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ORIGINAL ARTICLE

The longitudinal relationships among poverty, material hardship, and maternal depression in the USA: a latent growth mediation model

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Abstract

This study aims to understand the direct and indirect effects of poverty trajectories on maternal depression trajectories mediated by material hardship trajectories. A latent growth mediation model was tested using a predominantly low-income and mostly unmarried sample of mothers from the Fragile Families and Child Wellbeing Study, a national birth cohort of racially diverse mothers ($N = 3999$). Measures included family poverty, material hardship, and maternal depression from 5 waves of data which tracked mothers starting 1 year after childbirth until the child reached 15 years of age. The results revealed that (1) family poverty was associated with material hardship and maternal depression, and material hardship was related to maternal depression at the trajectory level and the rate of change, with the exception of the relationships between the rate of change in family poverty and the rate of change in maternal depression; (2) material hardship mediated the relationship between family poverty and maternal depression at the initial trajectory levels, and the rate of change in material hardship fully mediated the relationship between the rate of change in poverty and the rate of change in maternal depression. This study provides further evidence that alleviating material hardship might be a promising avenue to reducing maternal depression.

Keywords Maternal depression · Poverty · Material hardship · Fragile families · Latent growth curve models

Introduction

Depression is one of the most common and costly mental health disorders and the leading cause of disability among adults in the USA (Kessler et al. 2003; Merikangas et al. 2007). Rates of depression are high in mothers, with prevalence estimated at about 10% among mothers of children aged 18 or younger in any given year (Ertel et al. 2011) and at a range from 16 to 38% among low-income mothers in the USA (Pooler et al. 2013; Turney 2012). Maternal depression is a critical public health concern due to its prevalence, high risk for comorbidities (Kessler et al. 1997; Hasin et al. 2005; Substance Abuse and Mental Health Services Administration [SAMHSA] 2021), and profound impacts on the economics, the livelihood of mothers, and the well-being and healthy development of the child and the family system (Belle and Doucet 2003; Knitzer et al. 2008; Shrivastava et al. 2015; Trussell et al. 2018). These consequences highlight the vital need for population-based strategies designed to prevent or reduce maternal depression that focus on modifiable risk factors or exposures (Muñoz et al. 2010; Jacka et al. 2012).

Poverty is a risk factor for maternal depression (Bassuk et al. 2014; Smith and Mazure 2021; Wang et al. 2011). According to US national surveys, one out of seven American families with young children lived in poverty in 2019 (Children's Defense Fund 2021; U.S. Census Bureau 2020). Living in poverty is stress-provoking and can place mothers at an increased risk for depression. This linkage can be broadly understood through the family stress model (FSM; Conger et al. 2002), which posits that parents who experience economic hardship, such as low income and poverty, are more likely to feel economic pressure, also known as material hardship, which helps to explain the association between economic hardship and parents' mental health problems. Economic pressure can include multiple consumption-based indicators (e.g., inability to pay bills, food insecurity, and having utilities cut off; BCRCW

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2018; Conger et al., 2002). The FSM was first demonstrated using the US populations, but findings have been replicated with diverse samples from both within and outside the USA (see Masarik and Conger 2017 for a review).

Research has generally supported the association between poverty and mothers' depressive symptoms (Heflin and Iceland 2009; Kahn et al. 2000; Ritsher et al. 2001). Given that poverty is moderately correlated with indicators of material hardship, such as insufficient food or clothing and the inability to pay bills (Beverly 2008; Conger et al. 2002; Iceland and Bauman 2007; Jenkins et al. 2008), and material hardship is also associated with depression (Dijkstra-Kersten et al. 2015; Gershoff et al. 2007; Heflin and Iceland 2009; Heflin et al. 2005; Katz et al. 2018; Newland et al. 2013; Weaver et al. 2018), it seems reasonable to expect material hardship to be a mediator. Indeed, a growing number of studies have demonstrated that material hardship is a mediator between economic hardship such as poverty and mothers' mental health (e.g., Shelleby 2018; Zhang et al., 2020).

