Poverty, Material Hardship, and Depression*

Colleen M. Heflin, *University of Missouri*

John Iceland, *Pennsylvania State University*

Objective. Mental health disorders are of great social, economic, and policy concern. A higher incidence of major depressive disorder has been reported among women living in or near poverty. Our study examines the extent to which the relationship between income and depression is mediated by measures of material hardship. *Methods.* We use measures of depression at two points in time from the longitudinal Fragile Families Survey to better discern the causal direction of the relationship between income poverty, hardship, and depression. More specifically, we use conditional logistic fixed-effect models that control for time-invariant unmeasured heterogeneity in the sample. *Results.* We found a strong relationship between hardships and depression. The most prominent hardships were problems paying bills and phone turned off. We also found that hardship helped mediate much, though not all, of the link between poverty and depression in the conditional fixed-effects logistic regression models. *Conclusion.* Our policy simulations suggest that public health efforts to reduce depression may be enhanced from efforts that focus on specific forms of material hardship.

Mental health disorders are of great social, economic, and policy concern. Mental health is defined according to the Surgeon General as "a state of successful performance of mental function, resulting in productive activities, fulfilling relationships with other people, and the ability to adapt to change and to cope with adversity" (U.S. Department of Health and Human Services, 1999:vii). Furthermore, mental health is required for an individual to maintain social relationships with others and contribute to society.

At the individual level, the general association between health and income is well established and has been found in different places, time periods, genders, and ages (Lynch et al., 2004; Adams et al., 2003). In terms of mental health disorders, Kessler et al. (1994) report a higher lifetime and 12-month incidence of depressive, anxiety, and substance use disorders among low-income individuals. More recently, Kessler et al. (2003) report a higher 12-month incidence of major depressive disorder among those living in or near poverty. Adults with serious psychological distress were more likely to

*Direct correspondence to Colleen M. Heflin, Truman School of Public Affairs, University of Missouri, Columbia, MO 65211 ⟨heflincm@missouri.edu⟩. Heflin will share all data and coding information necessary to replicate the study.

SOCIAL SCIENCE QUARTERLY, Volume 90, Number 5, December 2009

have less than a high school degree (34 percent) than those without serious psychological distress (17 percent). Additionally, adults with serious psychological distress were more likely to have family income below $20,000 (44 percent) than those without (20 percent) (Pratt, Dey, and Cohen, 2007).

The relationship between income and mental health is not just found at the very bottom of the income distribution or for those living below the federal poverty line. There is a clear income gradient to health such that every step above the poverty line is associated with an incremental improvement in health (Lynch et al., 2004; Ecob and Smith, 1999). While it is clear that depression results in lost income (Marcotte and Wilcox-Gok, 2001; Kessler et al., 2006; Greenberg et al., 2003), there is a growing consensus that socioeconomic disadvantage precedes poor mental health. Although reverse causation—poor mental health leading to lower earnings—is present, it is no longer considered the primary mechanism behind the association between income and health (Lynch et al., 2004). Several longitudinal studies have specifically examined the relationship between depression and socioeconomic status and concluded that the causal direction runs from socioeconomic status to depression (Muntaner et al., 2004; Miech et al., 1999; Johnson et al., 1999). Thus, exploring new dimensions along which the income-mental health gradient may operate is of substantial interest.

At the present time, most recent research on mental health outcomes continues to include either a measure of poverty, income, or socioeconomic status in the models (Perreira et al., 2005; Hawkins and Booth, 2005; Turner, Taylor, and Van Gundy, 2004; Serido, Almeida, and Wethington, 2004; Evenson and Simon, 2005). There is no research explicitly examining how material hardship mediates the effect of poverty on mental health. Moreover, the relatively few studies that looked at the broader association between hardship and mental health suffer from two limitations (Heflin et al., 2005; Heflin et al., 2007; Laraia et al., 2006; Casey et al., 2004). First, they tended to focus on only one type of hardship. In this project, we expand the scope to include five dimensions of hardship. Looking at multiple forms of hardship allows us to determine if some forms are associated more closely with depression than others. Second, previous work relied on cross-sectional data or data from community-based studies. We use longitudinal data collected in the Fragile Families Survey—a survey of births in cities with populations greater than 200,000 in 1999 in the United States. This allows us to conduct more precise causal modeling, via conditional logistic fixed-effect models, that explicitly incorporates time-invariant unmeasured heterogeneity. The data also provide insight on a population (households with new births) vulnerable to poverty and hardship and that have been the focus of policy interventions in recent years, such as through welfare reform initiatives. Finally, we contribute to literature in social epidemiology by providing a direct test of the extent to which the relationship between income and depression is mediated by material conditions.

The Relationship Between Poverty and Material Hardship

Poverty is usually defined and operationalized by researchers in terms of income deprivation. The ''official'' U.S. poverty measure—the focus here—has two components: poverty thresholds and the definition of family income that is compared to these thresholds. The thresholds were originally devised in the 1960s to represent the cost of a minimum diet multiplied by three to allow for expenditures on other goods and services. The thresholds vary by family size and age of household members, and have been updated yearly for inflation using the Consumer Price Index (CPI). The poverty threshold for a family of two adults and two children was $19,806 in 2005. The definition of family resources used consists of gross annual cash income from all sources, such as earnings, pensions, interest income, rental income, asset income, and cash welfare. A family and its members are considered poor if their income falls below the poverty threshold for a family of that size and composition.

Many researchers have since noted the technical deficiencies of the official poverty measure (Ruggles, 1990; Citro and Michaels, 1995; Iceland, 2006). For example, the poverty lines, originally devised by multiplying the cost of food needs by three to account for other needs (such as clothing and shelter), no longer capture families' basic needs because people today spend closer to one-seventh of their income on food rather than one-third. The definition of money income used in the official measure—gross cash income—also inadequately captures the amount of money people have at their disposal to meet basic needs by omitting noncash transfers (such as housing subsidies). In tandem with these technical criticisms of the income poverty measure, there is a growing interest in using measures of material hardship to identify individuals who do not consume minimal levels of basic goods and services such as food, housing, clothing, and medical care (Beverly, 2001; Boushey et al., 2001; Ouellette et al., 2004). Many argue that the U.S. public is or should be more concerned with meeting a basic set of needs instead of providing a basic level of income (Mayer and Jencks, 1989; Rector, Johnson, and Youssef, 1999).

