L., Lcsw, M., Rohde, C., Buchbinder, S., & Sia, C. (2000). Hawaii's Healthy Start program of home visiting for at-risk families: Evaluation of family identification, family engagement, and service delivery. *Pediatrics*, *105*(Supplement 2), 250–259.

Dunham, C., Benatar, S., & Schultz, D. (2020, January 30). *Today's home visiting workforce: Challenges and improvement strategies*. National Home Visiting Summit, Washington, D.C.

Dunkler, D., Plischke, M., Leffondré, K., & Heinze, G. (2014). Augmented backward elimination: A pragmatic and purposeful way to develop statistical models. *PLoS ONE*, *9*(11). https://doi.org/10.1371/journal.pone.0113677

Espelage, D. L., Low, S., Rao, M. A., Hong, J. S., & Little, T. D. (2014). Family violence, bullying, fighting, and substance use among adolescents: A longitudinal mediational model. *Journal of Research on Adolescence*, *24*(2), 337–349. https://doi.org/10.1111/jora.12060

Fabelo, T., Thompson, M. D., Plotkin, M., Carmichael, D., Marchbanks, M. P., & Booth, E. A. (2011). Breaking schools' rules: A statewide study of how school discipline relates to students' success and juvenile justice involvement. *New York: Council of State Governments Justice Center*.

Fifolt, M., Lanzi, R. G., Johns, E., Strichik, T., & Preskitt, J. (2017). Retention and attrition in a home visiting programme: Looking back and moving forward. *Early Child Development and Care*, *187*(11), 1782–1794. https://doi.org/10.1080/03004430.2016.1189420

Folger, A. T., Brentley, A. L., Goyal, N. K., Hall, E. S., Sa, T., Peugh, J. L., Teeters, A. R., Van Ginkel, J. B., & Ammerman, R. T. (2016). Evaluation of a community-based approach to strengthen retention in early childhood home visiting. *Prevention Science*, *17*(1), 52–61. https://doi.org/10.1007/s11121-015-0600-9

Ford, C. A., Bearman, P. S., & Moody, J. (1999). Foregone health care among adolescents. *JAMA*, *282*(23), 2227–2234.

Freeman, H. P., & Rodriguez, R. L. (2011). History and principles of patient navigation. *Cancer*, *117*(S15), 3537–3540. https://doi.org/10.1002/cncr.26262

Gomby, D. S., Culross, P. L., & Behrman, R. E. (1999). Home visiting: Recent program evaluations--Analysis and recommendations. *The Future of Children*, *9*(1), 4–26. https://doi.org/10.2307/1602719

Goyal, N. K., Hall, E. S., Jones, D. E., Meinzen-Derr, J. K., Short, J. A., Ammerman, R. T., & Van Ginkel, J. B. (2013). Association of maternal and community factors with enrollment in home visiting among at-risk, first-time mothers. *American Journal of Public Health*, *104*(S1), S144–S151. https://doi.org/10.2105/AJPH.2013.301488

Guterman, N. B. (2001). *Stopping child maltreatment before it starts: Emerging horizons in early home visitation services*. Sage Publications.

Hadley, A., Ingham, R., & Chandra-Mouli, V. (2017). *Teenage pregnancy and young parenthood: Effective policy and practice*. Routledge.

Halim, M. L., Yoshikawa, H., & Amodio, D. M. (2013). Cross-generational effects of discrimination among immigrant mothers: Perceived discrimination predicts child's healthcare visits for illness. *Health Psychology*, *32*(2), 203–211. https://doi.org/10.1037/a0027279

Hans, S. L., Edwards, R. C., & Zhang, Y. (2018). Randomized controlled trial of doula-home-visiting services: Impact on maternal and infant health. *Maternal and Child Health Journal*, *22*(1), 105–113. https://doi.org/10.1007/s10995-018-2537-7

Harrell, F. E. (2015). *Regression modeling strategies: With applications to linear models, logistic and ordinal regression, and survival analysis* (2nd ed.). Springer.

Healthy Families America. (2020). https://www.healthyfamiliesamerica.org/

Hebbeler, K. M., & Gerlach-Downie, S. G. (2002). Inside the black box of home visiting: A qualitative analysis of why intended outcomes were not achieved. *Early Childhood Research Quarterly*, *17*(1), 28–51. https://doi.org/10.1016/S0885-2006(02)00128-X

Heinze, G., & Dunkler, D. (2017). Five myths about variable selection. *Transplant International*, *30*(1), 6–10. https://doi.org/10.1111/tri.12895

Hilado, A., Leow, C., & Yang, Y. (2019). Understanding Immigration Trauma and the Potential of Home Visiting among Immigrant and Refugee Families. *ZERO TO THREE*, *39*(6), 44–53.

Holland, M. L., Olds, D. L., Dozier, A. M., & Kitzman, H. J. (2018). Visit attendance patterns in Nurse-Family Partnership community sites. *Prevention Science*, *19*(4), 516–527.

Holland, M. L., Xia, Y., Kitzman, H. J., Dozier, A. M., & Olds, D. L. (2014). Patterns of visit attendance in the nurse–family partnership program. *American Journal of Public Health*, *104*(10), e58–e65.

Kaplan, E. L., & Meier, P. (1958). Nonparametric estimation from incomplete observations. *Journal of the American Statistical Association*, *53*(282), 457–481. https://doi.org/10.2307/2281868

Kissman, K. (1998). High risk behaviour among adolescent mothers. *International Journal of Adolescence and Youth*, *7*(3), 179–191. https://doi.org/10.1080/02673843.1998.9747823

Koniak-Griffin, D., Nyamathi, A., Vasquez, R., & Russo, A. A. (1994). Risk-taking behaviors and AIDS knowledge: Experiences and beliefs of minority adolescent mothers. *Health Education Research*, *9*(4), 449–463. https://doi.org/10.1093/her/9.4.449

Korfmacher, J., O'Brien, R., Hiatt, S., & Olds, D. (1999). Differences in program implementation between nurses and paraprofessionals providing home visits during pregnancy and infancy: A randomized trial. *American Journal of Public Health*, *89*(12), 1847–1851. https://doi.org/10.2105/AJPH.89.12.1847

Korfmacher, J., Green, B., Spellmann, M., & Thornburg, K. R. (2007). The helping relationship and program participation in early childhood home visiting. *Infant Mental Health Journal: Official Publication of The World Association for Infant Mental Health*, *28*(5), 459–480.

Korfmacher, J., Green, B., Staerkel, F., Peterson, C., Cook, G., Roggman, L., Faldowski, R. A., & Schiffman, R. (2008). Parent involvement in early childhood home visiting. *Child & Youth Care Forum*, *37*(4), 171–196. https://doi.org/10.1007/s10566-008-9057-3

Korfmacher, J., Kitzman, H., & Olds, D. (1998). Intervention processes as predictors of outcomes in a preventive home-visitation program. *Journal of Community Psychology*, *26*(1), 49–64.

LeCroy, C. W., & Whitaker, K. (2005). Improving the quality of home visitation: An exploratory study of difficult situations. *Child Abuse & Neglect*, *29*(9), 1003–1013. https://doi.org/10.1016/j.chiabu.2005.04.003

Leve, L. D., & Chamberlain, P. (2005). Girls in the juvenile justice system: Risk factors and and clinical implications. In D. J. Pepler, K. C. Madsen, C. Webster, & K. Levene (Eds.), *The development and treatment of girlhood aggression* (pp. 191–215). Lawrence Erlbaum Associates Publishers.

McCurdy, K., & Daro, D. (2001). Parent involvement in family support programs: An integrated theory. *Family Relations*, *50*(2), 113–121.

McGuigan, W. M., Katzev, A. R., & Pratt, C. C. (2003). Multi-level determinants of retention in a home-visiting child abuse prevention program. *Child Abuse & Neglect*, *27*(4), 363–380. https://doi.org/10.1016/S0145-2134(03)00024-3

Meade, C. D., Wells, K. J., Arevalo, M., Calcano, E. R., Rivera, M., Sarmiento, Y., Freeman, H. P., & Roetzheim, R. G. (2014). Lay navigator model for impacting cancer health disparities. *Journal of Cancer Education*, *29*(3), 449–457. https://doi.org/10.1007/s13187-014-0640-z

Meeker, S. D., Edmonson, S., & Fisher, A. (2008). The voices of high school dropouts: Implications for research and practice. *International Journal on School Disaffection*, *6*(1), 40–52.

Michalopoulos, C., Lee, H., Duggan, A., Lundquist, E., Tso, A., Crowne, S. S., Burrell, L., Somers, J., Filene, J. H., & Knox, V. (2015). *The Mother and Infant Home Visiting Program Evaluation: Early findings on the Maternal, Infant, and Early Childhood Home Visiting Program (OPRE Report 2015-11)*. Washington, DC: Office of Planning, Research and Evaluation, Administration for Children and Families, U.S. Department of Health and Human Services.

MIECHV Technical Assistance Coordinating Center. (2015). *MIECHV issue brief on family enrollment and engagement*. 12.

Newcomb, M. D., & Bentler, P. M. (1987). The impact of late adolescent substance use on young adult health status and utilization of health services: A structural- equation model over four years. *Social Science & Medicine*, *24*(1), 71–82. https://doi.org/10.1016/0277-9536(87)90141-9

O'Brien, R. A., Moritz, P., Luckey, D. W., McClatchey, M. W., Ingoldsby, E. M., & Olds, D. L. (2012). Mixed methods analysis of participant attrition in the Nurse-Family Partnership. *Prevention Science*, *13*(3), 219–228. https://doi.org/10.1007/s11121-012-0287-0

Olds, D. L., & Korfmacher, J. (1998). Maternal psychological characteristics as influences on home visitation contact. *Journal of Community Psychology*, *26*(1), 23–36. https://doi.org/10.1002/(SICI)1520-6629(199801)26:1<23::AID-JCOP3>3.0.CO;2-2

Parents as Teachers. (2020). Parents as Teachers. https://parentsasteachers.org

Park, M., & Katsiaficas, C. (2019). *Leveraging the potential of home visiting programs to serve immigrant and dual language learner families*. Migration Policy Institute. https://www.migrationpolicy.org/research/home-visiting-immigrant-dual-language-learner-families

Percac-Lima, S., Benner, C. S., Lui, R., Aldrich, L. S., Oo, S. A., Regan, N., & Chabner, B. A. (2013). The impact of a culturally tailored patient navigator program on cervical cancer prevention in Latina women. *Journal of Women's Health*, *22*(5), 426–431. https://doi.org/10.1089/jwh.2012.3900

Radloff, L. S. (1977). The CES-D scale: A self-report depression scale for research in the general population. *Applied Psychological Measurement*, *1*(3), 385–401. https://doi.org/10.1177/014662167700100306

Raikes, H., Green, B. L., Atwater, J., Kisker, E., Constantine, J., & Chazan-Cohen, R. (2006). Involvement in Early Head Start home visiting services: Demographic predictors and relations to child and parent outcomes. *Early Childhood Research Quarterly*, *21*(1), 2–24. https://doi.org/10.1016/j.ecresq.2006.01.006

Ramos-Marcuse, F., Oberlander, S. E., Papas, M. A., McNary, S. W., Hurley, K. M., & Black, M. M. (2010). Stability of maternal depressive symptoms among urban, low-income, African American adolescent mothers. *Journal of Affective Disorders*, *122*(1–2), 68–75. https://doi.org/10.1016/j.jad.2009.06.018

Ritter, J., Stewart, M., Bernet, C., Coe, M., & Brown, S. A. (2002). Effects of childhood exposure to familial alcoholism and family violence on adolescent substance use, conduct problems, and self-esteem. *Journal of Traumatic Stress*, *15*(2), 113–122. https://doi.org/10.1023/A:1014803907234

Roggman, L. A., Cook, G. A., Peterson, C. A., & Raikes, H. H. (2008). Who drops out of Early Head Start home visiting programs? *Early Education and Development*, *19*(4), 574–599. https://doi.org/10.1080/10409280701681870

Rosenthal, J. A. (2011). *Statistics and data interpretation for social work*. Springer publishing company.

RStudio Team. (2015). *RStudio: Integrated development for R*. RStudio, Inc. http://www.rstudio.com/

Saewyc, E. M., Magee, L. L., & Pettingell, S. E. (2004). Teenage pregnancy and associated risk behaviors among sexually abused adolescents. *Perspectives on Sexual and Reproductive Health*, *36*(3), 98–105. https://doi.org/10.1363/3609804

Shlafer, R. J., Poehlmann, J., & Donelan-McCall, N. (2012). Maternal jail time, conviction, and arrest as predictors of children's 15-year antisocial outcomes in the context of a nurse nome visiting program. *Journal of Clinical Child & Adolescent Psychology*, *41*(1), 38–52. https://doi.org/10.1080/15374416.2012.632345

Singer, J. D., & Willett, J. B. (1993). It's about time: Using discrete-time survival analysis to study duration and the timing of events. *Journal of Educational Statistics*, *18*(2), 155–195. JSTOR. https://doi.org/10.2307/1165085

StataCorp. (2017). *Stata statistical software: Release 15*. StataCorp LLC.

Steinberg, L. (2008). A social neuroscience perspective on adolescent risk-taking. *Developmental Review*, *28*(1), 78–106. https://doi.org/10.1016/j.dr.2007.08.002

Stevens, J., Ammerman, R. T., Putnam, F. G., & Ginkel, J. B. V. (2002). Depression and trauma history in first-time mothers receiving home visitation. *Journal of Community Psychology*, *30*(5), 551–564. https://doi.org/10.1002/jcop.10017

Sullivan, E., Larke, P. J., & Webb-Hasan, G. (2010). Using critical policy and critical race theory to examine Texas' school disciplinary policies. *Race, Gender & Class*, *17*(1/2), 72–87. JSTOR.

