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Trajectories of maternal depressive symptoms from infancy through early childhood: The roles of perceived financial strain, social support, and intimate partner violence

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Abstract

Although new mothers are at risk of heightened vulnerability for depressive symptoms, there is limited understanding regarding changes in maternal depressive symptoms over the course of the postpartum and early childhood of their child's life among rural, low-income mothers from diverse racial backgrounds. This study examined distinct trajectories of depressive symptoms among rural low-income mothers during the first five years of their child's life, at 6, 15, 24, and 58 months, using data from the Family Life Project ($N = 1{,}292$). Latent class growth analysis identified four distinct trajectories of maternal depressive symptoms, including *Low-decreasing* (50%; $n = 622$), *Low-increasing* (26%; $n = 324$), *Moderate-decreasing* (13%; $n = 156$), and *Moderate-increasing* (11%; $n = 131$) trajectories. Multinomial logistic regression demonstrated that higher perceived financial strain and intimate partner violence, and lower social support predicted higher-risk trajectories (*Low-increasing*, *Moderate-decreasing*, and *Moderate-increasing)* relative to the *Low-decreasing* trajectory. Compared to the *Low-decreasing* trajectory, lower neighborhood safety/quietness predicted to the *Low-increasing* trajectory. Moreover, lower social support predicted the *Moderate-increasing* trajectory, the highest-risk trajectory, compared to those in *Moderate-decreasing*. The current analyses underscore the heterogeneity on patterns of depressive symptoms among rural, low-income mothers, and that the role of both proximal and broader contexts contributing to distinct trajectories of maternal depressive symptoms over early childhood.

Keywords: financial strain; intimate partner violence; maternal depressive symptoms; neighborhood safety; socioeconomic status; social support

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Introduction

Thirteen to nineteen percent of new mothers experience postpartum depression and one out of 10 women with a child under age 18 experience at least one episode of major depression (Ertel et al., 2011; O'Hara & McCabe, 2013; O'Hara & Swain, 1996). Elevated maternal depressive symptoms (MDS) may increase health risks for both mothers and their children (Goodman et al., 2011; O'Hara & McCabe, 2013). Women with heightened depressive symptoms often face challenges in their daily functioning within the personal and social contexts. MDS are associated with increased negative emotionality and cognitive biases towards others, and impairment in the ability to recognize affective cues (Dietz et al., 2009; Flanagan et al., 2011; Stein et al., 2010). In the family context, even at subclinical levels, MDS are associated with negative parenting behaviors, including decreased sensitivity or increased hostility during mother-child interactions (Dietz et al., 2009; Feldman et al., 2009; Ku & Feng, 2023; Lovejoy et al., 2000; Wu et al., 2017). In general, MDS typically decrease as children age (Ku & Feng, 2023; Wu et al., 2011). There is emerging evidence

for heterogeneity in both the severity and stability of long-term MDS (e.g., Ahmed et al., 2019; Chow et al., 2019; Denckla et al., 2018; Putnick et al., 2020). Yet, there is limited understanding of MDS trajectories among underserved populations, such as mothers living in poverty in rural areas (Wikman et al., 2020), who may be vulnerable to experiencing elevated postpartum MDS (Goyal et al., 2010; Halbreich & Karkun, 2006). Therefore, the current study aimed to identify distinct trajectories of MDS over the first five years using a sample of low-income mothers living in rural areas in the U.S. Importantly, we also examined the roles of various early social contexts in developing MDS trajectories with a focus on socioeconomic status (SES; both objective and subjective measures), perceived neighborhood safety, and interpersonal contexts (i.e., social support and intimate partner violence [IPV]).

Heterogeneity in longitudinal trajectories of depressive symptoms among rural, low-income mothers

Empirical studies have identified distinct trajectories of MDS from as early as the second trimester of pregnancy through early childhood, using both community samples (e.g., Choe et al., 2020) and population-based samples in Western, industrialized countries, among mothers with diverse socioeconomic backgrounds (e.g., Ahmed et al., 2019; Campbell et al., 2007; Denckla et al., 2018; Kiviruusu et al., 2020; Putnick et al., 2018; Wikman et al., 2020).

Across studies, the most commonly observed trajectories of MDS from infancy through early childhood include the following trajectories: (a) minimal symptoms over time, with the majority of mothers typically classified in this trajectory; (b) increasing over time; (c) decreasing over time; and (d) chronically high. For example, using a population-based sample of 4,866 mothers from New York State, Putnick et al. (2020) identified four trajectories of MDS from 4 to 36 months, including low-stable, low-increasing, medium-decreasing, and high-persistent trajectories. Moreover, using 615 high-SES mothers in Canada, Ahmed et al. (2019) identified four trajectories of MDS from mid-pregnancy through 5 years, including low-stable, moderate-stable, moderate-increasing, and high-decreasing. In contrast to other work (e.g., Campbell et al., 2007; Putnick et al., 2020), a chronically high trajectory was not identified among higher SES mothers in this sample, suggesting that additional risk factors associated with low-SES may influence trajectories of MDS.

While individuals in poverty are more likely to experience depression than those who are not in poverty (Pratt & Brody, 2008), a line of research with low-income mothers suggests that heterogenous patters of changes in MDS may also exist among high-risk populations (Christensen et al., 2011; Guyon-Harris et al., 2016; Mora et al., 2009). Using a community sample of 121 low-income, racially diverse mothers, Guyon-Harris et al. (2016) identified four trajectories across the third trimester of pregnancy, 3 months, 1-year, and 2-year postpartum, including the low-decreasing (47.5 %), stable-low (22.5 %), stable-moderate (21.7 %), and increasing (8.3%). Using a large sample of low-income mothers ($n = 1,735$) from urban areas of the U.S. Mora and colleagues (2009) identified five MDS trajectories from 15 weeks before giving birth through 25-month postpartum (i.e., never [71%], late [7%], antepartum [6%], postpartum [9%], chronic [7%] trajectories). It appears that a large percentage of low-income mothers exhibit minimal to low symptoms over the postpartum period and early childhood of their child's life.

In addition, poverty in rural areas presents unique challenges to mothers with young children. Rural low-income mothers often encounter challenges related to unsafe neighborhoods, food insecurity, inadequate housing, and limited access to childcare (Bauer & Dolan, 2011). There have been mixed findings regarding rural mothers' experience vs. urban. It has been documented that compared to urban low-income mothers living in the U.S., rural low-income mothers are greater risk of experiencing elevated depressive symptoms in early childhood (Mollard et al., 2016). In contrast, more recent evidence suggests that rural low-income mothers are not necessarily at high risk of experiencing elevated/ clinical levels of depressive symptoms. Instead, they tend to show differences in the patterns of depressive symptoms (e.g., Gueron-Sala et al., 2018). Using the dataset used in the current study, Gueron-Sale et al. (2018) reported that only six to nine percentage of the mothers exhibited clinical depression between 6 and 15-month postpartum. However, to our understanding, only a few studies appear to have investigated rural mothers' depression using a group-based approach (Familiar et al., 2019; Lee & Park, 2020). Familiar et al. (2019) found three trajectories among rural Uganda mothers with HIV (i.e., stable-low [53%], moderate-subclinical [39%], and chronic-high [8%]). Using a community sample, Sano et al. (2020) found two trajectories, the constantly depressed ($n = 11$) and constantly improved ($n = 21$) trajectories, over three years among rural, low-income mothers who had a child at the age of 13 or below. As such, examining distinct trajectories of MDS among rural lower-SES mothers is needed, which may expand our understanding of risk and resilience factors in those most vulnerable to experiencing adverse health outcomes.