Unfortunately, most studies to date have examined poverty as a static condition despite the fluid nature of poverty in America (Ackerman et al. 2004; Knifton and Inglis 2020; Rothwell et al. 2019). This has limited our knowledge about whether a family's poverty changes across time and how both the initial level of severity and the rate of change in poverty status are associated with material hardship and maternal depression. Latent growth curve models (LGCM) can be employed to untangle these relationships over an extended period of time. Thus, our objectives are to examine whether and how *levels* and *changes* in poverty, material hardship, and maternal depression are related among predominantly low-income mothers over 5 waves of data covering a 15-year follow-up period. More specifically, we examine the direct and indirect effects of poverty trajectories (the levels and changes) on maternal depression trajectories mediated by material hardship trajectories. These findings are critical to creating informed prevention and intervention strategies and health policies for addressing low-income mothers' depression as they provide insight into the mechanism that may act as "turning points" for reducing maternal depression.

We hypothesized that (1) the initial level (i.e., severity) of poverty would be associated with the initial levels of material hardship and maternal depression; (2) the rate of change (i.e., slope) in poverty would be related to rates of change in material hardship and maternal depression; (3) family material hardship's initial level would mediate the relationship between family poverty level and maternal depression level; and (4) the rate of change in material hardship would mediate the relationship between rates of change in poverty and changes in maternal depression.

Materials and methods

Data

Data were from the Fragile Families and Child Wellbeing Study (FFCWS), a longitudinal US birth cohort study of 4898 children born in 20 large cities that began in 2001 (Reichman et al. 2001). When weighted, the sample is representative of families who were living in US cities with populations of 200,000 or more between 1998 and 2000. Biological mothers were first interviewed directly following the birth of the focal child (wave 1, 2001). Follow-ups were conducted when the child was approximately 1, 3, 5, 9, and 15 years old (waves 2–6). We used data from waves 2–6. The current study was restricted to mothers who participated at wave 2 ($n = 4364$) and had at least three waves of data available for main variables ($n = 3999$).

Measures

Poverty (waves 2 to 6) was based on the ratio of total household income to the official US Census Bureau poverty thresholds based on family composition. We categorized families at 100% or below the income-to-needs ratio as being in poverty (1 = *below 100% of poverty*).

Material hardship (waves 2 to 6) was measured by questions adapted from the Survey on Income and Program Participation 1996, the 1997 and 1999 New York City Social Indicators Survey, and the 1999 Study of Work, Welfare, and Family Well-Being of Iowa families on Family Investment Program (BCRCW 2018). Eight dichotomous questions about their financial difficulties in the past year(s) were consistently asked. For example, mothers were asked if they "had not paid the full amount of rent or mortgage payment, did not pay the full amount of a gas, oil, or electricity bill" in the past 12 months. The *yes* responses were summed to create an index, with higher scores indicating higher levels of material hardship.

Maternal depression (waves 2 to 6) was determined using a constructed dichotomous variable from the FFCWS indicating whether the mother had a probable diagnosis of a major depressive episode in the past year based on the Composite International Diagnostic Interview-Short Form (CIDI-SF; Kessler et al. 1998; see DeKlyen et al. 2006 for details). Mothers were asked about their feelings of dysphoria or anhedonia in the past year that lasted for 2 weeks or more, and if these symptoms occurred every day and for how long. If they endorsed the diagnostic screening questions, then additional questions (e.g., had lower energy than normal) were asked to determine the major depression caseness (BCRCW 2018).

Covariates included dummy variables for marital status (1 = married/cohabitating; 0 = single/separated) and race/ethnicity (non-Hispanic [NH] Black, Hispanic, others [Asian American/Pacific Islander, American Indian/Alaskan Native and other races], reference group = NH White); an ordinal measure of mother's educational attainment (less than high school, high school or equivalent, some college or technical training, and college or graduate degree); and a continuous measure of mothers' age. Covariates were all from wave 2.