Supplee, L. H., & Duggan, A. (2019). Innovative research methods to advance precision in home visiting for more efficient and effective programs. *Child Development Perspectives*, *13*(3), 173–179.

Tandon, S. D., Mercer, C. D., Saylor, E. L., & Duggan, A. K. (2008). Paraprofessional home visitors' perspectives on addressing poor mental health, substance abuse, and domestic violence: A qualitative study. *Early Childhood Research Quarterly*, *23*(3), 419–428. https://doi.org/10.1016/j.ecresq.2008.02.002

UCLA: Statistical Consulting Group. (n.d.). *Survival Analysis with Stata*. Retrieved February 14, 2020, from https://stats.idre.ucla.edu/stata/seminars/stata-survival/

Vingilis, E., Wade, T., & Seeley, J. (2007). Predictors of adolescent health care utilization. *Journal of Adolescence*, *30*(5), 773–800. https://doi.org/10.1016/j.adolescence.2006.10.001

Wagner, M., Spiker, D., Linn, M. I., & Hernandez, F. (2003). Dimensions of parental engagement in home visiting programs: Exploratory study. *Topics in Early Childhood Special Education*, *23*(4), 171–187. https://doi.org/10.1177/02711214030230040101

Wang, H., Peng, J., Wang, B., Lu, X., Zheng, J. Z., Wang, K., Tu, X. M., & Feng, C. (2017). Inconsistency between univariate and multiple logistic regressions. *Shanghai Archives of Psychiatry*, *29*(2), 5.

Ware, L. M., Osofsky, J. D., Eberhart-Wright, A., & Leichtman, M. L. (1987). Challenges of home visitor interventions with adolescent mothers and their infants. *Infant Mental Health Journal*, *8*(4), 418–428. https://doi.org/10.1002/1097-0355(198724)8:4<418::AID-IMHJ2280080410>3.0.CO;2-L

Welch, K., & Payne, A. A. (2018). Latino/a student threat and school disciplinary policies and practices. *Sociology of Education*, *91*(2), 91–110. https://doi.org/10.1177/0038040718757720

Wen, X., Korfmacher, J., Hans, S., & Zhang, Y. (2020, June 22). *A multi-dimensional profile analysis of teen mothers' experience with a doula home visiting program: Associations with parenting outcomes*. National Research Conference on Early Childhood.

Yoshikawa, H. (2011). *Immigrants raising citizens: Undocumented parents and their young children*. Russell Sage Foundation. https://nyuscholars.nyu.edu/en/publications/immigrants-raising-citizens-undocumented-parents-and-their-young-

Zeanah, P. D., & Korfmacher, J. (2018). Infant mental health and home visiting: Needs, approaches, opportunities, and cautions. In C. H. Zeanah (Ed.), *Handbook of infant mental health* (pp. 610–625). Guilford Publications.

Zoccolillo, M., Meyers, J., & Assiter, S. (1997). Conduct disorder, substance dependence, and adolescent motherhood. *American Journal of Orthopsychiatry*, *67*(1), 152–157. https://doi.org/10.1037/h0080220

CHAPTER 4
RELATIONSHIP AS AN ACTIVE INGREDIENT: COMMUNITY DOULA-MOTHER RELATIONSHIP AND PARENTING BEHAVIOR IN HOME VISITING SERVICES

Abstract

Background: Home visiting programs are often described as "relationship-based" interventions, with the parent-home visitor relationship theorized as an active ingredient in achieving programs goals, including positive parenting behavior. Specifically, mothers are nurtured by the emotional availability of and trust with home visitors and model their parenting after this relationship. However, studying the impact of the parent-home visitor relationship on parenting is challenging since the quality of the relationship cannot be randomized, thus its effect could be confounded by other variables. This study uses propensity score-based methods to account for confounding variables and to test the "relationship as an active ingredient" hypothesis.

Methods: Data came from a sample of 124 young (M=18.6 yrs), low-income mothers (48% African American, 42% Latina, 10% European American) who were offered weekly home visiting services from community doulas prenatally until 6-weeks postpartum. Doulas also provided support and comfort to mothers during childbirth. Mothers rated the quality of their relationship with their doula at 3-weeks postpartum on the 4-point Working Alliance Inventory-Short Form, which includes questions about mothers' bond with their doula and agreement on tasks and goals. "Treatment" of a very positive relationship and "control" of a less positive relationship were defined by a cutoff of an average score of 3.5 (1=≥3.5; 0=<3.5). Mothers' parenting behaviors were coded from video-recorded mother-infant interactions at 3-months postpartum. Baseline (prenatal) covariates that were conceptually related to parenting outcomes and/or the mother-doula relationship were chosen. The propensity score (i.e., the probability of having a very positive mother-doula relationship) was estimated by regressing the "treatment" on

the baseline covariates in a logistic regression. An inverse probability of treatment weight (IPTW) was calculated for each mother. After balance was achieved, treatment effects were estimated.

Results: Twelve baseline variables were selected for the propensity score model including mothers' demographic and psychosocial characteristics and parenting attitudes. After weighting, the group with a very positive mother-doula relationship and the group with a less positive relationship were balanced on baseline characteristics and the propensity score. A very positive mother-doula relationship was associated with greater observed maternal sensitivity and careful handling of the infant, but not associated with intrusiveness, detachment or stimulation.

Conclusions: This study lends preliminary causal evidence to the "relationship as an active ingredient" hypothesis within home visitation, at least for certain parenting outcomes. The acceptance and understanding in a positive mother-doula relationship may make mothers feel valued and nurtured, and mothers may be more likely to perceive her infant's behavior acceptable, respond to her infant's cues effectively, and practice the sensitive and gentle parenting strategies promoted by her doula. Doulas used a strength-based approach in their work, identifying positive parenting while not singling out problematic parenting, and a very positive doula-mother relationship may be less effective in preventing negative parenting behaviors such as intrusiveness and detachment. Social workers in parenting programs may be most effective at promoting positive parenting when they develop a trusting relationship and partner with parents to achieve shared goals.

Keywords: adolescent mothers, client-provider relationship, propensity score-based methodology

Relationship as an Active Ingredient: Community Doula-Mother Relationship and Parenting Behavior in Home Visiting Services

Introduction

Home visiting has become the primary service delivery strategies to serve families with young children living in poverty in the U.S., and many evidence-based home visiting programs have been shown to be effective in promoting a wide range of outcomes, including maternal and child health, positive parenting practices, child development and school readiness, and family economic self-efficiency (Sama-Miller et al., 2018). The early childhood field now widely recognizes the central role of relationships in interventions and has shifted from child-focused or family-focused interventions that provide specific child learning activities or coordinate family services to interventions "fostering growth-producing parent-professional and parent-child relationships" (Kelly & Barnard, 1999; Ounce of Prevention Fund, 2020; Ruch, 2005). Accordingly, the home visitor-parent relationship is theorized to be an *active ingredient*—a critical component that produces desired changes in outcomes (Li & Julian, 2012), independently of the specific curricular activities that the home visitor delivers to parents. (Parents and mothers are used interchangeably in this paper). Specifically, the home visitor-mother relationship functions as a medium through which the home visitor provides the mother psychosocial support, validates her in her new role as a mother, engages with the complexity of her internal and external worlds, gives her the security to explore her innate maternal responses and shares specific parenting knowledge with her (Kelly & Barnard, 1999; Ruch, 2005; Stern, 1995). It has been argued that the "availability and trust of the intervener as experienced by the caregiver" should also be one of the primary goals of early childhood interventions (Emde et al., 2000). Being nurtured in a "holding environment" provided by the home visitor, the mother is then expected to engage in a nurturing parent-child relationship which works as a vehicle to promote

child development (Kelly & Barnard, 1999). This process is termed as the parallel process (Bernstein et al., 2001; Emde et al., 2000; Wong, 2009).

An Overview of Studies on the Client-Provider Relationship

In the broader literature of social service interventions and psychotherapy, the client-provider relationship has been conceptualized as a key process element central to the implementation of interventions (Marsh et al., 2012). It is argued that the "therapeutic relationship cannot be viewed as a nonspecific variable that is merely auxiliary to other active components of treatment" but deserves to be studied as a focal variable (Castonguay et al., 2006). Scholars have used different terms for the client-provider relationship, such as alliance, therapeutic alliance, helping alliance, or working alliance (Horvath et al., 2011). Three elements have been conceptualized to be at the core of the client-provider relationship: bonds (e.g., interpersonal attachments and trusting), tasks (e.g., agreements on what to be done), and goals (e.g., consensus on outcome expectations) (Bordin, 1975). Researchers in intervention sciences have long been interested in whether a causal relationship exists between the client-provider relationship and intervention outcomes, but have mainly focused on associations (Marsh et al., 2012). This is because the gold standard in social science—randomized controlled trials—cannot be applied to answer this question since a randomization into a good versus a less good relationship with the service provider is typically not feasible or ethnical, which poses a fundamental design limitation to the study of the client-provider relationship (Marsh et al., 2012).

Despite the methodological challenges, in the literature on individual adult psychotherapy, there has been robust evidence that the client-provider relationship is related to intervention outcomes (Horvath, 2000; Horvath et al., 2011; Horvath & Symonds, 1991). For

example, in a meta-analysis, Horvath and colleagues (2011) analyzed over 200 studies covering more than 14,000 psychotherapy treatments, and found that the overall aggregate association between the client-provider relationship and treatment outcome was 0.275 (95% confidence interval [0.25, 0.30]). However, compared to the literature on individual adult psychotherapy, there are fewer number of studies on youth psychotherapy or family therapy approaches, and the evidence regarding the role of the parent-therapist relationship is less strong (de Greef et al., 2017; Friedlander et al., 2011; McLeod, 2011).

One of the possible reasons for the less robust findings of parent-professional relationship in interventions for children, youth, and families is that the adult's role may be very different from that in individual adult psychotherapy. In the former, adult caregivers are either not targeted by interventions but only involved as partners (e.g., seeking treatment for their children), or are targeted in order to induce changes in child functioning (de Greef et al., 2017). In the latter, however, adults are usually the only target of interventions. Compared to interventions for older children, early childhood interventions rely more on the mechanism of targeting parents to promote child development since "parenting constitutes an initial and all- encompassing ecology of ... development" for infants (Bornstein, 2019), thus changes in parents' attitudes and behavior may be more salient. In general, the studies of the client-provider relationship are less developed in child- and family-focused interventions compared to individual adult psychotherapy (Marsh et al., 2012), and more research is needed to understand whether the parent-professional relationship is an active ingredient in interventions involving children, especially young children.

Studies of the Home Visitor-Mother Relationship in Early Childhood Interventions

In early childhood home visiting services, despite the theoretical attention on the role of the home visitor-mother relationship, the empirical evidence is generally limited. A synthesis of

14 qualitative studies on home visitation provided by nurses shows that home visitors perceived a high quality of relationship with parents to be essential for knowing the parent, gaining access to the home, and providing interventions (McNaughton, 2000). Researchers also reveals the variability of the quality in the home visitor-mother relationship: Some were collaborative, characterized by trust and joint effort working towards common goals, while others were difficult in which mothers may not open up to home visitors and/or were passive during home visits (Humphries & Korfmacher, 2012; McNaughton, 2000). Given the theoretical importance of the home visitor-mother relationship in shaping parenting behavior—one of the main outcome domains targeted by early childhood home visitation, it is surprising how little research attention has been given to test the empirical relation between the home visitor-parent relationship and parenting behavior (Stern, 2006). To date, only a few studies have tested these associations (Elicker et al., 2013; Heinicke et al., 2000; Kaitz et al., 2018; Korfmacher et al., 1998; Roggman et al., 2016; Santos, 2005). Although these studies differed in the measurement of the mother-home visitor relationship and parenting behavior, overall, they reported significant associations between the two variables, with an exception from the BabyFirst home visiting program (i.e., higher levels of the parent-home visitor alliance improvement at one year, *not* the alliance in the third months postpartum, was predictive of positive parenting at one year) (Santos, 2005).

These studies share some methodological similarities, which limit the strength of their conclusions. First, with the exception two studies (Kaitz et al., 2018; Korfmacher et al., 1998), all other evaluative studies had a sample size around 50. Although a small sample size is not uncommon in evaluations of home visiting services, it limits confidence in results from a single evaluation. Second, multiple regressions or pairwise correlations were used to examine the relation between the home visitor-mother relationship and outcomes, controlling for

confounders. However, despite the effort to control for some baseline mother- or family characteristics (e.g., mother depression was controlled for in almost all the aforementioned studies), existing studies were generally limited in the number and the type of baseline variables they controlled for. Little is known about whether the relation between the home visitor-mother relationship and intervention outcomes are still robust after controlling for other important mother and family characteristics (e.g., mother education and developmental history).

It is noted that in home visiting studies, "although the alliance has been linked with outcomes, the causal direction (if any) of this relationship has not been clearly established" (Korfmacher et al., 1998), and that "most models have not causally tested which ingredients drive intended outcomes" (Supplee & Duggan, 2019). Further empirical examination is needed to examine whether higher quality of home visitor-mother relationships contributes to more positive parenting behavior, in order to identify active ingredients and promote positive parenting in home visiting services. This study addresses the following research question: Does a very positive mother-doula relationship at 3 weeks postpartum contribute to more positive maternal parenting behavior at 3 months postpartum?

Method

Sample

Data came from a randomized controlled trial (RCT, $N = 312$) in which mothers were randomly assigned to receive either doula-enhanced home visiting services or case management services. (For details of sample recruitment and randomization procedures, see Hans et al., 2018). Only data from the intervention group ($n = 156$) were used because only intervention mothers had access to home visiting services and reported the quality of relationships with service providers. Mothers were interviewed at baseline (during pregnancy) and 3-weeks and 3-

months postpartum. Doulas were the primary service provider of home visitation from pregnancy to six weeks postpartum, and they focused on preparation for labor and delivery, breastfeeding, newborn care, and mothers' well-being. Doulas were expected to attend the birth at the hospital.