The empirical literature on the association between income poverty and various hardship measures indicates that they are only moderately correlated with one another in the United States (Mayer and Jencks, 1989, 1993; Mayer, 1995; Rector, Johnson, and Youssef, 1999; Beverly, 2000; Boushey et al., 2001; Perry, 2002; Bradshaw and Finch, 2003). On the one hand, poor people are more likely than nonpoor people to report a variety of material hardships. For example, Boushey et al. (2001) reported that while about 13 percent of respondents under 200 percent of the poverty level reported not having enough food to eat, only 2 percent of those over 200 percent of the poverty line said the same. While 25 percent of those under 200 percent of the poverty line were unable to make housing or utility payments, the figure for those above 200 percent of the poverty line was 8

percent. On the other hand, as these findings indicate, many people with low income do not report various types of material hardship, and some people who are not poor do. One of the best-developed measures of material hardship, the Food Security Scale, correlates with income and poverty at approximately 0.33 (Hamilton et al., 1997).

Iceland and Bauman (2004) find that income poverty is more strongly associated with some hardship measures, such as food insecurity, difficulty paying bills, and possession of consumer durables, and less strongly associated with others, including housing and neighborhood problems and fear of crime. They conclude that various hardship measures, often by design, tap into distinct dimensions of well-being. Income poverty measures capture the flow of income that can be used to meet recurring needs, and by and large do not attempt to take into account the stock of resources at people's disposal. Thus, neither a household's wealth nor its debt is typically included in these measures. Many of the material hardship measures, however, indirectly take a household's wealth or debt into account. There are likely some people with tremendous wealth who do not work and thus look income poor but may report no hardships. Conversely, there are people with high incomes who either hit a rough financial patch and report hardships, or who have high fixed costs and may have trouble meeting basic expenses.[1] For precisely some of these reasons, we believe it is important to investigate the relationship between health and both income poverty and material hardship measures. We explore the consequences of using an income measure tied to the federal poverty thresholds versus a material-hardship-based measure to model the risk of depression in a sample of mothers with new births.

Material Resources as Determinants of Depression

The premise that material hardship may mediate the income–mental-health relationship is based on what is known in the social epidemiology field as the neomaterial approach (Lynch et al., 2000). In the neomaterial tradition, material hardship measures could have a negative impact on mental health through a direct effect of nutritional shortfalls, exposure to unhealthy housing conditions, or deterioration in other basic living conditions. Previous research focused on components of the public infrastructure such as education, health services, transportation, environmental and occupational controls, quality of food, and quality of housing (Lynch et al., 2000).

At the individual level, research has focused on parsing out the relative contribution of different mechanisms through which disadvantage may

[1]For a conceptual model outlining possible determinants of material hardship, see Heflin, Corcoran, and Siefert's (2007) discussion of possible determinants of food insufficiency in which economic resources are only one factor. Other factors discussed include other types of resources, household demands, and individual characteristics that may interfere with the ability to cope with scarce resources.

affect health over the lifecourse (Miech et al., 1999). For example, Macleod and colleagues (2002, 2005) have explored the relative contribution of objective and subjective social status to health. Macleod and colleagues (2005) report that objective material conditions (such as lack of access to car or father's manual occupation), particularly those experienced earlier in life, are a more important determinant of health than perceptions of relative status.

Previous research pointedly debates the contribution of psychosocial and neomaterial measures to health (Macleod and Smith, 2003; Muntaner et al., 2004); however, currently, no individual-level studies have empirically differentiated the effects of income from measures of material well-being on mental health. This omission is largely the result of the conceptualization of socioeconomic status as a measure that encompasses an individual's income, education, and occupation (see, e.g., Miech et al., 1999). Yet, the population statistics that are viewed by policymakers and public health officials are usually released with results by income level and/or poverty status alone. Thus, understanding the extent to which income directly affects mental health and the extent to which it operates through material conditions is quite relevant.

It is important to note that there are a myriad of causal pathways between income and mental health that likely operate outside of variation in material hardship experiences (e.g., neighborhood effects). Therefore, while we expect material hardship to mediate a prime amount of the income–mental-health relationship, we expect that we have not captured all the possible causal pathways through which income can affect mental health. As a result, although we expect the direct effect to diminish in models containing material hardship, we expect that income will continue to be an important predictor of mental health.

Data

For this study, we analyze data from two waves of the Fragile Families and Child Wellbeing Study (FF), a longitudinal survey of 4,700 children. FF follows a cohort of newborn children and their parents in 20 U.S. cities (located in 15 states). A multistaged sampling design was used to randomly sample cities, hospitals within cities, and then births within hospitals. Baseline interviews were conducted with a probability sample of 3,712 unmarried mothers and a comparison group of 1,196 married mothers from 1998 to 2000. Mothers were interviewed in the hospital at the time of their child's birth (baseline) and over the telephone one and three years later. Trained interviewers conducted face-to-face interviews with the mothers between February 1998 and September 2000. One-year follow-up interviews were conducted between June 1999 and March 2002. The three-year follow-up interviews were conducted between April 2001 and December 2003 (Reichman et al., 2001). This project utilizes data from the one-year and three-year

follow-up interviews and is restricted to mothers with valid data on all variables in the model.

One limitation of the data is that they are not necessarily representative of the experiences of the population as a whole, particularly those living outside major metropolitan areas or households without children. The association between poverty, hardship, and depression could indeed differ among other populations. Nevertheless, the population here is of particular interest to many policymakers and the public who seek to bolster the long-term well-being of these young families and their children. Additionally, no nationally representative data sets contain information on depression, income poverty, and multiple domains of material hardship.

Measures

Mental health will be assessed using an indicator for major depressive disorder based on the definitions and criteria specified in the revised third edition of the American Psychiatric Association's *Diagnostic and Statistical Manual of Mental Disorders* (*DSM-III-R*) (APA, 1987). The depression diagnosis is operationalized based on the 12-month screening version of the World Health Organization's (WHO) Composite International Diagnostic Interview (CIDI) (WHO, 1990; Kessler et al., 1998). The CIDI is a structured interview schedule designed to be used by trained interviewers who are nonclinicians to assess the prevalence of specific psychiatric disorders (Robins and Regier, 1990). WHO field trials (Wittchen, 1994) and other methodological studies (Blazer et al., 1994) have demonstrated acceptable test-retest reliability and clinical validity of CIDI diagnoses. The measure is used here as a binary variable where a value of 1 indicates that the woman meets the screening criteria for depression.