Statistical analysis

We conducted a series of LGCM to examine the stabilities and changes in family poverty, family material hardship, and maternal depression over time and the relationships between all three *trajectories* (i.e., the initial levels and rates of change). LGCM is a technique that has the ability to examine model-implied trajectories and to assess between-person variations in initial levels and rates of change over time (Meredith and Tisak 1990). Prior to testing our hypotheses, we first run three unconditional univariate growth curves respectively for our three outcome variables across the five time points (Preacher et al. 2011) to examine whether the outcome changed or remained the same across time. In these models, we examined each outcome variable's initial level (intercept), rate of change (slope), and the covariance between the intercept and slope. Given that family poverty and maternal depression are binary outcomes, we followed the procedures recommended by Newsom and Smith (2020) to estimate the binary LGCM. More specifically, the binary observed variables (i.e., poverty vs. no poverty; depression vs. no depression) were captured by using continuous latent response variables. Thereafter, we used simplified terms "poverty" and "depression." The growth curves were estimated using a linear specification, with factor loadings fixed at − 14, − 12, − 10, − 6, and 0 for each time point starting wave 2 and leading up wave 6, which scaled the slope in terms of annual changes. The negative factor loadings simply aid ease of interpretation because change is more intuitively thought of as moving forward over historical time. For more discussion of time metrics and factor loadings in LGCM, see Bollen and Curran (2006).

Second, to test our hypotheses, a parallel process model was used to simultaneously examine the relationships among three trajectories: family poverty, family material hardship, and maternal depression. We incorporated the covariates into the model by specifying direct paths from each covariate to all the latent growth components to examine whether characteristics of mothers (e.g., race/ethnicity) were predictive of higher or lower starting points or steeper or less steep rates of change over time (Curran et al. 2014). For all models, we assessed model fit via comparative fit index (CFI), Tucker–Lewis index (TLI) values, and the root mean square error of approximation (RMSEA; Hu and Bentler 1998; Meade et al. 2008). We used full-information maximum likelihood (FIML) estimation to handle missing data which uses all available information for each person and has been shown to produce unbiased parameter estimates and standard errors for missing random data (Acock 2005; Enders and Bandalos 2001). Analyses were conducted using Mplus version 8 (Muthén and Muthén 2017).

Results

Descriptive statistics

Table 1 displays descriptive statistics for all study variables. Among the 3999 mothers, 21.8% were non-Hispanic (NH) Whites and about half of them were NH Blacks; their mean age was 26.09 ($SD = 6.02$) at wave 2 (between 1998 and 2000). Nearly 75% of mothers were single or separated. Approximately half of the mothers (43.8%) reported their families at 100% or below the poverty threshold at wave 2, and the prevalence of family poverty steadily decreased from waves 2 to 6. The means for material hardship across waves were 1 (*SDs* ranging from 1.26 to 1.38). The prevalence of past-year depression was the highest at wave 3 when children were at age 3 (20.1%).

Unconditional linear growth model

Three unconditional univariate LGCM were established to explore whether the growth trajectories for family poverty, material hardship, and maternal depression changed or remained stable across time. The model goodness-of-fit statistics for the three models were acceptable (see Table 2). Of all variables, only family poverty significantly decreased over time ($\mu = -0.025$, $p < 0.001$). However, the estimated variances of the intercept and linear slope for all variables were significant, suggesting the initial levels and rates of change varied significantly across mothers ($ps < 0.001$). Additionally, the significant intercept and slope covariances ($ps < 0.001$) indicated that, on average, mothers with high initial levels were more likely to experience declines over time compared to other mothers.

Parallel process model

A parallel process latent growth model including covariates (see Fig. 1) was conducted to test our hypotheses; results are shown in Table 3. The model achieved good fit with the data: χ^2 (150) = 545.18, $p < 0.001$, CFI = 0.99, TLI = 0.98, and RMSEA = 0.026 (90% CI [0.023, 0.028]). On the intercept level (intercept-to-intercept), family poverty was positively associated with family material hardship ($\beta = 0.39$,

Table 1 Descriptive statistics of variables included in analyses ($N = 3{,}999$)