Propensity Score Approach

If the quality of mother-doula relationship (Z = 1 indicating a very positive mother-doula relationship; Z = 0 a less positive relationship) can be randomized, then its effect on parenting outcomes can be quantified by calculating the observed mean difference in parenting behavior between the group with a very positive mother-doula relationship and the group with a less positive mother-doula relationship. However, such randomization is unfeasible and unethical, and researchers have to rely on observational studies, in which the treatment status (i.e., very positive *versus* less positive) is not randomized but is likely influenced by a variety of factors. It is necessary to control for systematic differences in background characteristics between the two groups (Rubin, 1997). The number of background characteristics is typically large, and multiple regressions have typically been used. However, multiple regressions rely on certain functional form, such as linearity and log linearity, for the relations between the independent variables and the outcomes within each group. Additionally, the standard output from statistical software for multiple regressions usually does not allow a straightforward assessment of whether the two groups overlap enough on background characteristics (Rubin, 1997). Therefore, conclusions drawn from traditional regression methods may produce untrustworthy extrapolations, which can be avoided by propensity score-based methods.

The propensity score θ is the conditional probability of having a very positive relationship with the doula given a set of observed baseline covariates $\boldsymbol{x}$. The joint distribution of $\boldsymbol{x}$ is balanced between the treated and control groups when the propensity score is held constant

(Rosenbaum & Rubin, 1983, 1984). Thus, conditioning on the propensity score is equivalent to conditioning on $\boldsymbol{x}$. In other words, propensity score-based methods "reduced the entire collection of background characteristics to a single composite characteristic that appropriately summarizes the collection" (Rubin, 1997). In randomized controlled trials, the true propensity score is known and defined by the study design while in observational studies, it is unknown but estimated from the study data (Austin, 2011). In observational studies, two important assumptions for propensity score methods are the overlap assumption ($0 < P(Z = 1 \mid X = x) < 1$) and the strong ignorability assumption, meaning that conditioning on the propensity score θ, treatment assignment is independent of the potential parenting outcomes (Rosenbaum & Rubin, 1983), in other words, treatment is as-good-as randomly assigned. The strong ignorability assumption is also referred to as "unconfoundedness" or "selection on observables" in the literature (Imbens, 2004). The first assumption is directly testable while the second is not.

This study will use two of the most widely utilized propensity score methods: inverse probability of treatment weighting (IPTW) and propensity score matching (PSM). Propensity score methods have been shown to demonstrate satisfactory performance in small sample sizes (e.g., under 100 or 50) or low prevalence of treatment (Pirracchio et al., 2012; Stone & Tang, 2013). To calculate the average treatment effect (ATE), IPTW assigns each individual *i* a weight equivalent to the inverse of the probability of receiving the treatment that the mother actually received: $1/\theta_i$ for treated mothers and $1/1 - \theta_i$ for control mothers. IPTW creates an artificial population in which treatment assignment is independent of treatment status (Joffe et al., 2004). To calculate the average treatment effect on the treated (ATT), the IPTW weight is applied as $Z_i + \frac{\theta_i(1-Z_i)}{1-\theta_i}$ (Austin & Stuart, 2015). The second analytical approach—PSM matches an individual in the treated group with a counterpart in the control group who has a similar

propensity score to calculate ATT, thus similar baseline characteristics. This is equivalent to imputing the missing counterfactual parenting outcome of a mother in the treated group by using the observed outcome of the most similar mother in the control group (Austin & Stuart, 2015; Hong, 2015). Analyses via more than one propensity score technique can provide "a sort of sensitivity analysis" since varying techniques with similar balance should yield similar effect estimates (Harder et al., 2010).

Measures

Mother-doula relationship. At 3-weeks postpartum, mothers responded to the Working Alliance Inventory-Short Form, which is composed of 12 items rated on a 4-point (1 = *never*, 2 = *sometimes*, 3 = *often*, 4 = *always*) Likert scale (Horvath & Greenberg, 1989; Tracey & Kokotovic, 1989). Cronbach's alpha for the 12 items was 0.91. The average score of the 12 items was calculated for each mother and was used in analyses. The advantage of using the average score instead of the sum score was that the average score can be interpreted on the original 4-point scale (Acock, 2013). Evidence suggests that the home visitor-mother relationship is usually highly skewed negatively towards indicating positive relationships (Korfmacher et al., 2007). A dichotomization using median split or based on the higher end (e.g., the highest rating = 1 and all else = 0) of the continuous measure of the relationship quality is often used to address the skewness (Beauford et al., 1997; Lee et al., 2013; Rijken & Liefbroer, 2009; Sønsterud et al., 2019; Yamamoto-Mitani et al., 2002). In this study, a very positive relationship is regarded as the "treatment." Mothers who reported having a very positive relationship with doulas comprised the treated group and those reported a less positive relationship comprised the control group. Given that 3 represents "often" and 4 represents "always," a cutoff of 3.5 (average score of the 12 items) was used to determine "treatment" status (1 = 3.5 or above; 0 = below 3.5). This

dichotomization takes into consideration the substantive meaning of the measure. However, Horvath (n.d.) cautioned against a standard or cutoff for a "good enough" alliance. Therefore, alternative cutoffs of 3.4 and 3.6 (median split) will be used for a robustness check.

Parenting outcomes. At 3-months postpartum, mothers were asked to play with their baby using a rattle, to show a book or read to her baby, and to undress, weigh, and re-dress her baby. The interactions were video-recorded and lasted approximately 15 minutes. Mother parenting behaviors on five dimensions were coded on 4-point Likert scales (1 = *not at all*, 2 = *minimal*, 3 = *moderate*, 4 = *highly*) adapted from the ones developed by the National Institute of Child Health and Human Development (NICHD Early Child Care Research Network, 1997), including sensitivity, careful handling, intrusiveness, detachment, and stimulation. Intrusiveness and detachment were highly skewed, and the original codes of 2, 3, and 4 were combined into an "absent" category (= 0) and the original code of 1 was kept as "present". Sensitivity, careful handling, and stimulation were less skewed, and the original 1 and 2 were combined. The recoded outcomes were on a 3-point scale (1 = *not at all* or *minimal*, 2 = *moderate*, 3 = *highly*) and used as continuous in the following analyses.

Sensitivity measured the extent to which the mother responded to the infant's cues, and examples included tuning into and providing support if the infant was uncomfortable. *Careful handling* measured the degree the mother held or carried her infant in a way that was gentle, appropriate to infant's physical abilities, and examples included supporting the infant's neck and touching gently. *Intrusiveness* measured the extent that mother-infant interactions were mother-centered as opposed to infant-centered, and examples included talking too loudly and shaking the rattle excessively in the infant's face to cause distress. *Detachment* measured the extent to which the mother appeared disinterested or distracted while interacting with her infant, and examples

included being oblivious to the infant's facial expressions and/or noises and expressing more interest in mobile devices than in the child. *Stimulation* measured the degree to which mothers tried to foster the infant's overall development, and examples included labeling and describing pictures in the book and engaging through words and facial expressions during the dressing task.

Two graduate-level coders who were blind to family information were trained and supervised by the principal investigators of the RCT. One of the coders was bilingual in English and Spanish. In order to establish inter-rater reliability after initial training, two coders rated video-recordings independently and then met to discuss and resolve their disagreements, consulting with the principal investigators as needed. After acceptable inter-rater reliability was established, both coders subsequently rated every 5th video to maintain reliability (.57 for sensitivity, .80 for stimulation).

Baseline variables selected for the propensity score model. In propensity score analysis, it is recommended to select either variables related to outcomes or confounding variables related to both the treatment and the outcomes, especially with small sample sizes (Austin et al., 2007; Pirracchio et al., 2012). This is because including variables only related to the treatment but not the outcome may increase the variance and bias of effect estimates (Brookhart et al., 2006; Patrick et al., 2011). It is cautioned that statistical hypothesis tests in the analytic sample should be avoided due to the possibly low statistical power of small sample sizes when identifying the prognostically important or confounding covariates. Instead, the selection of baseline variables should be guided by substantive theories (Austin & Stuart, 2015). Additionally, to avoid overfitting the propensity score model, it is recommended that the number of baseline variables should not exceed 10% of the sample size (Harrell, 2015). Guided by these principals, this study relied on theories of parenting behaviors in infancy.

Belsky (1984) theorized that beyond social class and cross-cultural differences, factors influencing parenting fall into three domains: (1) parents' developmental history (e.g., experience of child maltreatment and separation from parents as a child) and personal psychological resources (e.g., depression and self-esteem); (2) the child's characteristics; and (3) contextual sources of stress and support (e.g., marital relations, social networks, and occupational experiences). Additionally, the parental investment model (PIM) theorizes that parents' attitudes, values and beliefs are also important predictors of parenting (Duncan et al., 2017; McLoyd et al., 2014; National Academies of Sciences, Engineering, and Medicine et al., 2016; Shonkoff & Phillips, 2000). Guided by these theories, this study identified the following candidate covariates which are theorized to be related only to parenting behavior or to both the mother-doula relationship and parenting behavior. (For details of scales for the baseline variables, please refer to Appendix C.)

(1) Demographics: mother's age, ethnicity, and whether had a high school degree.

(2) Mothers' developmental history: parental rejection experienced in childhood.

(3) Mothers' psychological resources: depressive symptoms, maternal self-confidence, and maternal worries over motherhood.

(4) Child characteristics: infant sex.

(5) Social support or stress: quality of general social support, support from the parent figure, trust and alienation with parent figure, co-residence with the parent figure, and whether in a relationship with the father of the baby (i.e., married, engaged, in a couple/boyfriend/partner relationship).

(6) Occupational experiences: whether currently working.

(7) Parenting attitudes: perceived negative aspects of childbearing, the degree that motherhood was valued, and feelings about children.

Statistical Analysis

Out of the 156 mothers who were assigned to doula home visiting services, 32 mothers had missing data on the "treatment" (i.e., working alliance at the 3-weeks postpartum interview) and/or outcomes (i.e., parenting sensitivity and stimulation at 3-months) due to mother's decline of the interview and/or video-recordings or interviewers unable to locate the mother. Listwise deletion was used (i.e., dropping 32 mothers out of the analysis). The final analytic sample size was 124.

The analyses followed three steps. First, logistic propensity score models were used to generate estimated probability of having a very positive relationship with the doula. After applying the IPTW weights or conducting the matching procedure, balance checking was examined. Balance checking helps to ensure that observed systematic differences between treated and control mothers have been removed conditioning on the estimated propensity score (Austin & Stuart, 2015). In order to be considered balanced, the absolute value of standardized differences needs to be smaller than 0.25, as a rule of thumb, and the variance ratio needs to be in the range of 0.5 to 2 (Rubin, 2001). A stricter cutoff, 0.10, is also suggested in the literature (Austin et al., 2007; Harder et al., 2010). Second, after balance was achieved, the average treatment effect (ATE) and the average treatment effect on the treated (ATT) were estimated. The *teffects* procedure in Stata can calculate standard errors of ATE and ATT accounting for the uncertainty in the estimated propensity score (StataCorp, 2017). Third, different cutoffs (i.e., 3.4 and 3.6) were used for the Working Alliance Inventory-Short Form to create the "treatment" in order to examine the robustness of findings to varying cutoffs. Fourth, sensitivity analysis of

ATT using the *sensatt* procedure (Ichino et al., 2008) was conducted to examine whether findings were sensitive to violations of the strong ignorability assumption. Insensitive estimates would lend causal inference more defensible. All analyses were conducted in Stata 15 (StataCorp, 2017).

Results

Descriptive Statistics of the Analytic Sample

About two thirds of mothers reported a very positive relationship with the doula at 3-weeks postpartum (i.e., 3.5 or above on a 4-point scale of the working alliance scale, $n = 84$, 67.7%) and about one third of mothers reported a less positive relationship (i.e., below 3.5, $n = 40$, 32.3%). Table 4.1 shows the descriptive statistics of baseline covariates between mothers with a very positive relationship with the doula and mothers with a less positive relationship. Since the significance from *t*-tests and *chi-square* tests can be influenced by the sample size, standardized differences were also presented. The absolute standardized differences of several baseline variables were greater than 0.25, indicating imbalance between treated and control mothers. Mothers with a very positive relationship with the doula were older, reported higher levels of general social support and support from, trust and communication with their parent figure and lower levels of parental rejection, depressive symptoms, and alienation with their parent figure. They also expressed more positive feelings towards children and reported valuing motherhood more than their counterparts who reported a less positive relationship with the doula. Table 4.2 shows the means of each of the five parenting behaviors of the two groups and the pairwise correlations between the continuous working alliance scores and the parenting behaviors. Mothers with a very positive relationship with their doula scored higher on sensitivity and careful handling and lower on detachment.