The conditions in which people are born, grow, live, work, and age and the fundamental drivers of these conditions are defined as the social determinants of health (SDH; Braveman & Gottlieb, 2014). Decades of research on the SDH have documented that contextual factors related to socioeconomic SES may influence individuals' health outcomes, either directly or indirectly (Adler & Stewart, 2010). The potential determinants include not only individuals' education and income, but also individuals' perception on their SES, neighborhood environments, and social support. In supportive of the SDH framework, empirical work on MDS also suggests that MDS may be affected by various factors at the interpersonal, family, and neighborhood levels (e.g., Goodman et al., 2007). In this way, each of the predictors included in the current analysis represent mothers' meaningful experiences that can affect their depressive symptoms.

In line with the SDH, studies examining trajectories of MDS in early childhood have collectively indicated that low objective SES (e.g., education, income) and inadequate interpersonal relationships (e.g., lack of social support, high levels of IPV) are reliably associated with high-risk trajectories, such as increasing and chronically high trajectories (e.g., Campbell et al., 2007; Choe et al., 2020; Denckla et al., 2018; Giallo et al., 2017). However, recent evidence suggests that subjective measures of SES, which refers individuals' evaluation of their own social status and/or financial and economic power are also an important factor predicting individuals' psychological symptoms, including depression (Assari et al., 2019; Baker et al., 2021; Kim & Radoias, 2021). In addition, while broader contexts (e.g., neighborhood environments) may affect MDS (Huang et al., 2018), little is known about how these contexts are associated with longitudinal trajectories of MDS. Given the importance of proximal and distal social determinants of MDS, the current study sought to extend prior research to examine the unique roles of objective and subjective SES, neighborhood environment, social support, and IPV in predicting trajectories of MDS in the first five years of their child's life among rural, low-income mothers.

Objective versus subjective measures of socioeconomic contexts predicting trajectory membership of maternal depressive symptoms

As noted above, objective measures of SES are considered important predictors of individuals' health disparities overall (Adler & Stewart, 2010), and longitudinal change in MDS, in particular (e.g., Kingsbury et al., 2015; Wikman et al., 2020). A systematic review of heterogeneity of individuals' depression conducted by Musliner et al. (2016) reported that women with low-income/education and of non-White racial/ethnic backgrounds tend to display greater symptoms over time. Indeed, empirical studies with new mothers also show that lower household income or more exposure to financial adversity predicted a greater likelihood of being in risk trajectories of MDS, such as moderate-increasing and chronically high trajectories (e.g., Campbell et al., 2007; Denckla et al., 2018). For example, Choe et al. (2020) identified three trajectories of MDS, low-decreasing, moderate, and increasing (a trajectory starting with elevated MDS with an increase over time) from 7 to 33 months and found lower paternal/ maternal SES (a composite of income, education, and occupational prestige) predicted an increased likelihood of being in the moderate or increasing trajectories, compared to the low-decreasing trajectory.

In addition, emerging evidence suggests that subjective measures of SES (e.g., perceived financial strain, perceived social standing) may affect overall mental health outcomes over and beyond the influence of objective SES (Franzini & Fernandez-Esquer, 2006; Goodman et al., 2007; Kim & Radoias, 2021). Notably, some studies report even stronger effects of subjective SES on health outcomes than objective SES (Adler et al., 2000). For example, Franzini and Fernandez-Esquer (2006) found that among low-income Mexican-American adults (75% women), both lower perceived social status and higher perceived financial strain (e.g., not having enough money to buy clothing and pay the rent) predicted poor mental health, independent of the contribution of education and income. In addition, using data from the Family Life Project (FLP), Newland et al. (2013) found that higher levels of subjective SES, measured by perceived financial strain, predicted MDS at early childhood, while objective SES measured by income-to-needs ratio did not. Theoretically, individuals' feelings related to social status or financial strain may be fundamental to health outcomes, given that negative feelings and subjective experiences related to lower SES (e.g., stress, disrespect, inferiority, distrust, and lower social cohesion) may interfere with neuroendocrine functioning and in turn, affect mental health symptoms and behavior (Wilkinson, 1999). Thus, subjective SES may be a key factor influencing longitudinal trajectories of MDS in early childhood, particularly among lower-income mothers.

Neighborhood adversity predicting trajectory membership of maternal depressive symptoms

Broader environmental contexts, such as community/neighborhood characteristics, have also been identified as a significant social determinant of maternal depression, independent of the predictive role of family SES (e.g., Huang et al., 2018; Shaw et al., 2016). Living in impoverished, dangerous, and noisy neighborhoods appear to undermine individuals' health and well-being and potentially increases depressive symptoms across the life span (Cammack et al., 2011; Cutrona et al., 2006; Kim, 2008; Kohen et al., 2008). For example, Huang et al. (2018) reported that greater exposure to community violence predicted increased depressive symptoms among low-income mothers, after controlling for family SES. Similarly, work by Cammack et al. (2011) demonstrates that perceived neighborhood violence is longitudinally associated with increased depressive symptoms in adolescents. Importantly, the authors also found that perceived neighborhood violence, compared to objective exposure to neighborhood violence, was more strongly associated with adolescents' depressive symptoms.

Early social support as a resilience factor for maternal depressive symptoms across early childhood

Social partners (e.g., a caregiver, an intimate partner) can reduce physiological stress responses among altricial species, including human and nonhuman primates, throughout the lifespan (Gunnar & Hostinar, 2015; Kikusui et al., 2006). In line with this notion, social support from a partner, extended family and friends, and the community are key resilience factors in the prevention and recovery from MDS in new mothers (Manuel et al., 2012; Nagy et al., 2022; Vliegen et al., 2014). In addition, Beck's (2001) meta-analysis informs that the effect of social support on maternal depression is even stronger than the effect of objective SES. Work using 414 Black rural, low-income mothers from the FLP data showed that mothers reporting high satisfaction with the quality of church-based social support in infancy reported fewer MDS at 24 months (Odom & Vernon-Feagans, 2010). In regard to longitudinal MDS, inadequate social support, such as low quality of interpersonal relationships, greater needs for social support, and increased loneliness, predicted chronically high or increasing trajectories, compared to mothers in low-stable/decreasing trajectories (Choe et al., 2020; Denckla et al., 2018; McCall-Hosenfeld et al., 2016). Thus, the examination of how social support predicts trajectory membership may provide meaningful implications in terms of early resilience factors for MDS among rural, low-income mothers.

Intimate partner violence predicting trajectory membership of maternal depressive symptoms

Intimate partner violence (IPV) is also relevant in considering MDS in diverse contexts (Conway et al., 2021), including low-income rural mothers in the U.S. (Gustafsson & Cox, 2012), Brazil (Ludermir et al., 2010), and South Africa (Tsai et al., 2016). Across both high- and low-income countries, mothers' exposure to physical and/or psychological (e.g., verbal aggression) violence by their intimate partner in pregnancy or early childhood has been consistently associated with elevated MDS. However, there is limited work examining the role of IPV on longitudinal trajectories of MDS. A few studies have reported that mothers' negative feelings and experiences with the partner (e.g., fear of the partner) are associated with high-risk trajectories of MDS in early childhood (Denckla et al., 2018; Giallo et al., 2017; Wikman et al., 2020). For example, Giallo and colleagues (2017) identified three trajectories of MDS from early pregnancy (< 24 weeks) through the first 4 years of the child's life, using a sample of 1,102 mothers in Australia who had relatively high SES (i.e., obtaining at least a college degree, married/living with a partner) and were in paid employment during pregnancy. They found that, compared to the minimal symptoms trajectory over time, mothers reporting greater relationship problems with their partner during pregnancy were more likely to fall into the elevated MDS trajectory, and those experiencing higher levels of fear of the partner at 6 months postpartum were more likely to fall into the persistently high MDS trajectory. Despite this evidence, there is less research using direct maternal-report measures of IPV (including both physical and psychological violence), rather than proximal experiences relevant to IPV (e.g., fear of partner), in predicting MDS.