Variable	% or mean (SD)
Mother's demographics at wave 2	
Age	26.09 (6.02)
Marital status	
Married or cohabitating	25.2%
Single or separated	74.8%
Race	
Non-Hispanic White	21.8%
Non-Hispanic Black	48.7%
Hispanic	26.0%
Others[a]	3.5%
Education	
Less than high school	30.2%
High school or equivalent	30.3%
Some college or technical training	28.0%
College or graduate degree	11.5%
Poverty (wave 2)	43.8%
Poverty (wave 3)	40.1%
Poverty (wave 4)	38.4%
Poverty (wave 5)	30.0%
Poverty (wave 6)	25.3%
Material hardship (wave 2)	.90 (1.26)
Material hardship (wave 3)	.89 (1.27)
Material hardship (wave 4)	.93 (1.30)
Material hardship (wave 5)	1.13 (1.38)
Material hardship (wave 6)	.91 (1.29)
Maternal depression (wave 2)	15.4%
Maternal depression (wave 3)	20.1%
Maternal depression (wave 4)	16.2%
Maternal depression (wave 5)	14.4%
Maternal depression (wave 6)	14.7%

[a]Others = Asian American/Pacific Islander, American Indian/Alaskan Native and other races

$p < 0.001$) and maternal depression ($\beta = 0.15$, $p < 0.01$); family material hardship was positively associated with maternal depression ($\beta = 0.45$, $p < 0.001$), supporting our hypothesis 1. The slope-to-slope associations showed that family poverty slope was significantly associated with material hardship slope ($\beta = 0.37$, $p < 0.01$), and material hardship slope was positively correlated with mothers' depression slope ($\beta = 0.59$, $p < 0.001$), Surprisingly, the family poverty slope was not significantly related to the maternal depression slope ($\beta = 0.01$, $p = 0.87$). Therefore, our hypothesis 2 was partially supported.

The 95% bootstrapped CIs sample revealed that the indirect effect from the family poverty level to maternal depression level through material hardship level was significant ($\beta = 0.18$, 95% CI [0.13, 0.22]), supporting our hypothesis 3. Thus, mothers who had higher poverty levels were likely to have higher material hardship level, which was associated with higher maternal depression level. Also, the 95% bootstrapped CIs sample revealed that the rate of change in material hardship mediated the relationship between rates of change in poverty and maternal depression ($\beta = 0.22$, 95% CI [0.12, 0.32]), supporting our hypothesis 4; this result suggested that the rate of change in poverty was positively related to the rate of change in material hardship and which in turn was positively associated with the rate of change in maternal depression. Additional analysis found that the direct relationship between the rate of change in poverty and the rate of change in maternal depression was significant ($\beta = 0.21$, $p < 0.05$) in the model without material hardship. The strength of this relationship became weaker and insignificant ($\beta = 0.01$, $p = 0.87$) in the mediation model, which suggests a full mediation.

Table 2 Model statistics for unconditional latent growth curve models

Model statistics	Family poverty	Material hardship	Maternal depression
Goodness of fit			
χ^2 (*df*)	50.232 (10)	338.057 (10)	86.213 (10)
RMSEA [90% CIs]	.032 [.023, .041]	.091 [.082, .099]	.044 [.035, .052]
CFI	.995	.913	.970
Linear growth slope	$-.025^{***}$	.001	.001
Variances			
Level	$.730\ (.036)^{***}$	$.988\ (.022)^{***}$	$.631\ (.053)^{***}$
Slope	$.002\ (.000)^{***}$	$.004\ (.000)^{***}$	$.003\ (.000)^{***}$
Intercept-slope covariance	$.015^{***}$	$.033^{***}$	$.021^{***}$

Note: Standard errors are shown in parentheses. Values are unstandardized coefficients for the linear models. χ^2, chi-square; *df*, degrees of freedom; *RMSEA*, root mean square error of approximation; *CI*, confidence intervals; *CFI*, comparative fit index