Table 4.1 Baseline Characteristics of the Study Sample (N = 124)

	Treated (i.e., working alliance ≥3.5)	Control (i.e., working alliance < 3.5)	Group difference	Standardized difference
	n = 84 (67.7%)	*n* = 40 (32.3%)		
Categorical				
Ethnicity			$\chi^2 = 2.17$	
African American	36 (44.0%)	23 (48.9%)		0.22
Latina	33 (43.4%)	18 (38.3%)		**0.29**
European American	7 (9.2%)	6 (12.8%)		0.09
High school degree	38 (45.2%)	15 (37.5%)	$\chi^2 = 0.66$	0.16
Currently working	20 (23.8%)	6 (12.0%)	$\chi^2 = 1.27$	0.22
Coresidence with parent figure	58 (76.3%)	40 (85%)	$\chi^2 = 0.43$	0.13
In a relationship with father of the baby	52 (68.4%)	36 (76.6%)	$\chi^2 = 0.30$	0.11
Infant sex			$\chi^2 = 0.14$	
Male	40 (52.6%)	25 (53.2%)		0.07
Female	36 (47.4%)	22 (46.8%)		
Continuous				
Age	18.78 (1.91)	18.14 (1.53)	*t* = -1.83 †	**0.37**
Parental rejection in childhood	20.73 (5.78)	22.98 (6.32)	*t* = 1.96 †	**0.37**
Depressive symptoms	12.96 (7.94)	15.8 (9.11)	*t* = 1.79 †	**0.33**
Maternal self-confidence	20.46 (3.74)	19.78 (4.38)	*t* = -0.91	0.17
Social support	80.35 (8.07)	76.68 (8.67)	*t* = -2.32 *	**0.44**
Support from parent figure	4.28 (0.83)	3.89 (0.99)	*t* = -2.30 *	**0.43**
Trust with parent figure	13.20 (2.20)	11.95 (3.05)	*t* = -2.60 *	**0.47**
Communication with parent figure	12.66 (2.44)	11.43 (3.24)	*t* = -2.36 *	**0.43**
Alienation with parent figure	6.51 (2.82)	8.10 (2.76)	*t = 2.96***	**0.57**
Perceived negative aspect of childrearing	11.87 (5.55)	13.33 (6.28)	*t* = 1.31	0.25
Maternal worries	25.31 (7.19)	26.70 (6.01)	*t* = 1.06	0.21
Mothers' feelings towards children	25.31 (3.38)	23.73 (3.90)	*t* = -2.32*	**0.43**
Valuing motherhood	18.43 (2.82)	16.80 (3.82)	*t* = -2.67 **	**0.49**

Note. Standard deviations or percentages are in parentheses.
Absolute standardized differences greater than 0.25 (in bold) indicate imbalances in baseline variables.
† $p < 0.1$; * $p < 0.05$, * $p < 0.01$

Table 4.2 Descriptive Statistics of Parenting Behaviors at 3-Months Postpartum by Treatment Status

	Treated (very positive mother-doula relationship)	Control (less positive mother-doula relationship)	*t*-test statistics	Pairwise correlation between continuous working alliance and parenting outcomes
Sensitivity	2.38 (0.64)	2.10 (0.55)	2.40 *	0.23 *
Careful handling	2.51 (0.59)	2.15 (0.80)	2.83 **	0.17 †
Intrusiveness	0.14 (0.35)	0.25 (0.43)	1.46	-0.21 **
Detachment	0.07 (0.26)	0.23 (0.42)	2.49 *	-0.22 *
Stimulation	1.76 (0.72)	1.83 (0.81)	0.44	-0.03

Note. Standard deviations or percentages are in parentheses.
† $p < 0.1$; * $p < 0.05$, * $p < 0.01$

Propensity Score-Based Analysis

Inverse Probability of Treatment Weighting Analysis. The propensity score model was a logistic regression in which the binary treatment of whether having a very positive relationship with the doula was regressed on baseline covariates. The estimated propensity score (i.e., probability of receiving the treatment) was estimated for each mother. After applying IPTW weights, standardized differences and variance ratios were calculated for baseline covariates, including those not included in the propensity score model (Stuart, 2010) and the propensity score. To reach a final propensity score model, an iterative procedure was used. To improve balance, possible solutions suggested by Garrido and colleagues (2014) were used, including dropping variables that are less theoretically important, recategorizing variables, and adding interactions between variables. The following propensity score model was used (Model 1):

$$\ln\left(\frac{P(Z=1)}{1-P(Z=1)}\right) = \ln\left(\frac{\theta}{1-\theta}\right) = \beta_0 + \beta_1 MotherAge + \beta_2 AfricanAmerican + \beta_3 EuropeanAmerican + \beta_4 HighSchoolDegree + \beta_5 Employed + \beta_6 InARelationshipWithFatherOfBaby + \beta_7 ParentalRejection + \beta_8 DepressiveSymptoms + \beta_9 SocialSupport + \beta_{10} SupportFromParentFigure + \beta_{11} AlienationWithParentFigure + \beta_{12} FeelingsToChidlren$$

This model provided satisfactory balances in baseline variables (Table 4.3), including those that were included in the propensity score model and those that were not (i.e., absolute standardized difference smaller than 0.25 and variance ratio close to 1. The overlap assumption was satisfied since the estimated propensity score of each mother fell in the range of (0, 1). Figure 4.1 shows the distribution of estimated propensity score of the two groups. Since there were no sizable differences between the maxima and minima of the density distribution, no cases were removed (Baum, 2013).

Table 4.3 Raw and Weighted Absolute Standardized Differences of Baseline Covariates

	Raw standardized difference	Model 1 (IPTW)
Estimated propensity score	0.88	0.08
Baseline variables		
Age	0.37	**0.10**
Ethnicity (reference = Latina)		
African American	0.22	**0.15**
European American	0.09	**0.01**
High school degree	0.16	**0.03**
Currently working	0.22	**0.04**
In a relationship with father of the baby	0.11	**0.06**
Parental rejection in childhood	0.37	**0.02**
Depressive symptoms	0.33	**0.02**
Social support	0.44	**0.03**
Support from parent figure	0.43	**0.03**
Alienation with parent figure	0.57	**0.07**
Mothers' feelings towards children	0.43	**0.07**
Infant sex (reference = girl)	0.07	0.04
Valuing motherhood	0.49	0.13
Trust with parent figure	0.47	0.06
Communication with parent figure	0.43	0.02
Maternal self-confidence	0.17	0.06
Perceived negative aspect of childbearing	0.25	0.09
Maternal worries	0.21	0.02
Coresidence with parent figure	0.13	0.21

Note. Bolded cells indicate variables included in the propensity score model.

Figure 4.1 Distribution of Estimated Propensity Score (N = 123)

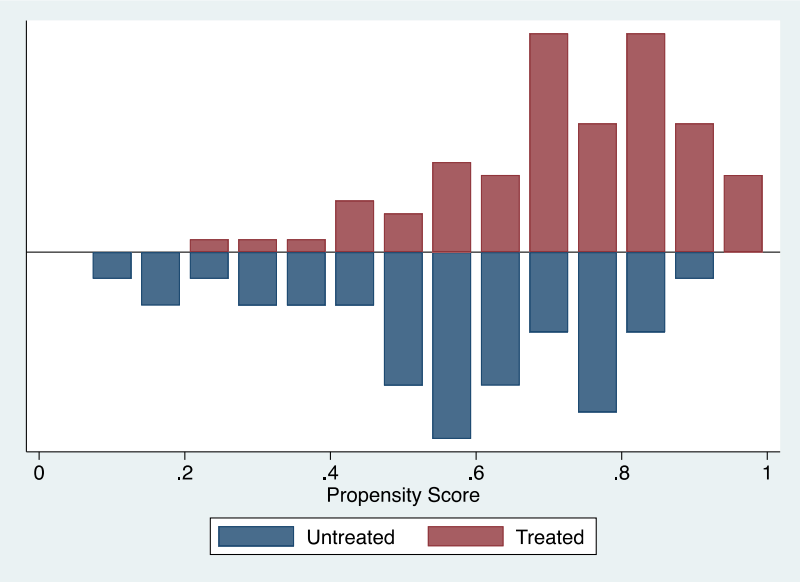


Table 4.4 shows the estimated average treatment effect (ATE) and average treatment effect on the treated (ATT) of having a very positive relationship with the doula on mothers' parenting behaviors via IPTW analyses. Mothers in the two groups did not differ on stimulation, intrusiveness or detachment, but did differ on sensitivity and careful handling. Mothers with a less positive relationship with her doula on average scored 2.08 on the 3-point sensitivity scale (i.e., moderate), and mothers with a good relationship with her doula on average scored 0.27 point higher. Mothers with a less positive relationship with her doula on average scored 2.17 on the 3-point careful handling scale (i.e., moderate), and mothers with a good relationship with her doula on average scored 0.28 point higher.

Table 4.4 Estimated Average Treatment Effect (ATE) and Average Treatment Effect on the Treated (ATT) of a Very Positive Mother-Doula Relationship on Parenting Outcomes of Model 1

	Sensitivity	Careful Handling	Intrusiveness	Detachment	Stimulation
ATE (IPTW)	0.27*	0.28*	-0.07	-0.11	-0.20
	(0.11)	(0.14)	(0.08)	(0.07)	(0.14)
ATT (IPTW)	0.32**	0.32*	-0.08	-0.13	-0.23
	(0.12)	(0.16)	(0.09)	(0.08)	(0.16)
ATT (Radius Matching)	0.31*	0.30 †	-0.07	-0.16 †	-0.17
	(0.16)	(0.17)	(0.09)	(0.09)	(0.17)

Note. † $p<0.1$, * $p < 0.05$, ** $p < 0.01$. Standard errors in parentheses.
In ATT(Matching), standard errors were analytical standard errors obtained via *attr* radius matching with in Stata.

Propensity Score Matching. Propensity score-based radius matching was applied to estimate ATT. Each treated unit was matched only with the control units whose propensity score were in a predefined neighborhood of the propensity score of the treated unit (Becker & Ichino, 2002). Both 0.1 (the default in Stata) and 0.08 were used to define the neighborhood. Balances in the baseline variables in the propensity score model were achieved. (Estimated ATT using radius 0.08 were similar to results from using radius 0.1, thus was not presented, but was available upon request.) Mothers with a very positive relationship with her doula scored about 0.3 point higher on sensitivity and careful handling than their counterpart, although the latter was only significant at the 0.1 level ($p = 0.07$). Overall, propensity score-based radius matching supported the findings from the previous IPTW analyses.

Two other specifications of propensity score models (Model 2 and Model 3) also provided satisfactory balances in baseline characteristics. Their balance checking and estimated ATE and ATT are presented in Appendix D. The above IPTW and PSM analyses were done with Model 2 and Model 3, and the results were robust across three differently specified propensity score models.

Robustness Check using Different Cutoffs for the Working Alliance Inventory

In the analyses reported above, a cutoff of 3.5 was used for the 4-point Working Alliance Inventory-Short Form to create the binary "treatment" variable (1 = 3.5 or above, a very positive mother-doula relationship; 0 = below 3.5, a less positive relationship). To examine whether those findings are robust to different dichotomization, the above analytical procedures for ATE were applied when 3.4 and 3.6 were used as cutoffs for the 4-point Working Alliance Inventory-Short Form (Table 4.5). Results regarding the difference in parenting sensitivity and careful handling were consistent with those using 3.5 as the cutoff, although the difference in parenting sensitivity when 3.6 was used as cutoff was only significant at 0.1 level ($p = 0.07$). (ATT estimates using 3.4 and 3.6 were not presented since some prognostically important baseline variables were not balanced, thus rendering the ATT estimates invalid.)

Table 4.4 Estimated Average Treatment Effect of a Very Positive Mother-Doula Relationship on Parenting Outcomes Using Different Cutoffs

	Sensitivity	Careful Handling	Intrusiveness	Detachment	Stimulation
3.4 as cutoff (treated: n = 93, 75.0%; untreated: n = 31, 25.0%)					
ATE (IPTW)	0.34*	0.35*	-0.03	-0.14	-0.14
	(0.16)	(0.17)	(0.09)	(0.10)	(0.19)
3.6 as cutoff (treated: n = 69, 55.7%; untreated: n = 55, 44.4%)					
ATE (IPTW)	0.19 †	0.26*	-0.01	-0.10 †	-0.10
	(0.10)	(0.11)	(0.07)	(0.05)	(0.12)

Note. † $p<0.1$, * $p<0.05$, ** $p<0.01$. Standard error in parentheses.
ATT results were likely to be invalid, thus were not presented since some prognostically important baseline variables were not balanced. For example, the standardized differences of male in 3.6 cutoff and valuing motherhood in 3.4 cutoff were greater than 0.25.

Sensitivity Analysis Examining the Strong Ignorability Assumption

The strong ignorability assumption assumes once conditioning on propensity scores, treatment is as-good-as randomly assigned. This assumption is not directly testable and requires

sensitivity analysis. The *sensatt* procedure in Stata was used to examine how robust or insensitive ATT estimates of the effect of mother-doula relationship on parenting sensitivity and careful handling were to unobserved or unmeasured confounders. (Details of the sensitivity analysis can be found in Appendix E.) The sensitivity analysis shows that the findings are robust even when there exists an unobserved or unmeasured confounder with relatively strong associations to both the mother-doula relationship and parenting outcomes, lending support to the causal role of the mother-doula relationship.

Discussion

Many early childhood home visiting interventions are based on the principal that the provider-parent relationship is a critical medium through which desired intervention outcomes are achieved. However, researchers are limited in making a causal claim regarding the role of provider-parent relationships because of methodological challenges (e.g., infeasibility of randomizing relationship quality). This study used propensity score-based methods to examine the theorized impact of provider-parent relationships on intervention outcomes and found that a very positive mother-doula relationship was related to parenting sensitivity and careful handling, although not to parenting intrusiveness, detachment, or stimulation. In these analyses, mothers with a very positive relationship and mothers with a less positive relationship were balanced on a wide array of baseline characteristics. The findings were supported by a variety of robustness checks, including three specifications of propensity score models, two propensity-based methods (i.e., inverse probability of treatment weighting and propensity score matching), different cutoffs for the dichotomization of the continuous measure of the mother-doula relationship when creating the "treatment" (i.e., 3.4, 3.5, and 3.6 on a 4-point working alliance scale), and sensitivity analyses of the strong ignorability assumption.