Current study

Given the importance of proximal and broader social determinants in predicting MDS, the current study aimed to examine the unique roles of objective and subjective SES, neighborhood environment, social support, and maternal-reported exposure to IPV in predicting trajectories of MDS in the first five years of their child's life among low-income, rural mothers. We considered changes across the first five years because maternal mental health greatly impacts the well-being of both mothers and their young children during the early childhood years (Dietz et al., 2009; Goodman et al., 2007 Flanagan et al., 2011; Stein et al., 2010). Moreover, recent empirical evidence demonstrates that mothers consistently show changes in their depressive symptoms over time and exhibit individual differences in these longitudinal changes over the course of early childhood (e.g., Ahmed et al., 2019; Denckla et al., 2018). Therefore, identifying factors associated with risk and resilience in MDS trajectories may have implications for practice and policy interventions aimed at promoting the well-being of their mothers and their children's development.

Importantly, a better understanding of the early predictors of low-income mothers' depressive symptoms may also contribute to identifying mothers at greater risk of developing elevated MDS/clinical depression at distinct time points, and may increase our knowledge about the factors promoting resilience to maladaptive outcomes.

Method

Participants

The Family Life Project (FLP) is a prospective longitudinal study of families residing in six predominantly low-income and rural counties in Pennsylvania (PA) and North Carolina (NC). These regions were selected to be representative of the Black South and Appalachia, respectively (Dill & Myers, 2004). Adopting a developmental epidemiological design, a representative sample of 1,292 families who resided in one of the six counties at the time of the child's birth were recruited. Participants were oversampled for low-income in both states and for African American race in NC. Information about participants' ethnicity was not collected. A comprehensive description of the sampling procedure is provided by Vernon-Feagans et al. (2013). Among 1,292 families (51% boys), 59% of mothers were White and 41% were African American.

Procedure

For this study, families were seen in home visits at child age of 2, 6, 15, 24, and 58 months. At all times, demographic information was collected and primary caregivers completed questionnaires asking about their mental health symptoms. In the current study, MDS assessed with the Brief Symptoms Inventory-18 at 6, 15, 24, and 58 months were included. Data used in the current study also included primary caregivers' demographic information (i.e., race, state) at 2 months, and multiple aspects of family and neighborhood environments, health information, and social relationships at 6 months.

Measures

Maternal depressive symptoms

At 6, 15, 24, and 58 months primary caregivers completed the Brief Symptoms Inventory-18 (BSI-18; Derogatis, 2000), a validated, widely used self-report questionnaire adapted from the Symptom Checklist-90-Revised (SCL-90-R; Derogatis, 1977) and BSI-53 (Zabora et al., 2001). The BSI-18 consists of the three subscales of depression, anxiety, and somatization with each subscale including 6 items (Govindasamy et al., 2020). The items of the depression subscale asked about mothers' depressive symptoms in the preceding seven days and each was scored on a Likert-type scale, $0 = not\ at\ all$ to $4 = extremely$, ($\alpha s = 0.81–.86$ across 6 and 58 months). The BSI-18 has been widely used in studies with diverse populations, including both in community samples and large-national level samples (e.g., Houghton et al., 2013; Newland et al., 2013) and postpartum mothers, in particular (e.g., Gueron-Sela et al., 2018; Kotchick et al., 2005; Lega et al., 2022; Padrutt et al., 2023). Prior work has shown high internal consistency of the depression subscale in diverse populations (e.g., Derogatis, 2017; Houghton et al., 2013; Prinz et al., 2013), including rural low-income mothers from their postpartum period through the early childhood of their child (Aisenberg, 2001; Gueron-Sela et al., 2018; Ku & Blair, 2023). The internal consistent of the current measure was high, ranging from 0.81 to .86 across 6 and 58 months. The

depression subscale has good convergent, discriminant, and construct validity in assessing depressive symptoms of individuals across the United States and countries in Europe (e.g., Hamidia et al., 2022; Kim et al., 2021; Li et al., 2018; Prinz et al., 2013; Spitzer et al., 2011). For the current analysis, outliers (i.e., scores ± 3SD from the mean at each time point) were replaced with the second highest or lowest values (n = 2, n = 3, n = 3, n = 6 across 6 and 58 months, respectively). The mean score was square-root transformed to correct skewness. In our sample, the percentage of mothers showing MDS scores at or above clinical cutoff (T-scores at or above 63; Derogatis, 2000) at each time point were: 7% at 6 months, 9% at 15 months, 7% at 24 months, and 7% at 58 months.

Maternal education

Primary caregivers reported their highest levels of completed education in years, ranging from 6 to 22(*doctoral degree*). This approach has been used in a large number of studies using the FLP dataset (e.g., Ku & Blair, 2023; Newland et al., 2013).

Income-to-needs ratio (INR)

INR were calculated by dividing the total household income by the federal poverty threshold for the number of people residing in the household for that year. An INR below 1 thus indicates households with incomes that fall below the federal poverty level. INR has been used in various studies using the FLP dataset (e.g., Gustafsson & Cox, 2012; Gueron-Sela et al., 2018; Newland et al., 2013).

Financial strain

Primary caregivers completed the Economic Strain Questionnaire, adapted from Conger and Elder's (1994). The original measure has been used to assess financial strain or financial stress experienced by individuals or families. The current measure consisted of six items assessing financial pressure/difficulty, the degree to which the family had difficulty paying bills and ran out of money each month (1 = *great deal of difficulty* to 5 = *no difficulty at all*). This measure has been widely used to assess financial hardship families experienced among families with diverse backgrounds (e.g., rural low-income families; Kainz et al., 2012; Ku & Blair, 2023; Newland et al., 2013; Odom & Vernon-Feagans, 2010). Prior work has shown the high reliability of the current measure (e.g., Newland et al., 2013; Odom & Vernon-Feagans, 2010). Perception of financial strain assessed by the current measure has been found to be associated with other measures of SES, such as negative correlations with education attainment, income-to-needs ratio, and occupational prestige and positive associations with maternal health outcomes, such as depression and anxiety (e.g., Ku & Blair, 2023; Odom & Vernon-Feagans, 2010). Scores of positively worded items were reverse-scored, and scores of all items were averaged ($\alpha = .81$).

Neighborhood safety/quietness

Mothers completed the Windshield Survey consisting of 12 items drawn from the Post-Visit Reaction Inventory in the FAST Track project (Conduct Problems Prevention Research Group, 1992). The current study included three items asking about the safety and quietness of the neighborhood around the dwelling on a Likert type scale (1 = *obviously dangerous/noisy* to 4 = *above average safety/quietness*). This measure has been widely used in studies, showing high internal consistency in prior work (e.g., Burchinal et al., 2008; De Marco & Vernon-Feagans, 2013). The average scores across the items have shown positive associations with maternal education attainment, income-to-needs ratio, and occupational prestige, and

a negative association with MDS (e.g., Ku & Blair, 2023). For the current study, scores of all items were averaged and higher scores represent safer and quieter neighborhood environment ($\alpha = .76$).