FF contains information on five types of material well-being at two points in time. In keeping with standard practice, each form of material hardship is represented with a dichotomous measure that indicates if the domain if present (or not). The following questions are asked after the introductory question is asked. "We are also interested in some of the problems families face making ends meet. In the past 12 months, did you do any of the following because there wasn't enough money?" FREE FOOD is indicated if the respondent answered in the affirmative to the question: "In the past 12 months, did you receive free food or meals?"[2] Respondents were asked if they did not pay the full amount of rent or mortgage, did not pay the full

[2]This is not the strongest measure of food hardship. Other measures typically used include the single-item food insufficiency question or the full 18-item Food Security Scale created by the U.S. Department of Agriculture and included in the Current Population Survey and the Panel Study of Income Dynamics, among other surveys. However, since prior research has so strongly indicated a relationship between food hardship and mental health, rather than leave this dimension of material hardship out of the study, we include it but fully appreciate its weaknesses.

amount of a gas, oil, or electricity bill, or had to borrow money from friends or family to help pay bills. If any of these three items is answered affirmatively, the respondent is coded as having DIFFICULTY PAYING BILLS. LACK OF MEDICAL CARE is indicated if the respondent answered in the affirmative to the question: "In the past 12 months, was there anyone in your household who needed to see a doctor or go to the hospital but couldn't go because of the cost?" TELEPHONE TURNED OFF is indicated by an affirmative response to the question: "In past year, was telephone service ever disconnected?" Respondents were asked if they were evicted for nonpayment; stayed at a shelter, in an abandoned building, an automobile, or any other place not meant for regular housing even for one night; or moved in with other people even for a little while because of financial problems. If any of these three items is answered affirmatively, the respondent is coded as having UNSTABLE HOUSING.

Finally, we include standard control variables in models of mental health. Education level is captured at three levels: LESS THAN HIGH SCHOOL, HIGH SCHOOL GRADUATES, MORE THAN HIGH SCHOOL. Race is measured with a series of dummy variables as WHITE if the respondent self-identified herself as non-Hispanic white; BLACK indicates non-Hispanic black; HISPANIC indicates that the respondent self-identified as Hispanic; and OTHER indicates Native American, Asian, or some other combination. AGE indicates the women's age and has a range from 18 to 53. NUMBER OF CHILDREN indicates the total number of children in the household under age 18. AGE OF YOUNGEST CHILD indicates the age of the youngest children in the household under age 18.[3] Marital status is controlled with three categorical variables—married, widowed/divorced, and never married, with the latter category serving as the omitted reference group. A measure of global self-rated health is included as a dichotomous variable with "fair" or "poor" health equal to 1 and "excellent," "very good," or "good" health equal to 0. Finally, we create a series of measures of the ratio of total household income to the federal poverty threshold for the family size for less than 1.0 (the poverty line), an income to needs ratio between 1.0 and 1.5, an income to needs ratio between 1.5 and 2.0, an income to needs ratio between 2.0 and 4.0, and an income to needs ratio greater than 4.0. This produces a common set of cutoffs that also have sufficient sample representation. All variables, with the exception of race, are time varying as indicated in Table 1.

Methods

To estimate the relationship between depression and material well-being, we estimate a series of pooled cross-sectional and conditional logistic re-

[3]Variation in age of child comes from two sources. First, while the follow-up interviews are ideally completed 12 months and 36 months after birth of the child, in reality there is a quite a bit more variation. Second, in some cases, mothers have had additional children by the 36-month followup.

TABLE 1

Descriptive Statistics (Unweighted)

	Year 1 Followup %	Year 3 Followup %
Depression	15.9%	20.1%
Material Hardship		
Lack of medical care	5.3%	6.1%
Free food	7.8%	9.6%
Phone turned off	12.9%	20.9%
Unstable housing	12.1%	9.7%
Problems paying bills	39.0%	37.9%
Income to Needs Ratio		
<1.0 (reference group)	43.4%	41.1%
1.0 to <1.5	14.1%	13.9%
1.5 to <2.0	10.5%	11.5%
2.0 to <4.0	21.9%	21.8%
≥ 4.0	10.2%	11.7%
Demographic Controls		
Less than high school (reference group)	31.2%	29.6%
High school diploma	30.6%	29.7%
More than high school	38.7%	42.5%
Mean number of children	2.3	2.4
Mean age of youngest child	1.2	2.0
Poor/fair self-reported health	13.0%	12.7%
Mean age of householder	26.5	28.2
White (reference group)	23.5%	23.7%
African American	47.9%	47.6%
Hispanic	24.9%	24.9%
Other	3.8%	3.7%
Marital Status		
Married	35.0%	37.6%
Divorced/widowed	8.7%	10.4%
Never married (reference group)	56.3%	52.0%
Sample size	3,541	3,516

gression models. The statistical model can be specified as:

$$\text{Prob}(Y_{it} = 1) = \Lambda(\text{B}_0 + \text{B}_1\text{X}_i + \text{B}_2\text{Z}_i + \tau_t + e_i), \quad (1)$$

where Y_i is the mental health outcome of individual i at time t. Λ represents the logistic cumulative distribution function. X is a vector of measures of material well-being discussed above. Z is a vector of individual characteristics that have been shown to be associated with mental health. This includes age, race, marital status, educational level, presence of children, age of children, and physical health. Finally, τ is a year indicator that controls for unmeasured factors associated with time. For all the logit models, Huber-White standard errors are presented and the standard errors are corrected to

account for the intraindividual correlation using the cluster subcommand in STATA 10.0.

Once we determine if there is a direct relationship between material well-being and mental health, we then explore the extent to which this relationship modifies the relationship between mental health and poverty with the following two models:

$$\text{Prob}(\text{Y}_{it} = 1) = \Lambda(B_0 + B_1\text{POV}_\text{i} + \text{B}_2\text{Z}_i + \tau_\text{t} + e_i), \quad (2)$$

where POV indicates a vector of categories indicating the income-to-needs ratio of individual *i*, and the other terms are defined as above. Note that in this model we exclude the X vector of measures of well-being in order to capture the direct effect of poverty on health status.

$$\text{Prob}(Y_{it} = 1) = \Lambda(\text{B}_0 + \text{B}_1\text{POV}_i + \text{B}_2\text{Z}_i + \text{B}_3\text{X}_\text{i} + \tau_\text{t} + e_i) \quad (3)$$

Finally, in Equation (3), we examine the extent to which the marginal effect of poverty on health status (B_1) declines in the presence of the vector of material well-being measures.

