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Maternal depression and economic well-being: A quasi-experimental approach

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ABSTRACT

Maternal depression is associated with adverse impacts on the health of women and their children. However, further evidence is needed on the extent to which maternal depression influences women's economic well-being and how unmeasured confounders affect estimates of this relationship. In this study, we aimed to measure the association between maternal depression and economic outcomes (income, employment, and material hardship) over a 15-year time horizon. We conducted longitudinal analyses using the Fragile Families and Child Wellbeing Study, an urban birth cohort study in the United States. We assessed the potential contribution of time-invariant unmeasured confounders using a quasi-experimental approach and also investigated the role of persistent versus transient depressive symptoms on economic outcomes up to 15 years after childbirth. In models that adjusted for time-invariant unmeasured confounders, maternal depression was associated with not being employed (an adjusted risk difference of 3 percentage points (95% CI 0.01 to 0.05)) and experiencing any material hardship (an adjusted risk difference of 14 percentage points (95% CI 0.12 to 0.16)), as well as with reductions in the ratio of household income to poverty by 0.10 units (95% CI -0.16 to -0.04) and annual household income by $2114 (95% CI -$3379 to -$850). Impacts at year 15 were strongest for those who experienced persistent depression. Results of our study strengthen the case for viewing mental health support services as interventions that may also foster economic well-being, and highlight the importance of including economic impacts in assessments of the cost-effectiveness of mental health interventions.

1. Introduction

Depression is a major contributor to maternal health globally, with 10–19% of women experiencing depression during the postpartum period (Bauman, 2020; Woody et al., 2017). Postpartum depression is a debilitating condition, and a large literature has found strong negative associations between maternal postpartum depression and poor maternal health and quality of life as well as children's adverse health and development outcomes up to age 18 years (Srinivasan et al., 2020; Slomian et al., 2019). Moreover, emerging evidence indicates that maternal depression may persist for many years, including more than a decade after childbirth (Putnick et al., 2020; Najman et al., 2017). A small number of studies have examined impacts of chronic maternal depression (that is, persistently elevated depressive symptoms at multiple time points after childbirth) compared to transient maternal depression (symptoms that increase postpartum and then decline relatively quickly). Evidence on chronic maternal depression has thus far been largely limited to the impacts on children's health and development outcomes, and suggests that chronic maternal depression that persists over one or more years is particularly detrimental to child and adolescent outcomes, as compared to more transient forms (Netsi et al., 2018; Tainaka et al., 2022; De Oliveira et al., 2019).

Maternal depression may also have broader consequences for mothers and children, in particular, for economic well-being. Mental health is an important contributor to cognitive and emotional functioning, affecting energy, motivation, and productivity (Judd et al., 1996; Layard, 2013). At the population level, poor mental health has been associated with poor work performance, lower income, and

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increased risk of unemployment (Whooley et al., 2002; Zabkiewicz and Schmidt, 2007; Mojtabai et al., 2015; Frijters et al., 2014). Studies have documented associations between maternal postpartum depression and economic outcomes in the short-term period after childbirth, including increased risk of household food insecurity, housing instability, and missed work days, as well as unemployment and poverty many years later (Noonan et al., 2016; Corman et al., 2016; Curtis et al., 2014; Reichman et al., 2015; Guerrero et al., 2020; Ammerman et al., 2016; Garg et al., 2015; Rokicki et al., 2022). While these papers demonstrate associations between maternal depression and economic trajectories across a number of domains (Smith and Mazure, 2021), the literature has provided limited evidence on two fundamental issues, which are the research questions we aim to address in this paper. First, to what extent do the observed short- and long-term associations between maternal depression and economic outcomes reflect unmeasured confounding? And second, is there a differential impact of transitory versus persistent maternal depression on economic well-being?

Considering the high prevalence of postpartum depression, the findings from previous studies of adverse associations between maternal depression and economic-related outcomes, and the fact that maternal depression often persists or recurs, it is possible that maternal depression has long-term adverse effects on economic outcomes that are substantial and highly consequential for population health and well-being. Moreover, as socioeconomic status is itself a risk factor for depression (Harper et al., 2002; Laaksonen et al., 2007), maternal depression may play a significant role in perpetuating socioeconomic inequities and intergenerational poverty (Smith and Mazure, 2021; Law et al., 2021). Given long-standing gender-based, socioeconomic and racial inequalities in both rates of depression and access to health care and support services (Platt et al., 2021), interventions to reduce maternal depression could potentially disrupt a cascading cycle of adverse health and economic outcomes and reduce health disparities (Smith and Mazure, 2021; Kozhimannil et al., 2011). Assessing the full impact of such interventions requires the consideration not only of health outcomes, but also of economic outcomes over both the short- and long-term (van Zoonen et al., 2014).