Social support

Social support was assessed using the nine items from the modified version of the Questionnaire on Social Support (Crnic et al., 1983). The measure has been widely used to assess social support among populations from diverse backgrounds (e.g., Barnett & The Family Life Project Key Investigators, 2008), and this has shown high internal consistency in other studies as well as the current study ($\alpha = .80$). Mothers rated their satisfaction with the quality of relationships with their intimate partner, extended family, and friends on a 4-point Likert-type scale (1 = *very dissatisfied* to 4 = *very satisfied*). Previous studies have identified social support as a predictor of positive maternal outcomes, such as positive maternal behavior with their child and lower postpartum depressive symptoms (Crnic et al., 1983; Crockenberg, 1981, 1987; Taraban et al., 2017; Unger & Powell, 1980; Weinraub & Wolf, 1983). The nine items were selected by the FLP Investigators based on factor analyses and were averaged to generate a social support composite.

Intimate partner violence (IPV)

Mothers rated their partners' use of verbal and physical violence during the past 12 months on the Conflict Tactics Scale (CTS– Couple Form R [CTS-R]; Straus et al., 1996), a widely used measure of IPV. Scores from the CTS across the three subscales (i.e., verbal aggression, physical violence, and reasoning) have demonstrated good internal consistency for mothers in the postpartum and early childhood of their child (Gustafsson & Cox, 2012). For the present study, the means of the verbal aggression (six items) and physical violence (nine items) subscales were averaged to create an IPV composite. The scores from the items showed acceptable internal consistency ($\alpha = .68$). Previous work has demonstrated that higher IPV, as measured by the physical violence at 6 months, predicted higher MDS at 15 months (Gustafsson & Cox, 2012). For the present study, among the 1,006 mothers who participated in the 6-month demographic interviews, 84.69% reported having a spouse/partner, either residential or nonresidential. However, the current relationship status was not used as the eligibility criterion for mothers to complete the survey because mothers were asked to reflect on their experiences in the past 12 months with any romantic partner.

Covariates

Maternal race (0 = *White*; 1 = *Black*), age, whether the mother lived with a spouse/partner (0 = *no*; 1 = *yes*), state (0 = *PA*; 1 = *NC*), and maternal anxiety (measured by the anxiety symptomology subscale of BSI-18) were included as covariates in analytic models. Maternal depression and anxiety symptoms are common sources of distress for new mothers and the most prevalent psychological symptoms new mothers experience. Although the two types of psychological symptoms may be comorbid, recent evidence shows distinct trajectories of two symptoms (Ahmed et al., 2019) and each has unique effects on maternal behavior (Feldman et al., 2009; Hakanen et al., 2019). The inclusion of maternal anxiety as a covariate allows us to examine the impact of other factors on membership of MDS trajectories, while accounting for the influence of anxiety.

Missing data

Among 1,292 families enrolled at the 2-month assessments, 6.97% of the families were not seen at the 6-month assessment, 10.06% at 15 months, 14.78% at 24 months, and 17.80% at 58 months. Families who did not participate at 6, 15, 24, or 58 months did not differ from those who participated on most study variables but differed on some sociodemographic variables ($ps < .05$). Specifically, families residing in PA were more likely to have assessments at 6 and 24 months, compared to those in NC. Families with higher maternal education tended to have the 15-month assessments, and those with higher INR tended to have the 24-month assessments. Full information likelihood estimation (FIML) was used to account for missing data, as FIML produces unbiased parameter estimates under the condition of missing at random (Enders & Bandalos, 2001).

Analytic plan

Analyses proceeded in two steps using Mplus 8.4 (Muthén & Muthén, 1998–2017). First, we identified different trajectories of MDS between 6 and 58 months of the child age using latent class growth analysis (LCGA; Jung & Wickrama, 2008). LCGA is a special type of latent growth mixture modeling that allows one to identify multiple trajectories of certain characteristics among individuals and this approach does not estimate the variances of growth factors within classes (i.e., intercept and slope of maternal depressive symptoms). A series of LCGA models, from 1- to 6-trajectory models, were estimated with varying sets of starting values so that we ensured global maximum in each model (Masyn, 2013). We initially estimated both linear and quadratic growth of MDS in each profile across 1–7-trajectory models. All LPA models were unconditional models, which of each was estimated without any covariates. A set of criteria was used to determine the best fitting model, including Bayesian information criterion (BIC; Schwarz, 1978), Vuong-Lo-Mendell-Rubin likelihood ratio test (VLMR-LRT; Vuong, 1989), Lo-Mendell-Rubin likelihood ratio test (LMR-LRT; Lo et al., 2001), entropy (Jedidi et al., 1993), conceptual clarity and interpretability of the trajectory membership (Muthén, 2003), and a reasonable proportion of mothers assigned to each trajectory group, which is no less than 1% of the whole sample size (Jung & Wickrama, 2008). After the best fitting model was selected, we removed non-significant higher-order terms (i.e., a quadratic slope) to improve the precision of the model estimation. Next, multinomial logistic regression was estimated to examine whether indicators of early experiences predict membership in a particular depression trajectory after controlling for covariate, using the manual three-step approach with Bayesian estimation (Asparouhov & Muthén, 2014; 2021). For a full description of the three-step approach, see the Supplemental Materials at the end of the manuscript.

Results

Preliminary analyses

Means, standard deviations, and ranges for all study variables are presented in Table 1. MDS scores across 6 and 58 months had moderate, positive correlations with financial strain and IPV, and small to moderate, negative correlations with maternal education, INR, neighborhood safety/quietness, and social support.

Table 1. Descriptive statistics and bivariate correlations

Variable	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1. Black (ref. White)	1														
2. Maternal age	− **0.18**	1													
3. M living with a partner	− **0.45**	**0.36**	1												
4. NC (ref. PA)	**0.62**	− **0.11**	− **0.26**	1											
5. Anxiety 6mos	− 0.08	0.00	0.01	− **0.10**	1										
6. Maternal education	− **0.22**	**0.44**	**0.36**	− **0.17**	− 0.05	1									
7. Income-to-needs ratio	− **0.36**	**0.33**	**0.40**	− **0.23**	− 0.05	**0.53**	1								
8. Financial strain	**0.17**	− 0.03	− **0.13**	**0.17**	**0.25**	− **0.22**	− **0.35**	1							
9. Neighborhood safety	− **0.20**	**0.23**	**0.25**	0.06	− 0.08	**0.31**	**0.38**	− **0.18**	1						
10. Social support	− 0.01	− 0.01	− 0.04	− 0.02	− **0.31**	0.05	0.06	− **0.25**	0.06	1					
11. IPV	0.03	− **0.12**	− 0.04	− 0.04	**0.34**	− **0.14**	− 0.09	**0.25**	− **0.12**	− **0.32**	1				
12. MDS 6m	0.06	− **0.10**	− **0.13**	− 0.04	**0.63**	− **0.14**	− **0.17**	**0.32**	− **0.15**	− **0.40**	**0.40**	1			
13. MDS 15m	**0.13**	− **0.12**	− **0.13**	0.06	**0.41**	− **0.20**	− **0.19**	**0.32**	− **0.13**	− **0.35**	**0.39**	**0.54**	1		
14. MDS 24m	0.09	− 0.08	− 0.09	− 0.01	**0.37**	− **0.17**	− **0.17**	**0.29**	− **0.19**	− **0.28**	**0.28**	**0.46**	**0.50**	1	
15. MDS 58m	0.04	− 0.04	− 0.09	− 0.06	**0.33**	− **0.12**	− **0.13**	**0.21**	− **0.14**	− **0.29**	**0.24**	**0.40**	**0.45**	**0.49**	1
n	1,290	1,202	1,290	1,292	1,188	1,202	1,100	1,184	1,174	1,147	976	1,188	1,162	1,101	1,062
M or %	40.78%	26.45	65.74%	59.83%	0.37	14.44	1.92	13.73	2.99	3.33	0.87	0.43	0.47	0.43	0.38
SD	na	6.04	na	na	0.52	2.82	1.71	4.21	0.58	0.57	0.74	0.44	0.48	0.47	0.45
Min.	na	14.70	na	na	0	6	0	6	1	1	0	0	0	0	0
Max.	na	58.20	na	na	3.83	22	16.49	26	4	4	5.67	1.73	1.83	1.83	1.73