We begin by presenting results from the three models using the pooled cross-section.

Next, we consider the possibility that unmeasured heterogeneity is driving the relationship between material hardship and depression. Specifically, it is possible that women who have a latent propensity to experience emotional distress may also have a latent propensity to suffer from unmet medical need and/or other material hardships. To consider this possibility we rewrite the error term in Equations (1) to (3) as the standard error components for panel data models $e_i = \eta_{\text{it}} + \varphi_\text{i}$, where φ_i captures person-specific and time-invariant unobserved heterogeneity and η_{it} is an independently and identically distributed random error term.

To consider this possibility, we estimate conditional fixed-effect logistic regression models. Thus, our three models above become:

$$\text{Prob}(\Delta Y_{it} = 1) = \Lambda(\text{B}_1\Delta\text{X}_\text{i} + \text{B}_2\Delta Z_i + \eta_{\text{it}}) \quad (4)$$

$$\text{Prob}(\Delta\text{Y}_{\text{i}t} = 1) = \Lambda(\text{B}_1\Delta\text{POV}_\text{i} + \text{B}_2\Delta Z_i + \eta_{\text{it}}) \quad (5)$$

$$\text{Prob}(\Delta\text{Y}_{\text{i}t} = 1) = \Lambda(\text{B}_1\Delta\text{POV}_\text{i} + \text{B}_2\Delta Z_i + \text{B}_3\Delta X_\text{i} + \eta_{\text{it}}) \quad (6)$$

where Δ refers to the two-year difference operator such that $\Delta\text{Y}_i = \text{Y}_{2i} - \text{Y}_{1i}$ for our measure of depression. The fixed-effect models include the same list of covariates as Equations (1)–(3). However, because the model uses variation within an individual over time, factors that do not vary over time are unidentified. Additionally, coefficients are identified only using those individuals with changes in depression status over the two waves of observation. In other words, neither women who never meet the criteria for depression nor those who meet the criteria for depression at both waves are used to estimate the coefficients. As such, results from these models may not be

generalizable to the full sample of households with children in the 20 most populous cities in the United States. Finally, unobserved factors that vary over time will continue to bias the estimated coefficients. For example, if a woman's household management abilities change over time and are correlated with material hardship and mental health, then failing to control for this variable would bias the estimates of the material hardship coefficients. Results may be interpreted as the change in the log odds of meeting the screening criteria for depression associated with a unit change in material hardship (or income to needs category).

Results

Sample Description

Table 1 presents descriptive statistics (means and standard deviations) for selected outcomes and demographics for the unweighted data at the Year 1 and Year 3 follow-up interviews (hereafter Y1 and Y3). As indicated, 15.9 percent of respondents meet the criteria for major depression disorder at Y1 and 20.1 percent at Y3. This is higher than the 12-month national average for all women, 12.9 percent, but consistent with the finding that rates of affective disorders, which include major depression, decline monotonically as income and education increases (Kessler et al., 1994). Forty percent of women had an improvement in depression status (1 to 0) and 60 percent had a worsening of depression status (0 to 1) between the two observation points.

Reflecting the high rates of poverty that children in the United States are exposed to and the sampling focus of the FF data (urban births with an oversample of unmarried mothers), the prevalence of hardship and poverty are relatively high among the sample respondents. In terms of reports of material hardship, approximately 39.0 percent report having difficulty paying bills at Y1, 12.9 percent report having a phone turned off, 12.1 percent report having unstable housing, 7.8 percent report receiving free food or meals, and 5.3 percent report an unmet medical need at Y1. The incidence of hardships is similar at Y3, with the exception of having a phone turned off, which rises to 20.9 percent. In terms of income-to-needs levels, 43.4 percent are under the poverty line; 14.1 percent are just above the poverty line with income to needs ratios between 1.0 and 1.5; 10.5 percent are near poor with income to needs ratios between 1.5 and 2.0; 21.9 percent have income to needs ratios between 2.0 and 4.0; and 10.2 percent have income to needs ratios above 4.0 at Y1. In terms of education, 31.2 percent have less than a high school education, 30.6 percent have a high school diploma, and 38.7 percent have education past the high school level at Y1. Both income and education levels rise slightly between the Year 1 and Year 3 follow-up interviews.

Pooled Cross-Sectional Models

In Table 2 we present the results of the pooled cross-sectional models. In the first set of columns we present results of the logistic regression model that examines the relationship between material hardship and depression. We find that each of the five forms of material hardship captured in the Fragile Families data—PROBLEMS PAYING BILLS, LACK OF MEDICAL CARE, FREE FOOD, PHONE TURNED OFF, and UNSTABLE HOUSING—are positively associated with elevated risk for depression.

Other demographic control variables follow as expected. The risk of depression is negatively associated with the age of the mother but is unrelated to age of youngest child or the number of children present in the household. Poor health is associated with an increased risk of depression. Finally, in terms of race, we find that while the risk of depression is lower for Hispanics compared to whites, African Americans face no higher risk of depression compared to whites in this sample of new births. Women who are widowed, separated, or divorced face higher odds of depression than never-married mothers.

In Model 2 of Table 2, we present the results of the logistic regression model that omits the measures of material hardship but includes the multiple categories of the income to need threshold in order to derive a baseline of the effect of the income to need ratio and depression with Model 3. Here, we find that risk of depression decreases in a straightforward monotonic relationship. This result is exactly as expected and is consistent with the findings of others (Kessler et al., 1994). It should be noted, however, that having income to needs ratios of less than 2.0 is statistically indistinguishable from living in poverty and only the top two categories are statistically significant. The odds ratio of the top income to needs ratio category indicates, for example, that women whose family income is four times the poverty line are just over half as likely to report depression as women with family incomes below the poverty line.

In Model 3 of Table 2, we present results of the logistic regression models including both the measures of material hardship and the income to needs categories. We find that while each of the reported forms of material hardship continues to have a strong positive effect on the risk of depression, each of the income to needs categories is not statistically significant. This finding suggests that the relationship between the income to needs ratio and depression is fully mediated by the inclusion of material hardship. Other control variables remain consistent to what is reported in Model 1. However, it is still possible that unmeasured heterogeneity is biasing the results.