The finding that a very positive mother-doula relationship was related to observed parenting sensitivity and careful handling during mother-infant interactions supports the hypothesis that relationships matter in home visiting interventions but does not explain the mechanisms through which those relationships matter. One explanation is that relationships matter through a parallel process (Bernstein et al., 2001; Emde et al., 2000; Wong, 2009)—that supportive mother-child relationships will parallel supportive provider-mother relationships through a process of emotional transference and/or modeling. In a very positive mother-doula relationship, mothers may have experienced the doula as an emotionally available caregiving figure, whose acceptance and understanding may make the mothers feel valued and transfer those feelings to their baby (Bernstein, 2002). The experience of being accepted and cared for in a safe and nurturing environment provided by the doula then shaped the way that the mothers interacted with her infant such as to be observant of and respond to her infant's cues more effectively. Additionally, doulas use gentle touch with the mothers during pregnancy and childbirth (Yarbrough, 2005), and mothers with a good mother-doula relationship may in turn more likely to use gentle touching demonstrated by the doula when holding and physically supporting her young infant.

The mother-doula relationship, however, was not related to all types of parenting behavior that were examined in this study, including parenting stimulation. Although doulas are effective at helping mothers to talk to their infants and otherwise promote their infants learning compared to mothers who only received case management in the RCT (Edwards et al., 2020), within mothers in the doula home visiting group, those having a very positive relationship with their doula did not differ from their counterparts on the level of stimulation provided to their infant. It is possible that regardless of the relationship quality with their doula, mothers well

received the message from her doula and agreed with the benefit of early stimulation and infant development; they then engaged in behaviors such as labeling and describing to similar extent when interacting with their infant. In other words, it is likely that the provision of stimulation was promoted not through a parallel process in which building trust and bond between the doula and the mother was a priority for building a bond between the mother and baby, but through the doula sharing knowledge of stimulation and early brain development with the mother, which was not highly dependent on the relationship quality between them.

Also, the mother-doula relationship was not predictive of parenting intrusiveness or detachment. The non-significant findings could be due to how doulas work with mothers. They are trained not to focus on negative aspects of the mother-child relationship, but rather to nurture positive behaviors. They work with the family in ways that build upon family strengths, in particular to be non-judgmental and to "use inquiry as intervention" instead of singling out problems for mothers to fix. Doulas avoid correcting mothers, but instead, they share a positive observation by commenting on the infant's behavior (e.g., "He seemed to like it when …") and inquire about how the mothers understand and interpret the infant's behavior (e.g., "What made you decide to try that?") (Bernstein, 2002). This "inquiry-as-intervention" approach may be more effective in promoting positive parenting behavior since mothers may perceive doulas' inquiries and questions regarding positive mother-infant interactions as a validation for her parenting behavior (e.g., positive reinforcement), therefore continue such practices. This approach may be less effective in preventing negative parenting behavior (e.g., intrusiveness and detachment) since doulas do not directly point out these behaviors and mothers may not perceive them as problematic (e.g., raising voice to get the child's attention). Future studies can examine the specificity of how the home visitor-mother relationship, service content (e.g., whether focusing

on infant learning), and approaches (e.g., inquiry as intervention) shape varying domains of parenting behaviors.

This study has its limitations, and the findings need to be interpreted with caution. First, the mother-doula working alliances were only rated by the mothers. Future studies can explore home visitor-rated (see e.g., Heinicke et al., 2000) and independent observer-rated (see e.g., Roggman et al., 2016) working alliances since working alliances rated from different perspectives are usually inconsistent (Hans et al., 2017; Shick Tryon et al., 2007). Second, this study only measured the mother-doula working alliance at one time point, and longitudinal measurement is needed since evidence suggests that working alliances may be "a moving target" and go through periods of disruption and repair (Emde et al., 2000). Third, this study only measured the mother's working alliance with her doula at 3 weeks postpartum and not with her home visitor. Although the mother typically spends less time with her home visitor during pregnancy and immediately postpartum, this relationship may nonetheless have unique implications for early parenting behavior. Fourth, despite some sensitivity analyses to support the findings of this study, unobserved and/or unmeasured confounders, such as mothers' adult attachment style and characteristics of home visitors, programs, and neighborhoods, can nevertheless pose a threat to the causal role of mother-doula relationship. Future research can include characteristics at the mother-, home visitor-, program-, and neighborhood levels and examine the robustness of findings from this study. Additionally, it is possible that post-treatment characteristics, such as postpartum depression, may shape the parenting behavior. Mediation analysis can be used to further specify the pathways from mother-doula relationship to parenting behavior. Last but not least, this study did not include mothers who had missing data

on working alliances or the parenting outcomes, and the generalization of findings to home visiting participants who drop out of interventions or studies should be cautioned.

Despite these limitations, this study provided important empirical evidence to the causal role of the home visitor-mother relationship, especially the parallel process that has long been theorized to be at the core of home visiting interventions. As pointed out by Emde and colleagues (2000), home visitors work "in a network of relationships" and their relationships with mothers and families are a key medium through which positive parenting and other intervention goals are achieved. Home visiting service providers should prioritize building a positive relationship with families in order to promote positive parenting. To facilitate this relationship-building process, researchers can further examine whether the effect of this active ingredient is moderated by mother-, family-, and home visitor-characteristics and the specific pathways through which the effect is mediated to influence parenting behavior.

References

Acock, A. C. (2013). *Discovering structural equation modeling using Stata*. Stata Press.

Armsden, G. C., & Greenberg, M. T. (1987). The inventory of parent and peer attachment: Individual differences and their relationship to psychological well-being in adolescence. *Journal of Youth and Adolescence*, *16*(5), 427–454.

Austin, P. C. (2011). An introduction to propensity score methods for reducing the effects of confounding in observational studies. *Multivariate Behavioral Research*, *46*(3), 399–424. https://doi.org/10.1080/00273171.2011.568786

Austin, P. C., Grootendorst, P., & Anderson, G. M. (2007). A comparison of the ability of different propensity score models to balance measured variables between treated and untreated subjects: A Monte Carlo study. *Statistics in Medicine*, *26*(4), 734–753.

Austin, P. C., & Stuart, E. A. (2015). Moving towards best practice when using inverse probability of treatment weighting (IPTW) using the propensity score to estimate causal treatment effects in observational studies. *Statistics in Medicine*, *34*(28), 3661–3679. https://doi.org/10.1002/sim.6607

Baum, C. F. (2013). *Propensity score matching, regression discontinuity, limited dependent variables*. Boston College Department of Economics. https://fmwww.bc.edu/EC-C/S2013/823/EC823.S2013.nn12.slides.pdf

Beauford, J. E., McNiel, D. E., & Binder, R. L. (1997). Utility of the initial therapeutic alliance in evaluating psychiatric patients' risk of violence. *The American Journal of Psychiatry, 154*(9), 1272–1276. https://doi.org/10.1176/ajp.154.9.1272

Becker, S. O., & Ichino, A. (2002). Estimation of average treatment effects based on propensity scores. *The Stata Journal*, *2*(4), 358–377. https://doi.org/10.1177/1536867X0200200403

Belsky, J. (1984). The determinants of parenting: A process model. *Child Development*, *55*(1), 83. https://doi.org/10.2307/1129836

Bernstein, V. (2002). Strengthening families through strengthening relationships: Supporting the parent-child relationship through home visiting. *Newsletter of the Infant Mental Health Promotion Project*, *35*, 1–5.

Bernstein, V. J., Campbell, S., & Akers, A. (2001). Caring for the caregivers: Supporting the well-being of at-risk parents and children through supporting the well-being of the programs that serve them. In J. N. Hughes, A. M. La Greca, & J. C. Conole (Eds.), *Handbook of psychological services for children and adolescents* (pp. 107–131). Oxford University Press.

Bordin, E. S. (1975). *The working alliance: Basis for a general theory of psychotherapy*. Annual Meeting of the American Psychological Association, Washington, D.C.

Bornstein, M. H. (2019). Parenting infants. In M. H. Bornstein (Ed.), *Handbook of parenting: Vols. 1. Children and parenting* (3rd ed., pp. 3–55). Routledge.

Brookhart, M. A., Schneeweiss, S., Rothman, K. J., Glynn, R. J., Avorn, J., & Stürmer, T. (2006). Variable selection for propensity score models. *American Journal of Epidemiology*, *163*(12), 1149–1156. https://doi.org/10.1093/aje/kwj149

Castonguay, L. G., Constantino, M. J., & Holtforth, M. G. (2006). The working alliance: Where are we and where should we go? *Psychotherapy: Theory, Research, Practice, Training*, *43*(3), 271–279. https://doi.org/10.1037/0033-3204.43.3.271

Cutrona, C. E., & Russell, D. W. (1987). The provisions of social relationships and adaptation to stress. *Advances in Personal Relationships*, *1*(1), 37–67.

de Greef, M., Pijnenburg, H. M., van Hattum, M. J. C., McLeod, B. D., & Scholte, R. H. J. (2017). Parent-professional alliance and outcomes of child, parent, and family treatment: A systematic review. *Journal of Child and Family Studies*, *26*(4), 961–976. https://doi.org/10.1007/s10826-016-0620-5

Duncan, G. J., Magnuson, K., & Votruba-Drzal, E. (2017). Moving beyond correlations in assessing the consequences of poverty. *Annual Review of Psychology*, *68*, 413–434.

Edwards, R. C., Vieyra, Y., & Hans, S. L. (2020). Maternal support for infant learning: Findings from a randomized controlled trial of doula home visiting services for young mothers. *Early Childhood Research Quarterly*, *51*, 26–38. https://doi.org/10.1016/j.ecresq.2019.08.001

Elicker, J., Wen, X., Kwon, K.-A., & Sprague, J. B. (2013). Early Head Start relationships: Association with program outcomes. *Early Education & Development*, *24*(4), 491–516. https://doi.org/10.1080/10409289.2012.695519

Emde, R. N., Korfmacher, J., & Kubicek, L. F. (2000). Towards a theory of early relationship-based intervention. In J. D. Osofsky & H. I. Fitzgerald (Eds.), *Early Intervention, Evaluation & Assessment* (Vol. 1–Vol 2 of World Association of Infant Mental Health Handbook of Infant Mental Health, pp. 2–32). John Wiley & Sons.

Friedlander, M. L., Escudero, V., Heatherington, L., & Diamond, G. M. (2011). Alliance in couple and family therapy. *Psychotherapy*, *48*(1), 25–33. https://doi.org/10.1037/a0022060

Garrido, M. M., Kelley, A. S., Paris, J., Roza, K., Meier, D. E., Morrison, R. S., & Aldridge, M. D. (2014). Methods for constructing and assessing propensity scores. *Health Services Research*, *49*(5), 1701–1720. https://doi.org/10.1111/1475-6773.12182

Hans, S. L., Edwards, R. C., & Zhang, Y. (2018). Randomized controlled trial of doula-home-visiting services: Impact on maternal and infant health. *Maternal and Child Health Journal*, *22*(1), 105–113. https://doi.org/10.1007/s10995-018-2537-7

Hans, S., Wen, X., & Korfmacher, J. (2017). *Helping relationships in a doula home visiting program: Perspectives from young mothers and home visitors*. Society for Social Work and Research 21st Annual Conference, New Orleans, LA. https://sswr.confex.com/sswr/2017/webprogram/Paper29168.html

Harder, V. S., Stuart, E. A., & Anthony, J. C. (2010). Propensity score techniques and the assessment of measured covariate balance to test causal associations in psychological research. *Psychological Methods*, *15*(3), 234.

Harrell, F. E. (2015). *Regression modeling strategies: With applications to linear models, logistic and ordinal regression, and survival analysis* (2nd ed.). Springer.

Heinicke, C. m., Goorsky, M., Moscov, S., Dudley, K., Gordon, J., Schneider, C., & Guthrie, D. (2000). Relationship-based intervention with at-risk mothers: Factors affecting variations in outcome. *Infant Mental Health Journal*, *21*(3), 133–155. https://doi.org/10.1002/1097-0355(200007)21:3<133::AID-IMHJ1>3.0.CO;2-P

Hong, G. (2015). *Causality in a social world: Moderation, mediation and spill-over*. John Wiley & Sons, Ltd.

Horvath, A. O. (2000). The therapeutic relationship: From transference to alliance. *Journal of Clinical Psychology*, *56*(2), 163–173. https://doi.org/10.1002/(SICI)1097-4679(200002)56:2<163::AID-JCLP3>3.0.CO;2-D

Horvath, A. O. (n.d.). *Criteria for "good alliance"*. Working alliance inventory. https://wai.profhorvath.com/criteria

Horvath, A. O., Del Re, A. C., Flückiger, C., & Symonds, D. (2011). Alliance in individual psychotherapy. *Psychotherapy*, *48*(1), 9–16. https://doi.org/10.1037/a0022186

Horvath, A. O., & Greenberg, L. S. (1989). Development and validation of the Working Alliance Inventory. *Journal of Counseling Psychology*, *36*(2), 223–233. https://doi.org/10.1037/0022-0167.36.2.223

Horvath, A. O., & Symonds, B. D. (1991). Relation between working alliance and outcome in psychotherapy: A meta-analysis. *Journal of Counseling Psychology*, *38*(2), 139–149. https://doi.org/10.1037/0022-0167.38.2.139

Humphries, M. L., & Korfmacher, J. (2012). The good, the bad, and the ambivalent: Quality of alliance in a support program for young mothers. *Infant Mental Health Journal*, *33*(1), 22–33. https://doi.org/10.1002/imhj.20334

Ichino, A., Mealli, F., & Nannicini, T. (2008). From temporary help jobs to permanent employment: What can we learn from matching estimators and their sensitivity? *Journal of Applied Econometrics*, *23*(3), 305–327. https://doi.org/10.1002/jae.998

Imbens, G. W. (2004). Nonparametric estimation of average treatment effects under exogeneity: A review. *Review of Economics and Statistics*, *86*(1), 4–29.