Note. Correlations in bold are *p* < 0.001; IPV = intimate partner violence; MDS = maternal depressive symptoms; scores of MDS are square−root transformed to correct skewness; *m* = months.

Table 2. Comparisons of fit among latent class growth analysis solutions with 1–6-trajectory models of maternal depressive symptoms

LCGA models	BIC	Entropy	VLMR-LRT p value	LMR-LRT p value	Size of the smallest class
1-profile	5851.97	na	na	na	na
2- profile	4744.14	.80	.000	.000	356 (29%)
3- profile	4560.67	.78	.000	.000	93 (8%)
4- profile	**4389.59**	**.79**	**.045**	**.050**	**127 (10%)**
4-profile refined	**4373.21**	**.79**	**.015**	**.018**	**131 (11%)**
5- profile	4083.52	.86	.265	.272	74 (6%)
6- profile	3704.71	.87	.021	.023	51 (4%)

Note. LCGA = Latent class growth analysis; BIC = Bayesian Information Criteria; VLMR = Vuong-Lo-Mendell-Rubin; LMR = Lo-Mendell-Rubin; lower values of BIC indicate better fitting models and entropy values at or above 0.70 indicate good classification; a significant p-value of VLMR and LMR suggests that an estimated model with K trajectories was a better fit compared to a model with K-1 trajectories; the row with bold text is the best solution based on overall fit indices, parsimony, and interpretability; the 4-profile refined model was estimated after nonsignificant quadratic terms were removed from each profile.

Latent profiles of maternal depressive symptoms trajectories

Given model comparison and fit criteria (see Analytic plan), the four-profile model was selected (Table 2). The four-profile showed a smaller BIC value and higher entropy relative to the other solutions, and also showed significant VLMR and LMR tests. The five- and six-profile models showed smaller BIC values than the four-profile model. However, the VLMR and LMR tests in the five-profile model were not significant, indicating that this model was not significantly better than the four-profile model. In addition, the six-profile model had one subgroup including only 4% of the participants, and two profiles in the six-profile model also displayed very similar patterns of MDS, both of which had moderate initial levels of MDS and showed a slight increase over time. Finally, the four-profile solution showed reasonably high posterior probabilities (range = .80–.92), and the identified trajectories aligned with the theoretical framework and empirical research. Then, the initial four-trajectory model was refined by removing nonsignificant quadratic growth terms and the refined, final model showed good model fit with posterior probabilities ranging from .81 to .91 (Table 2).

As presented in Figure 1, the final LCGA model identified four trajectories of MDS: *Low-decreasing* (50%; $n = 622$), *Low-increasing* (26%; $n = 324$), *Moderate-decreasing* (13%; $n = 156$), and *Moderate-increasing* (11%; $n = 131$) trajectories. The *Low-decreasing* trajectory (50%) consisted of half of the mothers, who showed consistently low levels of MDS, specifically low with a slight linear decrease, through early childhood. ($M_{Int} = 0.22$, $SE = 0.02$, $p < .001$; $M_{LinearSlope} = -0.03$, $SE = 0.01$, $p = .001$). T-scores of MDS on average demonstrated that those mothers' symptoms fell below clinical cutoff scores (T-scores at or above 63) at all time points (T-score $Ms = 42.92$, 43.00, 42.42, 40.62 at 6, 15, 24, 58 months). Next, in the *Low-increasing* trajectory (26%), mothers had moderate levels of MDS at 6 months, equivalent to the average of MDS among the whole sample at 6 months, and showed a slight linear increase over time ($M_{Int} = 0.42$; $SE = 0.05$, $p < .001$; $M_{LinearSlope} = 0.06$, $SE = 0.01$, $p < .001$). For this group, the means of T-scores fell below clinical cutoff scores across all time points (T-score $Ms = 46.35$, 48.48, 48.31, 51.74 across 6 and 58 months). The third trajectory, *Moderate-decreasing* (13%), consisted of

mothers with high levels of MDS at 6 months, and they showed a large linear decrease from 6 through 58 months ($M_{Int} = 0.98$; $SE = 0.05$, $p < .001$; $M_{LinearSlope} = -0.14$, $SE = 0.01$, $p < .001$). This trajectory group had MDS T-scores on average below the clinical cutoff at all time points (T-score $Ms = 58.24$, 57.80, 54.01, 42.90 from 6 through 58 months). Lastly, the *Moderate-increasing* trajectory has the smallest group size (11%; $n = 131$) and mothers in the trajectory showed a slight linear increase of MDS across 6 and 58 months ($M_{Int} = 1.01$; $SE = 0.06$, $p < .001$; $M_{LinearSlope} = 0.05$, $SE = 0.01$, $p < .001$). These mothers started with MDS below the clinical cutoff at 6 months (T-score $M = 58.41$), which was equivalent levels of MDS at 6 months in the *Moderate-decreasing* trajectory. Then, they showed a linear increase over time, and reported clinical levels of MDS T-scores on average at 58 months (T-score $Ms = 61.19$, 60.97, 64.43 at 15, 24, 58 months).

Predictors of trajectory membership

As demonstrated in Table 3, we compared all three trajectories with elevated risk to the *Low-decreasing* trajectory (reference group) to examine early risk and resilience factors that differentiate high-risk trajectories from *Low-decreasing*. Relative to those in the *Low-decreasing* trajectory profile, mothers in *Low-increasing* were less likely to live in safer neighborhoods and to report social support, and more likely to report higher IPV. Also, relative to mothers in *Low-decreasing*, mothers in *Moderate-decreasing* and *Moderate-increasing* were more likely to experience higher financial strain and IPV, and less likely to report social support. Next, we compared between three risk trajectories to investigate early proximal and broader contexts associated with maternal membership of distinct MDS trajectories. Relative to mothers in the *Low-increasing* trajectory, those in *Moderate-decreasing* reported higher financial strain and IPV. Mothers in the *Moderate-increasing* trajectory, relative to those in *Low-increasing*, showed higher financial strain and IPV, and lower social support. Lastly, mothers in the *Moderate-increasing* trajectory reported lower social support than those in *Moderate-decreasing*.