Conditional Logistic Regression Models

As explained above, it is possible that women who have a latent propensity to report symptoms of depression may also have a latent propensity to report

TABLE 2

Logistic Regression Models Estimating the Probability of Depression

	Model 1		Model 2		Model 3	
	Beta Odds Ratio	SE	Beta Odds Ratio	SE	Beta Odds Ratio	SE
Material Hardship						
Lack of medical care	0.565***	0.124			0.558***	0.125
	1.760				1.747	
Free food	0.468***	0.108			0.457***	0.108
	1.597				1.579	
Phone turned off	0.442***	0.085			0.434***	0.086
	1.555				1.544	
Unstable housing	0.360***	0.100			0.359***	0.100
	1.434				1.432	
Problems paying bills	0.671***	0.073			0.663***	0.073
	1.956				1.940	
Income to Needs Ratio						
1.0 to < 1.5[a]			−0.071	0.100	−0.038	0.103
			0.932		0.963	
1.5 to < 2.0[a]			−0.161	0.121	−0.063	0.125
			0.851		0.939	
2.0 to < 4.0[a]			−0.293***	0.107	−0.054	0.109
			0.746		0.947	
≥ 4.0[a]			−0.647***	0.162	−0.207	0.162
			0.524		0.813	
Demographic Controls						
High school diploma[b]	−0.136	0.096	−0.110	0.096	−0.131	0.097
	0.873		0.896		0.878	
More than high school[b]	0.047	0.098	0.155	0.102	0.077	0.103
	1.048		1.168		1.080	
Number of children	0.014	0.028	0.011	0.028	0.007	0.029
	1.014		1.011		1.007	

TABLE 2—continued

	Model 1		Model 2		Model 3	
	Beta Odds Ratio	SE	Beta Odds Ratio	SE	Beta Odds Ratio	SE
Age of youngest child	−0.006	0.036	−0.014	0.034	−0.006	0.036
	0.994		0.986		0.994	
Poor/fair self-reported health	1.173***	0.089	1.366***	0.084	1.165***	0.089
	3.233		3.919		3.207	
Age of householder	−0.018***	0.007	−0.020***	0.007	−0.017**	0.007
	0.982		0.980		0.983	
African American[c]	0.020	0.101	−0.092	0.100	−0.001	0.102
	1.020		0.912		0.999	
Hispanic[c]	−0.326***	0.114	−0.489***	0.115	−0.351***	0.117
	0.721		0.613		0.704	
Other	−0.220	0.208	−0.279	0.205	−0.224	0.208
	0.802		0.757		0.799	
Married[d]	−0.007	0.094	−0.063	0.100	0.014	0.095
	0.993		0.939		1.014	
Widowed/separated/divorced[d]	0.484***	0.122	0.549***	0.117	0.482***	0.122
	1.623	0.067	1.731	0.064	1.619	
Year	0.303***		0.348***		0.303***	0.067
	1.354		1.417		1.354	
Sample Size	7,057		7,057		7,057	

[a]The omitted reference group is those with income to needs ratios <1.0.

[b]The omitted reference group is less than high school.

[c]The omitted reference group is white.

[d]The omitted reference group is never married.

NOTE: ***indicates significant at 0.01; **indicates significant at 0.050.

material hardship and/or low income to needs ratios. To allow for this possibility, we estimate the same three models using conditional logistic fixed-effect regression. Assuming the unmeasured heterogeneity present is constant across time, the estimates presented are consistent and unbiased estimators. Table 3 presents the results of this analysis estimated on only those women who report a change in depression ($N = 1{,}282$) and results are generalizable to this subgroup of the sample only.

In Model 1 of Table 3, we show that of the five forms of material hardship examined, after controlling for time-invariant heterogeneity, only two remain predictive of an increased risk of depression—problem paying bills and phone turned off. In particular, women who reported problems paying bills and women who had their phones turned off were 1.8 times and 1.5 times more likely to be depressed than women who did not report changes in those respective hardships. In contrast to prior work (Heflin et al., 2005), which shows a strong relationship between food insufficiency and mental health, we find no relationship between changes in free food and depression in the conditional logistic regression models. It is important to note that the item used here differs significantly in terms of wording from what is used in prior studies that find a relationship between food hardship and mental health. Similarly, while having unstable housing and lack of medical care were significant in the pooled cross-sectional analyses, changes in these domains of material hardship are statistically insignificant here.[4] Of the demographic controls, having a change in the number of children, the age of the householder, being widowed, separated, or divorced, and self-rated health are associated with a change in the risk of depression.

In Model 2 of Table 3, we present results omitting material hardship but including the income to needs categorical variables. Results here weaken from the pooled cross-sectional analysis. In the conditional logistic regression model we find that a strong relationship exists between the change in the income to needs categories between only the highest level and a change in the risk of depression.

Finally, in Model 3 of Table 3, we include both material hardship and the income to needs ratio categories. We find that changes in reports of problems paying bills and phone turned off remain significantly related to an increased risk of change in depression, even after explicitly controlling for a change in the income to needs ratio. The top income to needs ratio cat-

[4]To check if the lack of significance for phone off, lack of medical care, free food, and unstable housing was due to the inclusion of other forms of material hardship in the model, we ran separate conditional logistic regression models for each form of material hardship. Although phone off, lack of medical care, and unstable housing were statistically significant when they were the only form of material hardship in the model, free food remained statistically insignificant. Additionally, we have run joint tests of significance for differences in domains of material hardship. Where coefficients are statistically significant (phone off and bill payment), each domain is statistically different from each of the other domains. Where domains are not statistically different from zero, we cannot reject the null of differences between coefficients.