$^{***}p < .001$

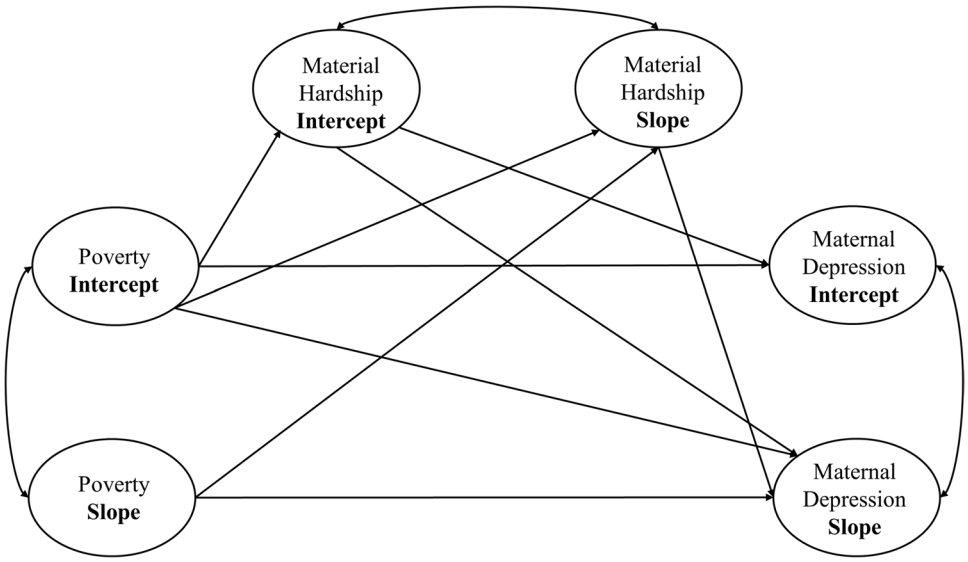

Fig. 1 The parallel process model. Observed repeated measures comprising the measurement model are not shown

Table 3 Coefficients for parallel process model

	Poverty		Material hardship		Depression		Indirect effects	
	Intercept	Slope	Intercept	Slope	Intercept	Slope		
	β (SE)	*β (SE)*	*β (SE)*	*β (SE)*	*β (SE)*	*β (SE)*	*β (SE)*	95% CI[a]
Covariates								
Age	.04 (.03)	.01 (.05)	−.11 (.02)***	−.08 (.03)**	−.001 (.04)	−.02 (.05)		
Education	−.47 (.04)***	−.17 (.08)*	−.07 (.04)*	.09 (.05)	−.12 (.06)*	−.10 (.09)		
Married	−.21 (.03)***	−.07 (.06)	−.12 (.03)***	.09 (.04)*	−.08 (.05)	−.07 (.07)		
Hispanic	−.21 (.11)*	−1.16 (.25)***	−.53 (.09)***	.50 (.20)*	−.51 (.14)***	−.27 (.30)		
Black	.08 (.05)	−.55 (.13)***	−.19 (.05)***	.36 (.11)**	−.35 (.09)***	−.23 (.17)		
Other races	.16 (.08)	.8 (.19)***	.39 (.07)***	−.35 (.15)*	.30 (.11)**	.15 (.22)		
Poverty intercept	–	–	.39 (.04)***	.07 (.06)	.15 (.06)**	−.01 (.07)		
Poverty slope	–	–	–	.37 (.06)***	–	.01 (.08)		
Material hardship intercept	–	–	–	–	.45 (.05)***	−.08 (.07)		
Material hardship slope	–	–	–	–	–	.59 (.07)***		
Intercept-to-intercept Indirect pathway							.18 (.02)***	**.13, .22**
Slope-to-slope indirect Pathway							.22 (.05)***	**.12, .32**

[a]Bootstrap estimate and 95% bias-corrected confidence intervals were based on 5,000 bootstrap samples. CIs do not contain 0, indicating there is a statistically significant result. Standardized coefficients are shown. ***$p < .001$, **$p < .01$, *$p < .05$

Discussion and conclusions

Maternal depression is prevalent and a serious public health issue (Hasin et al. 2005), which may be impacted by poverty (Bassuk et al. 2014; Smith and Mazure 2021; Wang et al. 2011). Because poverty is fluid (Ackerman et al. 2004; Knifton and Inglis 2020; Rothwell et al. 2019), we captured this change by using LGCM and five waves of data which tracked a sample of predominantly low-income and mostly unmarried mothers starting 1 year after childbirth until the child reached 15 years of age. The present study demonstrated parallel associations among *trajectories* of family poverty, material hardship, and maternal depression. Consistent with prior literature that has found parents who live in poverty (Heflin and Iceland 2009) and who experience material hardship (Heflin et al. 2005; Iceland and Bauman 2007; Meyer and Sullivan 2018; Sullivan

et al. 2008) are more likely to report depressive symptoms, we found that baseline levels of both poverty and material hardship significantly predicted depression.