In regard to covariates, mothers with greater anxiety symptoms were more likely to belong to three high-risk trajectories, compared to *Low-decreasing*. Similarly, compared to the *Low-increasing* trajectory, more anxious mothers tended to fall into *Moderate-decreasing* and *Moderate-increasing*. Compared to White mothers, Black mothers tended to belong to the *Moderate-increasing* trajectory than the *Low-decreasing* trajectory. In addition, maternal relationship status, whether they lived with a spouse/partner, was a significant early indicator of a highest-risk trajectory, such that compared to mothers in the *Low-decreasing* trajectory, those not living with a spouse/partner were more likely to belong to *Moderate-increasing*.

Discussion

The current study examined trajectories and sociodemographic predictors of MDS across the first five years of the child's life using a sample of low-income mothers living in rural areas of the US. We also found that lower levels of perceived SES, inadequate social support, and higher levels of IPV are key factors predicting high-risk trajectories of MDS (i.e., *Low-increasing*, *Moderate-decreasing*, and *Moderate-increasing* trajectories). The current study advances our understanding of heterogeneous changes in long-term MDS among low-income rural mothers, using a large, epidemiological sample of mothers with relatively racially diverse backgrounds. Moreover, our findings may have implications for interventions

Table 3. Multinomial regression: trajectory profile membership predicted by SES, neighborhood, and interpersonal context

	Low-decreasing (50%; n = 622, reference)											
	Low-increasing (26%; n = 324)				Moderate-decreasing (13%; n = 156)				Moderate-increasing (11%; n = 131)			
Predictor	B	SD	OR	95% CI	B	SD	OR	95% CI	B	SD	OR	95% CI
SES												
Education	−0.03	0.04	0.97	0.89, 1.05	−0.10	0.08	0.90	0.78, 1.03	−0.08	0.08	0.93	0.79, 1.07
INR	−0.05	0.09	0.95	0.79, 1.12	−0.24	0.24	0.79	0.46, 1.19	−0.07	0.21	0.93	0.61, 1.35
Financial strain	0.05	0.03	1.05	0.99, 1.11	**0.14**	**0.05**	**1.15**	**1.06, 1.27**	**0.17**	**0.05**	**1.18**	**1.08, 1.30**
Neighborhood												
Safety/quietness	**−0.05**	**0.19**	**0.64**	**0.44, 0.92**	−0.38	0.31	0.69	0.38, 1.26	−0.26	0.33	0.77	0.41, 1.44
Interpersonal contexts												
Social support	**−0.80**	**0.19**	**0.45**	**0.31, 0.65**	**−0.97**	**0.31**	**0.38**	**0.20, 0.67**	**−1.75**	**0.29**	**0.17**	**0.10, 0.30**
IPV	**0.63**	**0.18**	**1.87**	**1.31, 2.64**	**1.44**	**0.28**	**4.20**	**2.52, 7.44**	**1.30**	**0.26**	**3.67**	**2.17, 6.17**
Covariates												
Maternal age	−0.01	0.02	0.99	0.96, 1.03	−0.04	0.03	0.97	0.91, 1.03	0.00	0.03	1.00	0.94, 1.06
Anxiety	**1.67**	**0.42**	**5.31**	**2.41, 12.74**	**4.63**	**0.54**	**102.90**	**39.85, 348.41**	**4.65**	**0.55**	**104.85**	**39.49, 349.16**
Black	0.52	0.29	1.68	0.96, 3.00	0.84	0.49	2.31	0.88, 5.99	**1.32**	**0.55**	**3.76**	**1.32, 11.31**
NC	−0.34	0.27	0.71	0.42, 1.21	−0.07	0.48	0.93	0.37, 2.22	**−1.24**	**0.49**	**0.29**	**0.11, 0.73**
M with a partner	0.01	0.25	1.01	0.61, 1.67	−0.35	0.49	0.70	0.26, 1.80	**−1.08**	**0.44**	**0.34**	**0.14, 0.77**

	Low-increasing (26%, reference)								Moderate-decreasing (13%, reference)			
	Moderate-decreasing (13%)				Moderate-increasing (11%)				Moderate-increasing (11%)			
Predictor	B	SD	OR	95% CI	B	SD	OR	95% CI	B	SD	OR	95% CI
SES												
Education	−0.07	0.08	0.93	0.81, 1.09	−0.04	0.08	0.96	0.81, 1.12	0.03	0.07	1.03	0.89, 1.18
INR	−0.19	0.24	0.83	0.49, 1.29	−0.02	0.21	0.98	0.64, 1.43	0.16	0.22	1.17	0.79, 1.87
Financial strain	**0.10**	**0.05**	**1.10**	**1.01, 1.21**	**0.12**	**0.05**	**1.13**	**1.03, 1.24**	0.02	0.04	1.02	0.94, 1.11
Neighborhood												
Safety/quietness	0.07	0.32	1.08	0.59, 2.02	0.19	0.34	1.21	0.62, 2.38	0.11	0.30	1.12	0.65, 2.10
Interpersonal contexts												
Social support	−0.17	0.31	0.84	0.46, 1.55	**−0.96**	**0.30**	**0.38**	**0.21, 0.68**	**−0.77**	**0.30**	**0.46**	**0.25, 0.83**
IPV	**0.81**	**0.26**	**2.25**	**1.40, 4.00**	**0.67**	**0.26**	**1.96**	**1.21, 3.30**	−0.13	0.23	0.88	0.54, 1.32
Covariates												
Black	−0.03	0.03	0.97	0.91, 1.03	0.01	0.03	1.01	0.94, 1.07	0.04	0.03	1.04	0.97, 1.10
Maternal age	**2.96**	**0.48**	**19.26**	**8.13, 53.17**	**2.99**	**0.48**	**19.78**	**8.18, 54.7**	0.02	0.23	1.02	0.64, 1.62
M with a partner	0.31	0.48	1.36	0.54, 3.58	0.82	0.55	2.27	0.76, 6.60	0.52	0.53	1.68	0.58, 4.66
NC	0.26	0.49	1.30	0.50, 3.36	−0.90	0.51	0.41	0.15, 1.09	**−1.14**	**0.49**	**0.32**	**0.12, 0.84**
Anxiety	−0.36	0.49	0.70	0.26, 1.78	**−1.08**	**0.45**	**0.34**	**0.13, 0.81**	−0.72	0.43	0.49	0.21, 1.11

Note. SES = socioeconomic status; INR = income-to-needs ratio; IPV = intimate partner violence; M with partner = the mother living with a partner; *B* indicates a posterior coefficient estimate; *SD* indicates one-tailed posterior standard deviation; bold text indicates statistically significant coefficients or odds ratios with the 95% confidence interval.

designed to foster resilience of new mothers who are susceptible to experiencing moderate to severe MDS.