TABLE 3

Conditional Logistic Regression Model Estimating the Probability of Depression

	Model 1		Model 2		Model 3	
	Beta Odds Ratio	SE	Beta Odds Ratio	SE	Beta Odds Ratio	SE
Material Hardship						
Lack of medical care	0.287 1.332	0.253			0.240 1.271	0.256
Free food	0.168 1.182	0.216			0.191 1.211	0.217
Phone turned off	0.398*** 1.489	0.160			0.377** 1.459	0.161
Unstable housing	0.133 1.142	0.189			0.135 1.145	0.190
Problems paying bills	0.596*** 1.816	0.163			0.590*** 1.803	0.164
Income to Needs Ratio						
1.0 to $<$ 1.5[a]			0.069 1.072	0.189	0.059 1.060	0.196
1.5 to $<$ 2.0[a]			0.296 1.345	0.246	0.273 1.313	0.251
2.0 to $<$ 4.0[a]			–0.081 0.922	0.241	–0.042 0.959	0.250
$\geq$ 4.0[a]			–0.801** 0.449	0.401	–0.688* 0.502	0.414
Demographic Controls						
High school diploma[b]	–0.330 0.719	0.526	–0.373 0.689	0.516	–0.425 0.654	0.531
More than high school[b]	–0.692 0.501	0.574	–0.773 0.462	0.564	–0.774 0.461	0.577
Number of children	0.219** 1.245	0.098	0.234** 1.264	0.098	0.227** 1.254	0.099
Age of youngest child	–0.049 0.952	0.064	–0.032 0.968	0.065	–0.034 0.967	0.066
Poor/fair self-reported health	0.628*** 1.874	0.180	0.703*** 2.019	0.174	0.660*** 1.936	0.181
Age of householder	0.239*** 1.269	0.059	0.243*** 1.275	0.058	0.240*** 1.271	0.060
Married[c]	0.869 2.386	0.671	0.937 2.552	0.673	0.813 2.255	0.677
Widowed/separated/ divorced[c]	1.562** 4.766	0.774	1.910*** 6.753	0.768	1.526** 4.600	0.779
Panel Sample Size	1,282		1,282		1,282	

[a]The omitted reference group is those with income to needs ratios $<$ 1.0.

[b]The omitted reference group is less than high school.

[c]The omitted reference group is never married.

NOTE: ***indicates significant at 0.01; **indicates significant at 0.05; *indicates significant at 0.10.

egories remain statistically and negatively related to the risk of change in depression, with those with income to needs ratios over 4.0 facing half the risk of a change in depression than those living below the federal poverty threshold. The reduction in magnitudes in the relationship between material hardship and depression from Table 2 to Table 3 suggests that endogeneity from time-invariant unmeasured heterogeneity were biasing the estimates in Table 2 upward. When we use conditional fixed-effect logistic regression models, we find lower magnitudes but still a very robust relationship. It is also interesting to note that the effects of an income to needs ratio above 4 were underestimated in Table 2, suggesting that omitting individual fixed effects suppressed the importance of income.

Simulating a Change in Income Versus a Change in Material Hardship

To interpret the estimated change in depression due to a change in income compared to a change in material hardship, we estimate a series of simulations.[5] First, we estimate the predicted probability of depression for our base case—a black unmarried woman with a high school diploma and good self-rated health of the median sample age, having the median number of children in the sample, the youngest of which is at the median age of youngest child, income above twice the poverty line (income to needs 2.0–4.0), and no reports of our measures of material hardship. Then, we compare the increase in the predicted probability of depression that is associated with decreasing the income to needs category of the woman compared to adding the two types of material hardship for which we have reason to believe that a significant relationship exists with depression net of income and fixed effects—difficulty paying bills and telephone turned off. This allows us to compare the returns to focusing on an income-based versus material hardship focused social policy intervention.

Table 4 presents results from this simulation for Model 3 estimated with both logistic regression and conditional fixed-effect logistic regression. The latter here is our preferred model since it incorporates fixed effects, but the logistic regression model simulations are a bit easier to interpret. Regardless of which set of results is examined, the pattern regarding the relative increase in depression from a change in income to needs categories versus a change in material hardship is consistent across both estimation techniques.

The first two columns of Table 4, which present the results from the logistic regression, indicate that when poverty and all forms of material hardship are not present, the predicted probability that a woman will meet the criteria for depression is quite low—11.8 percent. If we decrease an average woman's income substantially from the 2.0–4.0 income to needs

[5]Note that we do not directly compare magnitudes of log odds ratios for income versus material hardship because they assume a linear effect with depression.

TABLE 4

Simulation of Change in Income to Needs Versus Material Hardship in Predicting Depression Status

	Logistic Regression[a]		Conditional FE Logistic Regression[b]	
	Predicted Probability	% ΔBase	Predicted Probability	% ΔBase
BASE: No poverty or hardships present	11.83%		50.00%	
Poverty present only	17.50	13.90%	22.32	61.16%
Difficulty paying bills present alone	48.66	17.59%	46.29	73.15%
Phone turned off present alone	45.02	17.16%	37.52	68.76%
All five hardships present	377.92	56.55%	74.98	87.49%
All five hardships and poverty present	430.91	62.82%	75.89	87.94%

[a]The logistic regression column presents the predicted probability of meeting the criteria for depression in the pooled cross-section.

[b]The conditional fixed-effect logistic regression column presents the predicted probability of meeting the criteria for depression at $t = 2$ relative to the base estimation, given that the criteria were not met at $t = 1$. Since all cases have both 0s and 1 on depression status at one time period, the base probability of observing depression is 0.50.

NOTE: The base model assumes median values for the number of children, age of youngest child, age of householder, for a black unmarried women with a high school diploma and good self-rated health with income to needs 2.0–4.0 and no hardship.

category to below the federal poverty threshold, the risk of depression would increase to 13.9 percent, representing an 18 percent increase over the base.

However, if we simulated a change in material hardship alone for this same ''average'' woman while leaving the income to needs category unchanged from the base, we would see increases in the predicted probability of depression of 17.6 percent for difficulty paying bills, representing a 49 percent increase over the base case. Similarly, the predicted probability of depression rises to 17.2 percent if we simulate having phone turned off. If we simulated a change from the base case in which all five areas of material hardship were present, we estimate that the predicted probability of depression would increase by 378 percent over the base to 56.6 percent, assuming the woman remains in the 2.0–4.0 income to needs category. If we simulated a drop in the income to needs category as well as the presence of all five types of material hardship, we estimate a predicted probability of depression of 62.8 percent.

Results for the conditional fixed-effect logistic regression models presented in the last two columns of Table 4 demonstrate a qualitatively similar pattern of results, although the magnitudes differ because the underlying probability of meeting the criteria for depression is 0.500 instead of 0.119. However, even after controlling for fixed characteristics of the woman that might be correlated with depression, income, and material hardship, we find

that simulating large drops in income to needs categories results in smaller increases in depression than changes in a single area of material hardship.