Furthermore, using longitudinal data, we were also able to test how the rate of change in poverty was related to rates of change in material hardship and depression. We found that the rate of change in material hardship was associated with the rate of change in maternal depression. Thus, the development of material hardship or maternal depression may not correspond simply to experiencing a high level of poverty or material hardship, which can be approximated by the initial trajectory level as discussed previously. Rather, material hardship and maternal depression in low-income mothers respectively corresponded to mothers' changes in poverty and material hardship over time. Changes in economic well-being over such an extended period of time may reflect a cumulative process. Thus, both the severity and deterioration/improvement in life course economic well-being appear to play important roles in the development of maternal depression. These findings provide support for the value and necessity of economic and policy initiatives targeting at helping low-income families move out of poverty and reduce material hardship.

We, however, did not find support for a significant correlation between the rate of change in poverty and the rate of change for mothers' depression in the parallel process LGCM; additional analysis revealed that this association was indeed significant without introducing material hardship in the model. These findings provided evidence for a full mediation of the effect of the rate of change in poverty on the rate of change in maternal depression by the rate of change in material hardship. Thus, it is possible that the results of quasi-experimental studies which found that mothers who received additional income were more likely to report fewer depressive symptoms (Costello et al. 2003; Dearing et al. 2004; Ozer et al. 2011) might be due to mothers being able to use additional funds to meet their family's material needs, which further reduced their depressive symptoms. The mediation of material hardship in our study is an important finding which generally reinforces numerous previous studies which replicate the FSM (Conger et al. 2002; Masarik and Conger 2017) and further confirms that the pressure of not meeting ends meet resulting from poverty is a promising explanation of why poverty is associated with depression.

The current findings have important programmatic and interventional implications for addressing mothers' depression, which is a potent risk factor for morbidities as well as the development of depression in their children (Goodman and Gotlib 1999; SAMHSA 2021). Programs and policies aimed at alleviating material hardship might be a promising avenue to reducing mothers' depression in this population (Heflin and Iceland 2009; Kiely et al. 2015). Thus, anti-poverty programs that simultaneously aim at reducing poverty at the income level and material hardship at the consumption level might be more effective in terms of well-being gains.

There are some limitations to the current study. First, we only considered family socioeconomic-related stressors as risk factors for maternal depression, ignoring other potential risk factors such as depressive cognitive processes and parental depression due to the unavailability of data (Hammen 2018); future studies may benefit from adding biological and genetic related risk factors in assessing maternal depression. Second, even though this study has the strength of covering a 15-year period, five time points with unequal years between measurements may not be the ideal timing for assessing the longitudinal relationships. More frequent measurement of variables might allow a more accurate estimation of changes in depression among mothers of young children. Third, we used an index score of material hardship which did not allow further detailed examination. Since material hardship includes multiple indicators, future research needs to examine whether the rate of change in poverty is related to the rates of change in all material hardship indicators in the same manner (Iceland et al. 2021).

Using a sample of predominantly low-income and mostly unmarried mothers, we expanded upon prior research by using a longitudinal design to untangle the dynamic relationships among poverty, material hardship, and depression over time. In particular, we examined the trajectories of poverty, material hardship, and mothers' depression over time and then tested the longitudinal mediating effects of material hardship between poverty and mothers' depression. Results demonstrated that poverty is positively associated with material hardship, which in turn is related to maternal depression at both of the initial trajectory levels and the rates of change. Our study findings not only reinforce the value and necessity of anti-poverty policies and initiatives, but also provide an important contribution to understanding the process by which poverty is associated with maternal depression across their child's infancy through adolescence.

Data availability The Data Archive at the Office of Population Research of Princeton University approved the use of these publicly available and deidentified data.

Declarations

Ethics approval This article does not contain any studies with human participants performed by any of the authors.

Consent to participate Informed consent was obtained from all individual participants included in the study.

Conflict of interest The authors declare no competing interests.

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