We found four distinct trajectories of MDS differentiated by various levels of initial MDS with differing patterns of change, including *Low-decreasing* (50%), *Low-increasing* (26%), *Moderate-decreasing* (13%), and *Moderate-increasing* (11%) trajectories. These trajectories are similar to those reported in prior work, which commonly identified three to six distinct trajectories of postpartum and later MDS across early childhood (e.g., Campbell

et al., 2007; Choe et al., 2020; Putnick et al., 2020). Our findings add to this literature by demonstrating that mothers with low-income backgrounds show similar patterns of changes in longitudinal MDS as those identified in higher-SES samples. Previous research examining depression among rural mothers has documented that mothers in rural communities are at a higher risk of developing depressive symptoms, both in the postpartum period (Mollard et al., 2016) and outside of the postpartum period (Groh, 2013; Simmons et al., 2015). However, this pattern was not observed
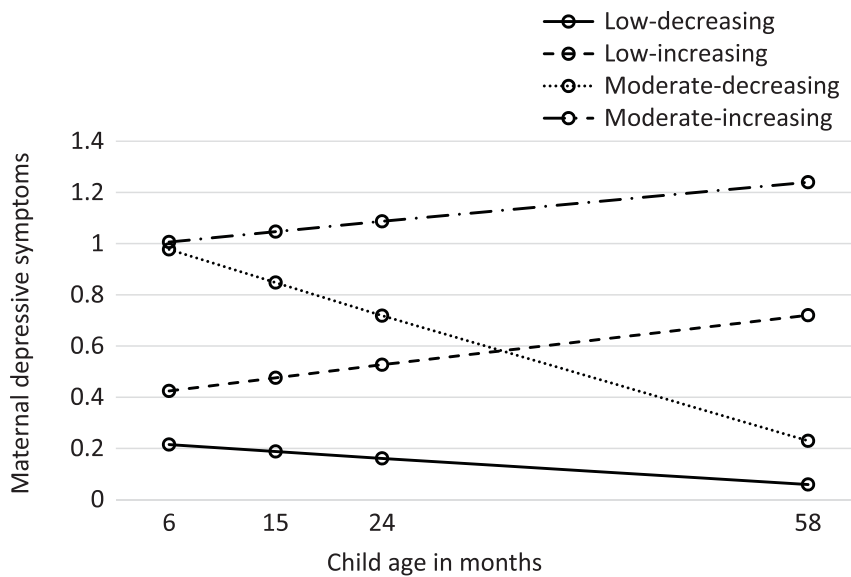
Figure 1. Estimated trajectories of maternal depressive symptoms from 6 to 58 months. The Y-axis indicates square-root transformed means of maternal depressive symptoms of each profile at 6, 15, 24, and 58 months. The original scores for each trajectory are as follows: (*a*) *low-decreasing* (0.12 at 6 months; 0.13 at 15 months; 0.10 at 24 months; and 0.02 at 58 months); (*b*) *low-increasing* (0.29, 0.42, 0.40, and 0.55 at 6, 15, 24, and 58 months); (*c*) *moderate-decreasing* (1.06, 1.05, 0.78, and 0.11 at 6, 15, 24, and 58 months); and (*d*) *moderate-increasing* (1.12, 1.41, 1.42, and 1.65 at 6, 15, 24, and 58 months).

in our sample of low-income, rural mothers living in North Carolina and Pennsylvania. Given the limited amount of existing literature focusing on rural mothers, most of which used small, community samples and diverse assessment tools across studies, it is challenging to make direct comparisons between the findings of the current study and prior research. Our findings regarding heterogeneity in MDS among rural mothers may reflect the fact that rural mothers in the U.S. are not homogenous but rather diverse in terms of risk and protective factors (e.g., Ku & Blair, 2023), which is one of the unique contributions of the present study to the field. Future studies may investigate MDS in rural areas across various regions of the U.S

In regard to the second aim of the current study, examining predictors of MDS trajectories, we found that mothers in all three of the high-risk trajectories of MDS tended to report higher financial strain, lower social support, and higher levels of IPV, compared to women in the *Low-decreasing* trajectory. We also observed that mothers who perceived their neighborhood as more dangerous and noisier were more likely to display relatively greater initial symptoms at 6 months postpartum with a gradual increase over time (i.e., *Low-increasing* trajectory). Importantly, we found that satisfaction with social support was the most salient predictor in differentiating mothers in the *Moderate-decreasing* trajectory from those in the *Moderate-increasing* trajectory.

A notable finding from the current study was that lower subjective SES, indexed by greater perceived financial strain, predicted high-risk trajectories. Specifically, mothers who reported higher financial strain were more likely to belong to *Low-increasing*, *Moderate-decreasing*, and *Moderate-increasing* trajectories than *Low-decreasing*. Moreover, greater financial strain also differentiated mothers in the *Moderate-decreasing* and *Moderate-increasing* trajectory relative to those in the *Low-increasing* trajectory. Our analyses revealed that when multiple indicators of SES were considered simultaneously in an analytic model, perceived financial strain predicted trajectory membership of MDS, above and beyond the traditional objective measures of SES, such as education and INR. These findings support prior findings that individuals' perceived SES has important implications for mental health, independent from objective SES (Franzini & Fernandez-Esquer, 2006; Goodman et al., 2007; Kim & Radoias,

2021). Furthermore, this evidence is consistent with prior work suggesting that subjective SES may even have a stronger influence on individuals' psychological functioning, assessed at discrete points in time, than objective SES across studies with diverse populations (Adler et al., 2000; Newland et al., 2013). In contrast, we found no association between objective SES and trajectory membership. One plausible reason for this nonsignificant association could be the restricted range of SES in our predominantly low-income sample, which may have limited our ability to detect associations between objective SES and trajectory membership. Mothers with depressive symptoms could also be more likely to perceive their socioeconomic status as low. These mothers may be more susceptible to experiencing feelings of inferiority, and may perceive their socioeconomic situations as stressful and unsupportive and even perceive their social environment as distrustful and less cohesive (Wilkinson, 1999). Mothers experiencing depressive symptoms also may report amplified negative perceptions of subjective SES, such as struggles to make ends meet and support their families' living expenses, relative to objective SES standing.

Along with the role of subjective SES, the current analyses also demonstrate that broader neighborhood contexts may contribute to differentiating trajectories of MDS. Specifically, we found that mothers who perceived their neighborhood as more dangerous and noisier tended to fall into the *Low-increasing* trajectory, characterized by low initial symptoms (i.e., approximately the average levels of symptoms of the entire sample at 6 months) with a gradual increase across early childhood, compared to those in *Low-decreasing*. This effect was only seen in the *Low-increasing* group in comparison with the *Low-decreasing* in the multinomial analysis. Importantly, we found that adverse neighborhood environments predicted increased MDS above and beyond the effects of subjective SES measures, suggesting a potential unique role of neighborhood characteristics in predicting MDS beyond potential associations with SES. For example, mothers who perceive their neighborhood as unsafe and noisy may experience intensified stress and anxiety (Cutrona et al., 2006), which may exacerbate MDS over time. However, our analysis revealed that neighborhood environments did not significantly differentiate between other trajectories. Given that the current study is the first to explore the

role of neighborhood environments in the trajectories of MDS, we can only speculate why and how differential associations emerged. Compared to the *Low-decreasing* and *Low-increasing* trajectories, mothers from the *Moderate-decreasing* and *Moderate-increasing* trajectories were socioeconomically underprivileged and lived in more dangerous neighborhoods in the postpartum. Those mothers may be worried about the environments in which they raise their infants and are likely to experience elevated MDS. A marginal difference in neighborhoods during the postpartum period may not differentiate the trajectories of MDS among mothers already experiencing elevated depressive symptoms during this time. Future research should consider investigating the role of neighborhoods in longitudinal MDS across diverse populations.