Conclusion

Social stratification research has relied on the federal poverty line as a marker of material deprivation for many years. However, given recent critiques of the federal poverty measure, the new availability of information on subjective reports of material hardship, and the relatively low correlation between the two, it is necessary to rethink the strategy of using income alone for all investigations. Our study therefore examined the correlation between the federal poverty measure, reports of five different forms of material hardship, and depression. We used longitudinal data collected in the Fragile Families Survey—a survey of births in cities with populations greater than 200,000 in 1999 in the United States. We estimated fixed-effects models that allow us to conduct more precise causal modeling and explicitly incorporate time-invariant unmeasured heterogeneity in our models.

Our findings suggest that reports of each of the five forms of material hardship are positively associated with an elevated risk for depression. The two most prominent hardships that remained significant in our fixed-effects models were problems paying bills and having the phone turned off. These relationships are consistent with theoretical perspectives that posit that hardships can have both direct and indirect effects on health (Lynch et al., 2004). Finally, we also found that hardship helped mediate much, though not quite all, of the link between poverty and depression. This suggests that there are also other avenues by which income affects mental health, such as increased presence of other chronic stressors due to, for example, living in poor neighborhoods.

Our policy simulation suggests that one avenue open for addressing the public health problem of depression may be to focus on specific areas of hardships. For example, our results on bill hardships suggest that programs that help low-income populations deal with high heating costs or avoid eviction may have higher social benefits than immediately apparent. However, these programs need to be available to those with incomes up to at least 200 percent of the poverty line as material hardship is not limited to those living in poverty.

Future work on economic well-being and health could also focus on identifying the mechanisms by which hardship affects depression, since our study does not have the data necessary for such inferences. Finally, since our sample was limited to a cohort of new mothers of children born in large cities in 1999, further research using a nationally representative sample would provide valuable evidence as to whether the findings of this study are generalizable to an even broader population.

REFERENCES

Adams, Peter, Michael Hurd, Daniel McFadden, Angela Merrill, and Tiago Ribeiro. 2003. "Healthy, Wealthy, and Wise? Test for Direct Causal Paths Between Health and Socioeconomic Status." *Journal of Econometrics* 112:3–56.

American Psychiatric Association (APA). 1987. *Diagnostic and Statistical Manual of Mental Disorders*. Washington, DC: American Psychiatric Association Publishing.

Beverly, Sondra. 2000. "Material Hardship in Working-Poor Households with Children." Presented at the Population Association of America. Los Angeles, CA.

———. 2001. "Measures of Material Hardship: Rationale and Recommendations." *Journal of Poverty* 5(1):23–41.

Blazer, D., et al. 1994. "The Prevalence Level Distribution of Major Depression in a Natural Community Sample." *American Journal of Psychiatry* 151:979–86.

Boushey, Heather, Chauna Brocht, Bethney Gundersen, and Jared Bernstein. 2001. *Hardships in America: The Real Story of Working Families*. Washington, DC: Economic Policy Institute.

Bradshaw, J., and N. Finch. 2003. "Overlaps in Dimensions of Poverty." *Journal of Social Policy* 32:513–25.

Casey, Patrick, Susan Goolsby, Carol Berkowitz, Deborah Frank, John Cook, Dina Cutts, Maureen Black, Nieves Zaldivar, Suzette Levenson, Tim Heeren, Alan Meyers, and the Children's Sentinel Nutritional Assessment Program Study Group. 2004. "Maternal Depression, Changing Public Assistance, Food Security, and Child Health Status." *Pediatrics* 113(2):298–304.

Citro, Constance F., and Robert T. Michael, eds. 1995. *Measuring Poverty: A New Approach*. Washington, DC: National Academy Press.

Ecob, Russell, and George Davey Smith. 1999. "Income and Health: What is the Nature of the Relationship?" *Social Science & Medicine* 48:693–705.

Evenson, R., and Robin Simon. 2005. "Clarifying the Relationship Between Parenthood and Depression." *Journal of Health and Social Behavior* 46(3):341–50.

Greenberg, P. E., R. C. Kessler, H. G. Birnbaum, S. A. Leong, S. W. Lowe, P. A. Berglund, et al. 2003. "The Economic Burden of Depression in the United States: How Did it Change Between 1990 and 2000?" *Journal of Clinical Psychiatry* 64:1465–75.

Hamilton, William L., John T. Cook, William W. Thompson, Lawrence F. Buron, Edward A. Frongillo, Christine M. Olson, and Cheryl A. Wehler. 1997. *Household Food Security in the United States in 1995*. Technical report of the Food Security Measurement Project. Washington, DC: Food and Consumer Service, U.S. Department of Agriculture.

Hawkins, Daniel N., and Alan Booth. 2005. "Unhappily Ever After: Effects of Long-Term, Low-Quality Marriages on Well-Being." *Social Forces* 84(1):451–71.

Heflin, Colleen, Mary E. Corcoran, and Kristine Siefert. 2007. "Work Trajectories, Income Changes and Food Insufficiency in a Michigan Welfare Population." *Social Service Review* 81(1):3–25.

Heflin, Colleen, Kristine Siefert, Mary E. Corcoran, and David R. Williams. 2005. "Food Insufficiency and the Mental Health of Current and Recent Welfare Recipients: Findings from a Longitudinal Survey." *Social Science & Medicine* 61:1971–82.

Iceland, John. 2006. *Poverty in America*, 2nd ed. Berkeley, CA: University of California Press.

Iceland, John, and Kurt J. Bauman. 2004. *Income Poverty and Material Hardship: How Strong is the Association?* National Poverty Center Working Paper 04-17. Available at ⟨http://www.npc.umich.edu/publications/workingpaper04/paper17/⟩.

Johnson, J. G., P. Cohen, J. S. Brook, et al. 1999. "A Longitudinal Investigation of Social Causation and Social Selection Processes Involved in the Association Between Socioeconomic Status and Psychiatric Disorders." *Journal of Abnormal Psychology* 108:490–99.

Kessler, R., H. S. Akiskal, M. Ames, H. Birnbaum, P. Greenberg, R. M. A. Hirschfeld, et al. 2006. "Prevalence and Effects of Mood Disorders on Work Performance in a Nationally Representative Sample of U.S. Workers." *American Journal of Psychiatry* 163:1561–68.

Kessler, R., G. Andrews, D. Mroczek, B. Ustun, and H. U. Wittchen. 1998. "The World Health Organization Composite International Diagnostic Interview Short-Form (CIDI-SF)." *International Journal of Methods in Psychiatric Research* 7:171–85.