Joffe, M. M., Ten Have, T. R., Feldman, H. I., & Kimmel, S. E. (2004). Model selection, confounder control, and marginal structural models: Review and new applications. *The American Statistician*, *58*(4), 272–279.

Kaitz, M., Chriki, M., Tessler, N., & Levy, J. (2018). Predictors of self-reported gains in a relationship-based home-visiting project for mothers after childbirth. *Infant Mental Health Journal*, *39*(2), 123–133. https://doi.org/10.1002/imhj.21693

Kelly, J. F., & Barnard, K. E. (1999). Parent education within a relationship-focused model. *Topics in Early Childhood Special Education*, *19*(3), 151–157.

Korfmacher, J., Green, B., Spellmann, M., & Thornburg, K. R. (2007). The helping relationship and program participation in early childhood home visiting. *Infant Mental Health Journal*, *28*(5), 459–480.

Korfmacher, J., Kitzman, H., & Olds, D. (1998). Intervention processes as predictors of outcomes in a preventive home-visitation program. *Journal of Community Psychology*, *26*(1), 49–64.

Lee, E., Esaki, N., Kim, J., Greene, R., Kirkland, K., & Mitchell-Herzfeld, S. (2013). Organizational climate and burnout among home visitors: Testing mediating effects of empowerment. *Children and Youth Services Review*, *35*(4), 594–602. https://doi.org/10.1016/j.childyouth.2013.01.011

Li, J., & Julian, M. M. (2012). Developmental relationships as the active ingredient: A unifying working hypothesis of "what works" across intervention settings. *American Journal of Orthopsychiatry*, *82*(2), 157–166. https://doi.org/10.1111/j.1939-0025.2012.01151.x

Marsh, J. C., Angell, B., Andrews, C. M., & Curry, A. (2012). Client-provider relationship and treatment outcome: A systematic review of substance abuse, child welfare, and mental health services research. *Journal of the Society for Social Work and Research*, *3*(4), 233–267. https://doi.org/10.5243/jsswr.2012.15

Masten, M. A., Poirier, A., & Zhang, L. (2019). *tesensitivity: A Stata package for assessing the unconfoundedness assumption* (p. 35). Stata Conference.

McLeod, B. D. (2011). Relation of the alliance with outcomes in youth psychotherapy: A meta-analysis. *Clinical Psychology Review*, *31*(4), 603–616. https://doi.org/10.1016/j.cpr.2011.02.001

McLoyd, V., Mistry, R. S., & Hardaway, C. R. (2014). Poverty and children's development: Familial processes as mediating influences. In E. T. Gershoff, R. S. Mistry, & D. A. Crosby (Eds.), *Societal contexts of child development: Pathways of influence and implications for practice and policy* (pp. 109–124). Oxford University Press.

McNaughton, D. B. (2000). A synthesis of qualitative home visiting research. *Public Health Nursing*, *17*(6), 405–414. https://doi.org/10.1046/j.1525-1446.2000.00405.x

National Academies of Sciences, Engineering, and Medicine, Division of Behavioral and Social Sciences and Education, Board on Children, Youth, and Families, & Committee on Supporting the Parents of Young Children. (2016). Parenting knowledge, attitudes, and practices. In H. Breiner, M. Ford, & V. L. Gadsden (Eds.), *Parenting matters: Supporting parents of children ages 0-8* (Vol. 21, p. 2019). National Academies Press.

NICHD Early Child Care Research Network. (1997). The effects of infant child care on infant-mother attachment security: Results of the NICHD Study of Early Child Care. *Child Development*, *68*(5), 860–879. https://doi.org/10.2307/1132038

Ounce of Prevention Fund. (2020). *Tips for early childhood educators: Building relationships to support children*. Ounce of Prevention Fund. https://www.theounce.org/resources/ready-to-learn/building-relationships-support-children/

Patrick, A. R., Schneeweiss, S., Brookhart, M. A., Glynn, R. J., Rothman, K. J., Avorn, J., & Stürmer, T. (2011). The implications of propensity score variable selection strategies in pharmacoepidemiology – an empirical illustration. *Pharmacoepidemiology and Drug Safety*, *20*(6), 551–559. https://doi.org/10.1002/pds.2098

Pirracchio, R., Resche-Rigon, M., & Chevret, S. (2012). Evaluation of the propensity score methods for estimating marginal odds ratios in case of small sample size. *BMC Medical Research Methodology*, *12*(1), 70. https://doi.org/10.1186/1471-2288-12-70

Radloff, L. S. (1977). The CES-D scale: A self-report depression scale for research in the general population. *Applied Psychological Measurement*, *1*(3), 385–401. https://doi.org/10.1177/014662167700100306

Rijken, A. J., & Liefbroer, A. C. (2009). The influence of partner relationship quality on fertility. *European Journal of Population / Revue Européenne de Démographie*, *25*(1), 27–44. https://doi.org/10.1007/s10680-008-9156-8

Roggman, L. A., Cook, G. A., Innocenti, M. S., Norman, V. J., Boyce, L. K., Christiansen, K., & Peterson, C. A. (2016). Home visit quality variations in two Early Head Start programs in relation to parenting and child vocabulary outcomes. *Infant Mental Health Journal*, *37*(3), 193–207. https://doi.org/10.1002/imhj.21565

Rohner, R. P., Saavedra, J. M., & Granum, E. O. (1978). *Development and validation of the Parental Acceptance-Rejection Questionnaire: Test manual*. JSAS Catalogue of Selected Documents in Psychology #1635.

Rosenbaum, P. R., & Rubin, D. B. (1983). The central role of the propensity score in observational studies for causal effects. *Biometrika*, *70*(1), 41–55.

Rosenbaum, P. R., & Rubin, D. B. (1984). Reducing bias in observational studies using subclassification on the propensity score. *Journal of the American Statistical Association*, *79*(387), 516–524.

Rubin, D. B. (1997). Estimating causal effects from large data sets using propensity scores. *Annals of Internal Medicine*, *127*(8_Part_2), 757–763.

Rubin, D. B. (2001). Using propensity scores to help design observational studies: Application to the tobacco litigation. *Health Services and Outcomes Research Methodology*, *2*(3–4), 169–188.

Ruble, D. N., Brooks-Gunn, J., Fleming, A. S., Fitzmaurice, G., Stangor, C., & Deutsch, F. (1990). Transition to motherhood and the self: Measurement, stability, and change. *Journal of Personality and Social Psychology*, *58*(3), 450.

Ruch, G. (2005). Relationship-based practice and reflective practice: Holistic approaches to contemporary child care social work. *Child & Family Social Work*, *10*(2), 111–123. https://doi.org/10.1111/j.1365-2206.2005.00359.x

Sama-Miller, E., Akers, L., Mraz-Esposito, A., Coughlin, R., Zukiewicz, M., Avellar, S., Paulsell, D., & Del Grosso, P. (2018). *Home visiting evidence of effectiveness review: Executive summary* [Mathematica Policy Research Reports]. Office of Planning, Research and Evaluation, Administration for Children and Families, U.S. Department of Health and Human Services. https://econpapers.repec.org/paper/mprmprres/ab92c1547bc142a6815d64f332358eb3.htm

Santos, R. G. (2005). *Effectiveness of early intervention for infants and their families: Relating the working alliance to program outcomes* [Unpublished doctoral dissertation]. University of Manitoba.

Shick Tryon, G., Collins Blackwell, S., & Felleman Hammel, E. (2007). A meta-analytic examination of client–therapist perspectives of the working alliance. *Psychotherapy Research*, *17*(6), 629–642. https://doi.org/10.1080/10503300701320611

Shonkoff, J. P., & Phillips, D. A. (Eds.). (2000). *From neurons to neighborhoods: The science of early childhood development*. National Academy Press.

Sønsterud, H., Kirmess, M., Howells, K., Ward, D., Billaud Feragen, K., & Halvorsen, M. (2019). The working alliance in stuttering treatment: A neglected variable? *International Journal of Language & Communication Disorders, 54*. https://doi.org/10.1111/1460-6984.12465

StataCorp. (2017). *Stata statistical software: Release 15*. StataCorp LLC.

Stern, D. N. (1995). *The motherhood constellation: A unified view of parent-infant psychotherapy*. Karnac Books.

Stone, C. A., & Tang, Y. (2013). Comparing propensity score methods in balancing covariates and recovering impact in small sample educational program evaluations. *Practical Assessment, Research, and Evaluation*, *18*(1), 13.

Stuart, E. A. (2010). Matching methods for causal inference: A review and a look forward. *Statistical Science : A Review Journal of the Institute of Mathematical Statistics*, *25*(1), 1–21. https://doi.org/10.1214/09-STS313

Supplee, L. H., & Duggan, A. (2019). Innovative research methods to advance precision in home visiting for more efficient and effective programs. *Child Development Perspectives*, *13*(3), 173–179. https://doi.org/10.1111/cdep.12334

Tracey, T. J., & Kokotovic, A. M. (1989). Factor structure of the Working Alliance Inventory. *Psychological Assessment: A Journal of Consulting and Clinical Psychology*, *1*(3), 207–210. https://doi.org/10.1037/1040-3590.1.3.207

Wong, J. Y. (2009). Understanding and utilizing parallel processes of social interaction for attachment-based parenting interventions. *Clinical Social Work Journal*, *37*(2), 163–174. https://doi.org/10.1007/s10615-008-0155-3

Yamamoto-Mitani, N., Aneshensel, C. S., & Levy-Storms, L. (2002). Patterns of family visiting with institutionalized elders: The case of dementia. *The Journals of Gerontology: Series B*, *57*(4), S234–S246. https://doi.org/10.1093/geronb/57.4.S234

Yarbrough, K. (2005). *The first days of life: Adding doulas to early childhood programs*. Ounce of Prevention Fund. https://www.theounce.org/wp-content/uploads/2017/03/FirstDaysofLife.pdf

CHAPTER 5
DISCUSSION

This three-paper dissertation used data from mothers who were assigned to the intervention group in a randomized controlled trial (RCT) of doula-enhanced home visiting services. It explored the variation in the service implementation process and associated mother and family characteristics, and the causal role of the mother-doula relationship in promoting positive parenting. Specifically, this dissertation found, in its three chapters, that: (1) There were differential patterns of supportive relationships across mothers, and that there was evidence for both "relationship-driven" and "needs-driven" mechanisms explaining mothers' involvement with their service providers. Specifically, mothers with strong supportive relationships tended to build a stronger relationship with their doula prenatally but experienced a decrease in service quantity postpartum. Mothers with more difficult relationships in their life histories, especially those who experienced parental rejection in childhood and alienation from their current parent figure, tended to be more involved in home visiting services postpartum; (2) Half of mothers remained in services at one year postpartum, and the largest percentage of attrition occurred from the second to the third month postpartum. Mothers who reported higher levels of risk-taking behavior and were at educational risk, who used only English at home, and who were in later months of pregnancy at service initiation discontinued services more rapidly; (3) A very positive mother-doula relationship was associated with greater maternal sensitivity and careful handling of the infant, but not associated with maternal intrusiveness, detachment or stimulation. Together, findings from the three-paper dissertation revealed important variability in the quantity and quality of services received by home visiting participants and demonstrated the importance of strong mother-home visitor relationships. These specific findings are discussed in detail within each of the papers.

Implications for Practice

Social workers are an integral part of the early childhood workforce. According to a national survey of the MIECHV-funded home visiting programs, social work is the second most common degree held by home visitors and supervisors (Sandstrom et al., 2020). Home visiting is a field with high staff turnover. Most home visitors are attracted to their job by their commitment to helping families (Sandstrom et al., 2020), but unfortunately one of the primary causes of departure is stress-related burnout (Bernstein et al., 2001). Insights gained from this dissertation have important implications for both social work and the early childhood field in their training and support of home visitors. These insights focus on two general themes: the importance and complex nature of building relationships, and the challenges and needed resources of building relationships with the most high-risk young mothers.

Through training and experience, home visitors are well aware of the importance of their relationship with mothers who participate in home visiting programs. This study provides validation that better quality home visitor-mother relationships are related to more sensitive mother-infant relationships. The findings also highlight the importance of the mother's other relationships on the development of the home visitor-mother relationship. The home visitor is working with the mother who has been shaped by past and current relationships, including experiences with caregivers during childhood, relationships with her parent figure and the father of the baby, and her general social network. Successful interventions work by targeting the mother-infant relationship, but home visitors need to be aware of the mother's other relationships, including those that "go across three or more generations" (Emde et al., 2000), and the impact they may have on her ability and desire to engage with services. The findings indicate that mothers with difficult family relationships may be hesitant or resistant to engage with

services at first, but they may increase their level of involvement over time. Supervisors can use this finding to help home visitors to understand the dynamic pattern of service involvement of mothers over time and help home visitors understand mothers' perspectives and possible reactions to a supportive figure, especially for mothers who are not accustomed to trusting others. Supervisors can support home visitors when they perceive possible distrust and disengagement from mothers and help them process their feelings and be gently persistent in their efforts to build trust with mothers (Bernstein et al., 2001).