Supporting social buffering theory (Kikusui et al., 2006), our analyses also suggest that the quality of social relationships may serve as a significant role in the longitudinal manifestation of MDS across early childhood. Mothers reporting higher social support, indexed by greater satisfaction with their social relationships, were more likely to display persistently low MDS from 6 to 58 months (i.e., *Low-decreasing* trajectory), relative to those in the other three high-risk trajectories. Our results are also consistent with other findings from recent studies demonstrating that mothers who felt more supported within their family and broader social network were less likely to belong to high-risk trajectories, such as elevated, increasing, and chronically high trajectories of MDS (Choe et al., 2020; McCall-Hosenfeld et al., 2016). Furthermore, our analyses suggest that among high-risk mothers with elevated MDS, higher social support may be a strong resilience factor for both preventing and attenuating MDS over time. Specifically, we found that mothers who reported greater social support at 6 months were more likely to show a decrease in MDS through early childhood (i.e., *Moderate-decreasing* trajectory). In contrast, mothers reporting lower social support at 6 months tended to demonstrate persistently high and increasing levels of MDS over time (i.e., *Moderate-increasing* trajectory). Overall, the significant role of social support in the trajectories of MDS echoes the tendency for rural women, who often seek informal networks such as extended family and community support. This is because rural women may encounter personal and/or public stigma when seeking mental health care, and access to healthcare is limited (Gauri, 2013; Mollard et al., 2016). Social support from various sources may collectively promote emotional well-being for new mothers.

Across distinct trajectories of MDS, IPV was an important predictor differentiating all high-risk trajectories (i.e., *Low-increasing, Moderate-decreasing, Moderate-increasing*) from the *Low-decreasing* trajectory. In addition, compared to mothers in the *Low-increasing* trajectory, those in *Moderate-decreasing* and *Moderate-increasing* reported greater IPV. Broadly, these findings extend the literature demonstrating that mothers' exposure to and experiences related to their partner's emotional and physical aggression predict elevated MDS, assessed at singular time points mostly during infancy and toddlerhood (Conway et al., 2021; Gustafsson & Cox, 2012; Ludermir et al., 2010; Tsai et al., 2016). Similarly, early IPV may be a key factor differentiating persistently high MDS from lowest-risk (e.g., constant-low) and relatively low-risk MDS trajectories among mothers with diverse sociodemographic backgrounds (Denckla et al., 2018; Giallo et al., 2017; Wikman et al., 2020). Exposure to severe physical and psychological IPV may significantly escalate stress as mothers would feel threatened and intimidated (Lutgendorf, 2019). Furthermore, IPV often leads to

adverse health outcomes (e.g., physical injuries, insomnia), financial hardships, and poor quality of life (Wong & Mellor, 2014). This may disrupt new mothers' well-being and emotional adjustment as a new mother, possibly leading to elevated MDS. We found the *Moderate-decreasing* and *Moderate-increasing* trajectory groups reported the highest IPV at 6 months among all of the trajectory groups; yet, it is not clear from the current data why one group showed a decrease in MDS while the other showed persistently high symptoms over time. However, one possibility is that some mothers might experience changes in IPV over time due to a variety of factors, such as a change in partnership (Chang et al., 2010), thereby helping reduce MDS over time.

Our findings also highlight racial differences in patterns of longitudinal change in MDS. Specifically, the current analysis indicates that compared to White rural mothers, Black rural mothers tended to belong to the *Moderate-increasing* trajectory (the highest-risk group) than the *Low-decreasing* trajectory (the lowest risk group). In this context, it is crucial to discuss how structural racism and inequality can significantly impact Black mothers' experiences in managing their depressive symptoms during the postpartum and early childhood phases of their child's life. These impacts may go beyond individual-level experiences, but extend to systemic challenges that may disproportionately affect marginalized communities, particularly Black mothers (Jones, 2000). The historical context of persistent racism and discrimination experience may exacerbate Black individuals' depressive symptoms through perceived discrimination, racial bias, and microaggression may exacerbate depressive symptoms (Williams & Mohammed, 2009), and this pattern is consistent with Black mothers and in particular the ones with young children living in rural communities (Odom & Vernon-Feagans, 2010; Schulz et al., 2006). In addition, intersections of race, gender, and poverty may compound the structural racism and inequality. Studies have shown that compared to White counterparts, Black mothers often have limited access to health care, and higher rates of poverty, unemployment, and housing instability (Williams & Mohammed, 2009), all of which can contribute to health disparities. It is also possible that stigma and cultural norms prevailed in the Black communities may prevent Black mothers from actively seeking support and engaging in appropriate interventions (Kozhimannil et al., 2011).

The longitudinal nature and repeated assessments of MDS across the first 5 years of the child's life are a significant strength of the current study. Furthermore, we characterized trajectories of MDS using a large sample of racially diverse mothers living in rural regions with high poverty rates, a population that has historically been neglected in research. This contributes to the existing literature, given that the majority of prior work conducted in developed countries, such as in the U.S. and Canada, has predominately included mothers with relatively high SES and/or mothers residing in urban areas (e.g., Ahmed et al., 2019; Choe et al., 2020). In addition, our data elucidates the unique and varied roles of perceived SES versus objective SES, neighborhood environments, social support and IPV in predicting different trajectories of MDS. This more holistic approach may increase our understanding of experiences of rural low-income mothers at the individual, family, and neighborhood levels, and how these contexts may affect longitudinal trajectories of MDS. Considering the growing body of literature that acknowledges the significant influence of MDS on child development over time (e.g., Choe et al., 2023), future research may explore the dynamics of MDS and their impact on various aspects of child health, social-emotional well-being, and cognitive development.

Despite these strengths, our findings should be interpreted alongside the limitations of this study. We relied on maternal self-reported early experiences in the family and neighborhood, and lacked diagnosis in MDS by clinicians. This may inflate associations between mothers' early experiences and MDS, such that mothers with severe depressive symptoms may interpret their financial situation as worse. Although the present study included extensive indicators of mothers' postpartum experiences in adversity and protective factors, we lacked data on prenatal/birth-related predictors of early childhood MDS as well as prenatal depressive symptoms. Most of mothers with elevated depressive symptoms may show a gradual decrease in depressive symptoms after birth (Ahmed et al., 2019); however, among some mothers, depressive symptoms may persistent throughout early childhood (Denckla et al., 2018; Giallo et al., 2017). Thus, we are mindful of the interpretation of the postnatal predictors of depression trajectory membership, especially the *Moderate-increasing* trajectory group. Finally, given that this sample is predominantly low-income, the regression coefficients might underestimate the effects.

The current findings have clinical implications for supporting mothers identified as high-risk for depression trajectories. Early detection of mothers who are susceptible to experiencing high-risk trajectory patterns is crucial. At the individual level, interventions targeting postpartum mothers should focus on managing financial stress, enhancing social support, and addressing IPV to prevent the escalation of depressive symptoms. Addressing neighborhood safety can also mitigate increasing depressive symptoms. Collaborative efforts involving healthcare professionals, mental health providers, community organizations, and policymakers are essential. Since a subgroup of new mothers may continue to struggle with MDS over time, there is a need for longitudinal support that extends beyond the postpartum period to help these mothers navigate evolving challenges. Given the sample's diversity, cultural sensitivity is crucial, especially for diverse racial and socioeconomic backgrounds, such as Black mothers at higher risk of elevated depressive symptoms. In summary, these findings shed light on the heterogenous longitudinal manifestations of MDS among historically underserved mothers in early childhood, informing targeted interventions.. This characterization is an integral step in helping to develop and implement novel, evidence-based strategies to mitigate the adverse consequences and burden of depression on women and their children.

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