Kessler, R., P. Barker, L. Colpe, et al. 2003. "Screening for Serious Mental Illness in the General Population." *Archives of General Psychiatry* 60:184–89.

Kessler, R., Katherine A. McGonagle, Shanyang Zhao, Christopher B. Nelson, Michael Hughes, Suzann Eshlemann, Hans-Ulrich Wittchen, and Kenneth S. Kendler. 1994. "Lifetime and 12-Month Prevalence of DSM-III-R Psychiatric Disorders in the United States." *Archives of General Psychiatry* 15:8–19.

Laraia, Barbara A., Anna Maria Siega-Riz, Craig Gundersen, and Nancy Dole. 2006. "Psychological Factors and Socioeconomic Indicators are Associated with Household Food Insecurity Among Pregnant Women." *Journal of Nutrition* 136:177–82.

Lynch, John, George Davey Smith, Sam Harper, Marianne Hillemeier, Nancy Ross, George Kaplan, and Michael Wolfson. 2004. "Is Income Inequality a Determinant of Population Health? Part 1. A Systematic Review." *Millbank Quarterly* 82(1):5–99.

Lynch, John, George Davey Smith, George A. Kaplan, and James S. House. 2000. "Income Inequality and Mortality: Importance to Health of Individual Income, Psychosocial Environment, or Material Conditions." *British Medical Journal* 320:1200–04.

Macleod, J., and G. Davey Smith. 2003. "Psychosocial Factors and Public Health: A Suitable Case for Treatment." *Journal of Epidemiology and Community Health* 57:565–70.

Macleod, John, G. Davey Smith, Pauline Heslop, Chris Metcalfe, Douglas Carroll, and Carole Hart. 2002. "Psychological Stress and Cardiovascular Disease: Empirical Demonstration of Bias in a Prospective Observational Study of Scottish Men." *British Medical Journal* 324:1247–51.

Macleod, John, G. Davey Smith, Chris Metcalfe, and Carole Hart. 2005. "Is Subjective Social Status a More Important Determinant of Health than Objective Social Status?" *Social Science & Medicine* 61(9):1916–29.

Marcotte, D. E., and V. Wilcox-Gok. 2001. "Estimating the Employment and Earnings Costs of Mental Illness: Recent Developments in the United States." *Social Science and Medicine* 53:21–27.

Mayer, S. E. 1995. "A Comparison of Poverty and Living Conditions in the United States, Canada, Sweden and Germany." In K. McFate, R. Lawson, and W. J. Wilson, eds., *Poverty, Inequality and the Future of Social Policy: Western States in the New World Order*. New York: Russell Sage Foundation.

Mayer, S. E., and Christopher Jencks. 1989. "Poverty and the Distribution of Material Hardship." *Journal of Human Resources* 24(1):88–114.

———. 1993. "Recent Trends in Economic Inequality in the United States: Income vs. Expenditures vs. Material Well-Being." In D. Papadimitriou and E. Wolff, eds., *Poverty and Prosperity in the USA in the Late Twentieth Century*. London: MacMillan.

Miech, R. A., A. Caspi, T. Moffitt, et al. 1999. "Low Socioeconomic Status and Mental Disorders: A Longitudinal Study of Selection and Causation During Young Adulthood." *American Journal of Sociology* 104:112–47.

Muntaner, Carles, William W. Eaton, Richard Miech, and Patrice O'Campo. 2004. "Socioeconomic Position and Major Mental Disorders." *Epidemiologic Review* 26:53–62.

Ouellette, Tammy, Nancy Burstein, David Long, and Erik Beecroft. 2004. *Measures of Material Hardship: Final Report*. Washington, DC: U.S. Department of Health and Human Services, Office of the Assistant Secretary for Planning and Evaluation.

Perreira, Krista M., Natalia Deeb-Sossa, Kathleen Mullan Harris, and Kenneth A. Bollen. 2005. "What Are We Measuring? An Evaluation of the CES-D Across Race/Ethnicity and Immigrant Generation." *Social Forces* 83(4):1567–1601.

Perry, B. 2002. "The Mismatch Between Income Measures and Direct Outcome Measures of Poverty." *Social Policy Journal of New Zealand* 19:101–27.

Pratt, L. A., A. N. Dey, and A. J. Cohen. 2007. *Characteristics of Adults with Serious Psychological Distress as Measured by the K6 Scale: United States, 2001–2004*. Advance Data from Vital Health and Statistics 382. Hyattsville, MD: National Center for Health Statistics.

Rector, R., K. A. Johnson, and S. E. Youssef. 1999. "The Extent of Material Hardship and Poverty in the United States." *Review of Social Economy* 57(3):351–87.

Reichman, N., J. Teitler, I. Garfinkel, and S. McLanahan. 2001. "Fragile Families: Sample and Design." *Children and Youth Services Review* 23(4–5):303–26.

Robins, Lee N., and Darrel A. Regier, eds. 1990. *Psychiatric Disorders in America: The Epidemiologic Catchment Area Study*. New York: Free Press.

Ruggles, Patricia. 1990. *Drawing the Line: Alternative Poverty Measures and Their Implications for Public Policy*. Washington, DC: Urban Institute.

Serido, Joyce, David M. Almeida, and Elaine Wethington. 2004. "Chronic Stressors and Daily Hassles: Unique and Interactive Relationships with Psychological Distress." *Journal of Health and Social Behavior* 45(1):17–33.

Turner, R. Jay, John Taylor, and Karen Van Gundy. 2004. "Personal Resources and Depression in the Transition to Adulthood: Ethnic Comparisons." *Journal of Health and Social Behavior* 45(1):34–52.

U.S. Department of Health and Human Services. 1999. *Mental Health: A Report of the Surgeon General—Executive Summary*. Rockville, MD: U.S. Department of Health and Human Services, Substance Abuse and Mental Health Services Administration, Center for Mental Health Services, National Institutes of Health, National Institute of Mental Health.

Wittchen, H. U. 1994. "Reliability and Validity Studies of the WHO-Composite International Diagnostic Review (CIDI): A Critical Review." *Journal of Psychiatric Research* 28:57–84.

World Health Organization. 1990. *Composite International Diagnostic Review, v. 1.0*. Geneva, Switzerland: World Health Organization.