It is well established in the home visiting literature and well known by home visitors and their supervisors that many mothers discontinue participation in home visiting services while they are still eligible. This study documents that mothers who engage in risk-taking behaviors, such as smoking, drinking, risky sexual behavior, and activities resulting in encounters with law enforcement, are likely to discontinue services early. Although this study did not examine the experiences of the home visitors, it is likely that mothers who engage in these behaviors may be experienced as challenging by home visitors. Ongoing supportive and reflective supervision, peer support and training for home visitors are critical (Bernstein et al., 2001; Hans & White, 2019) in encouraging them to continue engaging high risk mothers – mothers who may benefit most from their efforts. Additionally, supervisors can support home visitors in developing an understanding of the risk-taking behavior of young mothers in relation to their social and developmental context, to affirm their "worth, competence, and efficacy", and to nurture their resilience (Breheny & Stephens, 2007; Hans & White, 2019). Mothers enrolled in home visiting programs usually grow up in disadvantaged neighborhoods and family environments, and many witness and experience deep structural and interpersonal traumas, such as neighborhood and family violence, mental health challenges, and substance misuse. Supervisors can use tools such

as the NEAR@Home (NEAR is short for Neuroscience, Epigenetics, Adverse childhood experiences, and Resilience) to integrate trauma-informed principles when supporting home visitors (Cairone et al., 2017; Ounce of Prevention Fund, 2019). With strong support and reflective supervision, home visitors may build skills in carrying out sensitive conversations, facilitate the growth and resilience of their compassion, and appreciate the value of their work in promoting the well-being of mothers, including those whom they may experience as challenging (Ounce of Prevention Fund, 2019).

Strengths, Limitations, and Directions for Future Research

This dissertation has many methodological strengths. First, it linked interview data and administrative data and expanded the research capacity of existing home visiting data (Duggan et al., 2013). Second, it used longitudinal interview data of mothers and captured changes in service involvement. Third, it used both person-oriented and variable-oriented methodology to examine the implementation process of home visiting services, which offered complementary perspectives to conceptualize characteristics of home visiting participants.

This dissertation also has several limitations. First, it only examined one home visiting model—the doula-enhanced home visiting model, and generalizations of findings to other models should be cautioned. Second, data of working alliance from the home visitor's perspective and specific service content at each home visit were lacking. Future research can collect detailed data from the service implementation process and delve deeper into the "*black box*" since "examining the processes by which interventionists achieve outcomes is just as important as examining the outcomes themselves" (Emde et al., 2000). Third, the third paper testing the "relationship as an active ingredient" was restricted to a subsample of mothers who reported their working alliances at 3-weeks postpartum with their doula and who participated in

the video-recorded interaction with their infant at 3-months postpartum. Research on the home visitor-parent relationship should also pay attention to the relationship experience with home visitors among mothers who drop out of services and/or studies and whose voices are not always heard (see e.g., Edwards et al., 2019). Additionally, future studies can explore how the home visitor-parent relationship impacts parenting and whether this process is moderated by mother, home visitor and program characteristics.

It has been ten years since the establishment of the MIECHV program. There are many opportunities for programs to adapt to changing circumstances. For example, as family demographics become more diverse in the U.S., home visiting programs need to train their workforces to meet the diverse needs of families (e.g., immigrant and refugee families, Hilado et al., 2019; Park & Katsiaficas, 2019). Families with young children in poverty are especially vulnerable during challenging times, such as a global pandemic, which pose significant challenges for families to juggle parenting an infant or toddler and meeting basic needs of food and shelter. Many home visiting programs have started to use telephone and/or video communication to reach families when in person visits may not be safe (Health Resources & Services Administration, 2020). Nevertheless, a strong parent-home visitor relationship may still serve as a solid base for home visitors to support parenting and to broker information and resources related to health, food, and housing. A continued research interest in the service delivery process and active ingredients, especially the parent-home visitor relationship, is needed for successful intervention programs.

References (Chapter 1 & 5)

Adirim, T., & Supplee, L. (2013). Overview of the federal home visiting program. *Pediatrics*, *132*(Supplement 2), S59–S64. https://doi.org/10.1542/peds.2013-1021C

Anderson, M. L. (2008). Multiple inference and gender differences in the effects of early intervention: A reevaluation of the Abecedarian, Perry Preschool, and Early Training Projects. *Journal of the American Statistical Association*, *103*(484), 1481–1495.

Bernstein, V. J., Campbell, S., & Akers, A. (2001). Caring for the caregivers: Supporting the well-being of at-risk parents and children through supporting the well-being of the programs that serve them. In J. N. Hughes, A. M. La Greca, & J. C. Conole (Eds.), *Handbook of psychological services for children and adolescents* (pp. 107–131). Oxford University Press.

Blair, C., & Raver, C. C. (2012). Child development in the context of adversity: Experiential canalization of brain and behavior. *American Psychologist*, *67*(4), 309–318. https://doi.org/10.1037/a0027493

Bower, K. M., Nimer, M., West, A. L., & Gross, D. (2020). Parent involvement in Maternal, Infant, and Early Childhood Home Visiting programs: An integrative review. *Prevention Science*. https://doi.org/10.1007/s11121-020-01129-z

Breheny, M., & Stephens, C. (2007). Irreconcilable differences: Health professionals' constructions of adolescence and motherhood. *Social Science & Medicine*, *64*(1), 112–124. https://doi.org/10.1016/j.socscimed.2006.08.026

Brookes, S. J., Summers, J. A., Thornburg, K. R., Ispa, J. M., & Lane, V. J. (2006). Building successful home visitor–mother relationships and reaching program goals in two Early Head Start programs: A qualitative look at contributing factors. *Early Childhood Research Quarterly*, *21*(1), 25–45. https://doi.org/10.1016/j.ecresq.2006.01.005

Cairone, K., Rudick, S., & McAuley, E. (2017). *Creating a trauma-informed home visiting program* (Home Visiting Issues and Insights, Issue Brief: January 2017; p. 13).

Campbell, F. A., Ramey, C. T., Pungello, E., Sparling, J., & Miller-Johnson, S. (2002). Early childhood education: Young adult outcomes from the Abecedarian Project. *Applied Developmental Science*, *6*(1), 42–57. https://doi.org/10.1207/S1532480XADS0601_05

Duggan, A., Minkovitz, C. S., Chaffin, M., Korfmacher, J., Brooks-Gunn, J., Crowne, S., Filene, J., Gonsalves, K., Landsverk, J., & Harwood, R. (2013). Creating a national home visiting research network. *Pediatrics*, *132*(Supplement 2), S82–S89. https://doi.org/10.1542/peds.2013-1021F

Duggan, A., Windham, A., McFarlane, E., Fuddy, L., Lcsw, M., Rohde, C., Buchbinder, S., & Sia, C. (2000). Hawaii's Healthy Start program of home visiting for at-risk families: Evaluation of family identification, family engagement, and service delivery. *Pediatrics*, *105*(Supplement 2), 250–259.

DuMont, K., Mitchell-Herzfeld, S., Greene, R., Lee, E., Lowenfels, A., Rodriguez, M., & Dorabawila, V. (2008). Healthy Families New York (HFNY) randomized trial: Effects on early child abuse and neglect. *Child Abuse & Neglect*, *32*(3), 295–315. https://doi.org/10.1016/j.chiabu.2007.07.007

Duncan, G. J., Magnuson, K., & Votruba-Drzal, E. (2014). Boosting family income to promote child development. *The Future of Children*, *24*(1), 99–120. https://doi.org/10.1353/foc.2014.0008

Edwards, R. C., Zhang, Y., & Hans, S. L. (2019). *Mothers' perspectives on participation and disengagement from doula home visiting services*. Society for Social Work and Research, San Francisco, CA. https://sswr.confex.com/sswr/2019/webprogram/Session10053.html

Emde, R. N., Korfmacher, J., & Kubicek, L. F. (2000). Towards a theory of early relationship-based intervention. In J. D. Osofsky & H. I. Fitzgerald (Eds.), *Early Intervention, Evaluation & Assessment* (Vol. 1–Vol 2 of World Association of Infant Mental Health Handbook of Infant Mental Health, pp. 2–32). John Wiley & Sons.

Evans, G. W. (2004). The environment of childhood poverty. *American Psychologist*, *59*(2), 77–92. https://doi.org/10.1037/0003-066X.59.2.77

Garces, E., Thomas, D., & Currie, J. (2002). Longer-term effects of Head Start. *American Economic Review*, *92*(4), 999–1012. https://doi.org/10.1257/00028280260344560

Gomby, D. S., Culross, P. L., & Behrman, R. E. (1999). Home visiting: Recent program evaluations--Analysis and recommendations. *The Future of Children*, *9*(1), 4–26. https://doi.org/10.2307/1602719

Guterman, N. B. (2001). *Stopping child maltreatment before it starts: Emerging horizons in early home visitation services*. Sage Publications.

Hackman, D. A., Farah, M. J., & Meaney, M. J. (2010). Socioeconomic status and the brain: Mechanistic insights from human and animal research. *Nature Reviews Neuroscience*, *11*(9), 651–659. https://doi.org/10.1038/nrn2897

Hans, S. L., Edwards, R. C., & Zhang, Y. (2018). Randomized controlled trial of doula-home-visiting services: Impact on maternal and infant health. *Maternal and Child Health Journal*, *22*(1), 105–113. https://doi.org/10.1007/s10995-018-2537-7

Hans, S. L., & White, B. A. (2019). Teenage childbearing, reproductive justice, and infant mental health. *Infant Mental Health Journal*, *40*(5), 690–709.

Health Resources and Services Administration, & Administration for Children and Families. (2020). *The Maternal, Infant, and Early Childhood Home Visiting Program: Partnering with parents to help children succeed* (p. 4).

Health Resources & Services Administration. (2020, June 8). *Important home visiting information during COVID-19*. https://mchb.hrsa.gov/Home-Visiting-Information-During-COVID-19

Heckman, J. J. (2006). Skill formation and the economics of investing in disadvantaged children. In *Science* (Vol. 312, Issue 5782, pp. 1900–1902). https://doi.org/10.1126/science.1128898

Heckman, J. J., Moon, S. H., Pinto, R., Savelyev, P. A., & Yavitz, A. (2010). The rate of return to the HighScope Perry Preschool Program. *Journal of Public Economics*, *94*(1), 114–128. https://doi.org/10.1016/j.jpubeco.2009.11.001

Hernandez, D. J. (2011). Double jeopardy: How third-grade reading skills and poverty influence high school graduation. In *Annie E. Casey Foundation*. Annie E. Casey Foundation. https://eric.ed.gov/?id=ED518818

Hilado, A., Leow, C., & Yang, Y. (2019). Understanding immigration trauma and the potential of home visiting among immigrant and refugee families. *Zero to Three*, *39*(6), 44–53.

Holland, M. L., Xia, Y., Kitzman, H. J., Dozier, A. M., & Olds, D. L. (2014). Patterns of visit attendance in the nurse–family partnership program. *American Journal of Public Health*, *104*(10), e58–e65.

Home Visiting Evidence of Effectiveness. (2019). *Home Visiting Evidence of Effectiveness review: Executive summary* (OPRE Report #2019-93; p. 28). Migration Policy Institute.

Kelly, J. F., & Barnard, K. E. (1999). Parent education within a relationship-focused model. *Topics in Early Childhood Special Education*, *19*(3), 151–157.

Kirkland, K., & Mitchell-Herzfeld, S. (2012). Evaluating the effectiveness of home visiting services in promoting children's adjustment to school. *New York State Office of Children and Family Services, Bureau of Evaluation and Research*.

Korfmacher, J., Kitzman, H., & Olds, D. (1998). Intervention processes as predictors of outcomes in a preventive home-visitation program. *Journal of Community Psychology*, *26*(1), 49–64.

Kundakovic, M., & Champagne, F. A. (2015). Early-life experience, epigenetics, and the developing brain. *Neuropsychopharmacology*, *40*(1), 141.

LeCroy, C. W., & Krysik, J. (2011). Randomized trial of the healthy families Arizona home visiting program. *Children and Youth Services Review*, *33*(10), 1761–1766. https://doi.org/10.1016/j.childyouth.2011.04.036

Leventhal, T., & Brooks-Gunn, J. (2003). Children and youth in neighborhood contexts. *Current Directions in Psychological Science*, *12*(1), 27–31. https://doi.org/10.1111/1467-8721.01216

Li, J., & Julian, M. M. (2012). Developmental relationships as the active ingredient: A unifying working hypothesis of "what works" across intervention settings. *American Journal of Orthopsychiatry*, *82*(2), 157–166. https://doi.org/10.1111/j.1939-0025.2012.01151.x

Love, J. M., Kisker, E. E., Ross, C., Raikes, H., Constantine, J., Boller, K., Brooks-Gunn, J., Chazan-Cohen, R., Tarullo, L. B., Brady-Smith, C., Fuligni, A. S., Schochet, P. Z., Paulsell, D., & Vogel, C. (2005). The effectiveness of Early Head Start for 3-year-old children and their parents: Lessons for policy and programs. *Developmental Psychology*, *41*(6), 885–901. https://doi.org/10.1037/0012-1649.41.6.885

McGuigan, W. M., & Gassner, B. (2016). Engagement and retention in home visiting child abuse prevention programs. In L. Roggman & N. Cardia (Eds.), *Home visitation programs: Preventing violence and promoting healthy early child development* (pp. 101–117). Springer International Publishing. https://doi.org/10.1007/978-3-319-17984-1_7

McGuigan, W. M., Katzev, A. R., & Pratt, C. C. (2003). Multi-level determinants of retention in a home-visiting child abuse prevention program. *Child Abuse & Neglect*, *27*(4), 363–380. https://doi.org/10.1016/S0145-2134(03)00024-3

Michalopoulos, C., Lee, H., Duggan, A., Lundquist, E., Tso, A., Crowne, S. S., Burrell, L., Somers, J., Filene, J. H., & Knox, V. (2015). *The Mother and Infant Home Visiting Program Evaluation: Early findings on the Maternal, Infant, and Early Childhood Home Visiting Program (OPRE Report 2015-11)*. Washington, DC: Office of Planning, Research and Evaluation, Administration for Children and Families, U.S. Department of Health and Human Services.

Miller, T. R. (2015). Projected outcomes of Nurse-Family Partnership home visitation during 1996–2013, USA. *Prevention Science*, *16*(6), 765–777. https://doi.org/10.1007/s11121-015-0572-9

Olds, D. L. (2002). Prenatal and infancy home visiting by nurses: From randomized trials to community replication. *Prevention Science*, *3*(3), 153–172. https://doi.org/10.1023/A:1019990432161

Ounce of Prevention Fund. (2019). *NEAR@Home: Addressing ACEs in home visiting by asking, listening, and accepting*.

Park, M., & Katsiaficas, C. (2019). *Leveraging the potential of home visiting programs to serve immigrant and dual language learner families*. Migration Policy Institute. https://www.migrationpolicy.org/research/home-visiting-immigrant-dual-language-learner-families

Sandstrom, H., Benatar, S., Peters, R., Genua, D., Coffey, A., Lou, C., Adelstein, S., & Greenberg, E. (2020). *Home visiting career trajectories: Final Report* (OPRE Report #2020-11). Office of Planning, Research, and Evaluation, Administration for Children and Families, U.S. Department of Health and Human Services. https://www.acf.hhs.gov/opre/resource/home-visiting-career-trajectories

Wen, X., Korfmacher, J., Hans, S. L., & Henson, L. G. (2010). Young mothers' involvement in a prenatal and postpartum support program. *Journal of Community Psychology*, *38*(2), 172–190. https://doi.org/10.1002/jcop.20358

Yoshikawa, H., Aber, J. L., & Beardslee, W. R. (2012). The effects of poverty on the mental, emotional, and behavioral health of children and youth: Implications for prevention. *American Psychologist*, *67*(4), 272.

APPENDICES

Appendix A

Number of Prenatal and Postnatal Visits

At the 37-weeks of pregnancy interview, mothers were asked “How many times have you met in person?”; at the 3-weeks postpartum interview, participants were asked “Has your doula visited you at home since birth? If so, how many times”; at the 3-months postpartum interview, mothers were asked “How many times did you meet after your baby was born?”

Discrepancies between the number of prenatal visits calculated from the administrative data and mothers’ report in the 37-weeks pregnancy interview were expected because the doulas continue to offer visits between 37 weeks of pregnancy and the birth. Greater consistency was expected between the number of postnatal visits calculated from the administrative data and mother response in the 3-month interview. In either case, mothers’ self-report data may be subject to recall bias. A rough check between the two sources was conducted and the number of prenatal and postnatal visits from the administrative data was consistent with mothers’ self-report.

The exposure time for prenatal visits was created by calculating the length of time from the first doula home visit (obtained via the administrative system) to the baby’s date of birth (obtained via the 3 weeks interview). If either of these two dates were not available, the exposure time could not be calculated. For the analysis of prenatal doula visits, a mother would be entered into analysis only if she had both data on both the number of prenatal visits and the exposure time. Seventeen mothers were excluded from the analysis of prenatal doula visits due to lack data on either or both, and eight mothers were excluded for the analysis of postnatal doula visits. The calculated number of visits from the administrative data was used for prenatal visits and most of the mothers for the postnatal visits. For a few mothers whose administrative data were not available for the postnatal doula visit analysis, their self-report data were used (n=7).

Appendix B

Table B Distribution of Each Dimension of the Risk-taking Behavior

	n (%)
School suspensions and expulsions[a]	
Never	59 (37.8%)
1-2 times	53 (34.0%)
3-5 times	27 (17.3%)
6 or more times	17 (10.9%)
Justice system involvement[b]	
None	84 (53.9%)
Police questioning about misconduct	43 (27.6%)
Spent time in juvenile detention or jail	29 (18.6%)
Smoking[c]	
Never smoked	93 (59.6%)
Smoked less than daily pre-pregnancy	46 (29.5%)
Smoked daily pre-pregnancy and/or currently smoking	17 (10.9%)
Drinking[d]	
Never drank	32 (20.5%)
No drinking in year before pregnancy	24 (15.4%)
<2 drinks/week in year before pregnancy	62 (39.7%)
2-7 drinks/week in year before pregnancy	23 (14.7%)
>7 drinks/week in year before pregnancy	15 (9.6%)
Sex partners[e]	
1 partner	46 (29.5%)
2 partners	38 (24.4%)
3 partners	25 (16.0%)
4 partners	18 (11.5%)
5 or more partners	29 (18.6%)

Appendix C

Table C Measurement of Baseline Variables

Domains	Variables	Measurement Scale	Citation
Mothers' developmental history	parental rejection experienced in childhood	Parental Acceptance-Rejection Questionnaire (PARQ) (total score)	Rohner et al., (1978)
Mothers' psychological resources	depressive symptoms	Center for Epidemiologic Studies Depression Scale (CES-D)	Radloff, (1977)
	maternal self-confidence	Childbearing Attitudes Questionnaire (CAQ) - Maternal Self-Confidence Scale	Ruble et al., (1990)
	maternal worries over motherhood	CAQ -Maternal Worries Scale	
Social support and stress	quality of general social support	Social Provisions Scale (SPS) (total score)	Cutrona & Russell (1987)
	support from the parent figure	A 6-item 5-point Likert scale	Created by principal investigators of the study
	trust with the parent figure	Inventory of Parent and Peer Attachment (IPPA) - Trust Subscale	Armsden & Greenberg (Armsden & Greenberg, 1987)
	communication with the parent figure	IPPA - Communication Subscale	
	alienation with the parent figure	IPPA - Alienation Subscale Score	
Mothers' parenting attitudes	perception of the negative aspects of childcaring	CAQ - Negative Aspects of Caretaking Scale	Ruble et al., (1990)
	valuing motherhood	CAQ - Valuing Motherhood Scale	
	feelings towards children in general	CAQ - Feelings About Children Scale	

Appendix D

Table D1 Raw and Weighted Absolute Standardized Differences of Baseline Covariates of Three Models

	Raw standardized difference	Model 1 (IPTW)	Model 2 (IPTW)	Model 3 (IPTW)
Estimated propensity score	0.88[a]	0.08	0.09	0.07
Baseline covariates				
Age	0.37	**0.10**	**0.09**	**0.09**
Ethnicity (reference = Latina)				
African American	0.22	**0.15**	**0.15**	**0.14**
European American	0.09	**0.01**	**0.01**	**0.01**
High school degree	0.16	**0.03**	**0.02**	**0.01**
Currently working	0.22	**0.04**	**0.03**	0.09
In a relationship with father of baby	0.11	**0.06**	**0.05**	**0.03**
Infant sex (reference = girl)	0.07	0.04	**0.01**	**0.03**
Parental rejection in childhood	0.37	**0.02**	**0.02**	**0.02**
Depressive symptoms	0.33	**0.02**	0.03	**0.05**
Social support	0.44	**0.03**	**0.03**	**0.03**
Support from parent figure	0.43	**0.03**	**0.04**	**0.04**
Alienation with parent figure	0.57	**0.07**	**0.08**	**0.09**
Mothers' feelings towards children	0.43	**0.07**	**0.08**	0.11
Valuing motherhood	0.49	0.13	0.13	**0.02**
Trust with parent figure	0.47	0.06	0.06	0.02
Communication with parent figure	0.43	0.02	0.02	0.01
Maternal self-confidence	0.17	0.06	0.06	0.09
Perceived negative aspect of childbearing	0.25	0.09	0.10	0.14
Maternal worries	0.21	0.02	0.01	0.03
Coresidence with parent figure	0.13	0.21	0.21	0.21

Note. Bolded cells indicate variables included in the propensity score model.

[a] The raw standardized difference is 0.88 for Model 2, and 0.90 for Model 3.

Table D2 Estimated Average Treatment Effect and Average Treatment Effect on the Treated: Additional Robustness Check

	Sensitivity	Careful Handling	Intrusiveness	Detachment	Stimulation
Model 1					
ATE (IPTW)	0.27*	0.28*	-0.07	-0.11	-0.20
	(0.11)	(0.14)	(0.08)	(0.07)	(0.14)
ATT (IPTW)	0.32**	0.32*	-0.08	-0.13	-0.23
	(0.12)	(0.16)	(0.09)	(0.08)	(0.16)
ATT (Radius Matching)	0.31*	0.30 †	-0.07	-0.16 †	-0.17
	(0.16)	(0.17)	(0.09)	(0.09)	(0.17)
Model 2					
ATE (IPTW)	0.28*	0.29*	-0.07	-0.12	-0.21
	(0.11)	(0.14)	(0.08)	(0.07)	(0.15)
ATT (IPTW)	0.33**	0.33*	-0.08	-0.13	-0.24
	(0.12)	(0.16)	(0.09)	(0.08)	(0.16)
ATT (Radius Matching)	0.30*	0.31 †	-0.07	-0.16 †	-0.17
	(0.12)	(0.16)	(0.09)	(0.08)	(0.17)
Model 3					
ATE (IPTW)	0.27*	0.29*	-0.07	-0.12	-0.22
	(0.11)	(0.14)	(0.08)	(0.07)	(0.14)
ATT (IPTW)	0.33*	0.33*	-0.09	-0.14 †	-0.26
	(0.13)	(0.16)	(0.09)	(0.08)	(0.16)
ATT (Radius Matching)	0.32*	0.31 †	-0.09	-0.17 †	-0.18
	(0.13)	(0.17)	(0.09)	(0.09)	(0.17)

Note. ATE refers to average treatment effect and ATT refers to treatment effect on the treated. † $p<0.1$, * $p < 0.05$, ** $p < 0.01$. Standard errors in parentheses.

Appendix E

The *sensatt* in Stata requires both the treatment Z and outcome Y to be binary, therefore the parenting sensitivity score was recoded as (1 = *highly*, *n* = 47, 37.9%; 0 = *not at all*, *minimal*, or *moderate*, *n* = 77, 62.1%). The following table shows the sensitivity analysis for the ATT of a very positive mother-doula relationship on parenting sensitivity (Table C1). Four parameters p_{ij} were used (i.e., p_{11}, p_{10}, p_{01}, and p_{00}) and p_{ij} refers to proportion of *U* in treatment *i* and outcome *j* and characterizes the distribution of the unobserved binary confounding factor *U*, $Pr(U = 1|Z = i, Y = j, X) = Pr(U = 1|Z = i, Y = j) \equiv p_{ij}$. These four parameters were set equal to the ones observed for a baseline variable. In other words, the distribution of *U* is similar to the empirical distribution of observable binary covariates in the dataset. For example, if there is confounder *U* behaving like social support, then 87% of mothers in the very positive mother-doula relationship and high maternal sensitivity would experience *U* (i.e., $p_{11} = 0.87$) while only 53% of mothers in the less positive mother-doula relationship and low maternal sensitivity would experience *U* (i.e., $p_{00} = 0.53$).

Each subject gets a predicted value of *U*, and a new propensity score model including *U* is used to estimate ATT. This process is repeated many times (e.g., set to 300 times in this study) and the average of the ATTs over the distribution of *U* is used as the final ATT. If the newly estimated ATT is driven to zero or very far away from the baseline estimate, it means the results are sensitive to violation of the strong ignorability assumption and more cautions should be exercised in interpreting results. On the other hand, insensitive results lend support to the causal inference, making it more defensible.

The outcome effect and selection effect are calculated based on the four parameters p_{ij} to quantify the degree to which *U* may influence the treatment and outcome. In the following table, if *U* behaved like the variable high alienation with parent figure, then the selection effect of *U* was strong (7.42). If *U* behaved like social support, then both the outcome and the selection effect of *U* were strong (4.77 and 6.31). However, even in these scenarios, *U* did not impose a threat to the magnitude or significance of the ATT. Overall, the sensitivity analysis shows that under different hypotheses of the nature of the confounding factor *U*, the estimated ATT of a very positive mother-doula relationship on parenting sensitivity is quite robust, lending support to the causal claim for the role of a very strong mother-doula relationship. The sensitivity analysis demonstrated that the ATT on careful handling was also robust (results were not presented but were available upon request).

Table E Sensitivity Analysis of Mother-Doula Relationship and Maternal Sensitivity: Effect of "Calibrated" Confounders

	Fraction U = 1 by treatment/outcome				Outcome effect	Selection effect	The average of simulated ATT [a]	Standard error [a]
	*p*11	*p*10	*p*01	*p*00				
No confounder	0.00	0.00	0.00	0.00	-	-	0.269 *	0.093
Confounder-like								
Latina	0.46	0.47	0.38	0.31	2.02	1.94	0.272 *	0.095
Coresidence with parent figure	0.82	0.73	0.88	0.81	1.28	0.74	0.277 *	0.094
Depressive symptoms	0.28	0.36	0.25	0.28	1.38	1.35	0.275 *	0.094
Mother age	0.69	0.60	0.75	0.50	3.91	1.59	0.267 *	0.095
Alienation with parent figure	0.23	0.30	0.75	0.34	7.42	0.52	0.299 *	0.097
Social support	0.87	0.91	0.88	0.53	4.77	6.31	0.231 *	0.113
Valuing motherhood	0.95	0.89	0.50	0.81	0.32	4.50	0.313 *	0.101
Currently working	0.26	0.22	0.25	0.12	4.62	2.17	0.269 *	0.094
Infant sex	0.54	0.53	0.62	0.47	2.62	1.26	0.273 *	0.094

Note. * $p < 0.05$

[a] Three decimal points were shown for ATT and SE in order to better show the differences.

The *sensatt* procedure requires outcome Y and U to be binary. The original 4-point maternal sensitivity was recoded as 0 = *not at all*, *minimal*, or *moderate* , 1 = *highly*. The continuous baseline variables were dichotomized using cutoffs meaningful to the original scales. For example, 16 was used for CES-D depressive symptoms (Radloff, 1977) and 18 for age. The original alienation with the parent figure, social support, and valuing motherhood were on a 5-, 4-, and 7-point scale respectively. They were recoded using the following schema: 1 = 3 or above for alienation with parent figure and social support, and 5 or above for valuing motherhood. Sensitivity analysis procedures for ATE in Stata are currently under development (Masten et al., 2019), thus were not conducted in this study.