From a policy perspective, distinguishing the effects of depression from those of other causes on relevant outcomes is important for maximising the impact of maternal health interventions. Previous findings of links between maternal mental health and economic-related outcomes form an important motivation for this analysis, but few studies have adopted approaches to adjust for potential unobserved confounding (Ammerman et al., 2016; Rokicki et al., 2022; Casey et al., 2004; Reading and Reynolds, 2001; Hope et al., 1999). In this paper, we use repeated observations on the same respondents over 15 years, starting at childbirth, facilitating a fixed effects approach to account for time-invariant unmeasured confounders (Ervin et al., 2021; Gunasekara et al., 2014; Aitken et al., 2020; Garratt et al., 2016). We consider the following hypotheses: (1) maternal depression leads to adverse economic outcomes and this relationship remains even after adjusting for time-invariant confounding factors, and, (2) associations are strongest for those who experience persistent or recurrent depression.

2. Methods

2.1. Data

In this paper, we use data from the Fragile Families and Child Wellbeing Study (FFCWS), a U.S. urban cohort survey of 4898 children born in 1998–2000 and their families. The longitudinal design of the study allowed us to track the physical and mental health and economic status of mothers over a 15-year period. Recruitment of FFCWS participants was conducted in 75 hospitals in 20 large cities using a stratified random sample of all U.S. cities with populations over 200,000. In all but the two largest cities, all birth hospitals were used for the sampling frame. In the two largest cities, a random sample of hospitals was used. Because FFCWS's focus was on unmarried parents (Reichman et al., 2001), non-marital births were oversampled. Baseline information was collected from mothers in hospital after birth, with 5 follow-up surveys. We used information from interviews conducted 1, 3, 5, 9, and 15 years postpartum when data on symptoms of depression were collected, in conjunction with baseline sociodemographic and health characteristics from the postpartum interview, as well as information from medical records from the birth hospitalization of a subset of respondents (70% had these data available).

2.2. Analysis sample

All mothers who participated in the year 1 interview and completed the depression questions were included in our analytical sample (n = 4717). In models with multiple observations per person, we included all available data at 1, 3, 5, 9, and 15 years postpartum; these models had a potential maximum of 4717 * 5 = 23,585 total observations, but because of attrition and missing data the number was smaller (between 19,328 and 19,341 observations depending on the outcome). In models focusing on persistence in depression status with one observation per person, we included observations of respondents who participated in the survey at every time point (n = 2961).

2.3. Outcomes

We focused on three binary outcomes in this paper. These were whether the respondent was employed for pay last week; was living in a household with income below the federal poverty limit (FPL); and experienced any material hardship last year. The FPL was defined by the U.S. Census Bureau for the year preceding the interview and adjusted for household size. The material hardship indicator was based on 10 questions across various domains (food insecurity, difficulty paying bills, housing insecurity, utility shut-offs, and medical financial hardship). These questions, which pertained to ever having experienced a specific type of hardship in the past year, were taken from the Survey of Income and Program Participation and have been widely used in studies of hardship and poverty (Bauman, 1998; Mayer and Jencks, 1989; Pilkauskas et al., 2012). For our main analysis we created a binary outcome capturing reports of having experienced any type of hardship. We additionally considered two continuous outcomes: annual household income and the ratio of household income to the FPL.

2.4. Exposure

Maternal depression was measured using the Composite International Diagnostic Interview Short Form (CIDI-SF), administered at one year postpartum and again in each follow-up interview (Kessler et al., 1998; Walters et al., 2002). Respondents were asked if they had experienced feelings of depression or an inability to enjoy pleasurable activities lasting at least two weeks in the past year. If they did, they were asked the frequency and duration of these feelings, followed by more detailed questions about losing interest, feeling tired, weight status, difficulties sleeping, difficulties concentrating, feeling worthless, and thinking about death. The CIDI-SF is a standardized instrument often used to assess depression in questionnaire-based surveys and is based on items that are consistent with the Diagnostic and Statistical Manual of Mental Disorders–Fourth Edition (DSM-IV) (Kessler et al., 1998). Answers are scored to classify respondents based on criteria for a DSM-IV major depressive episode. A positive classification could reflect a major depressive disorder or episodes that take place as part of a bipolar or psychotic disorder. FFWCS provides two binary classifications for diagnosis of major depression over the past year: a conservative version based on the Walters et al. scoring algorithm (Kessler et al., 1998; Walters et al., 2002) and a more liberal version (Walters et al., 2002). The conservative diagnosis is based primarily on having experienced depressive symptoms most of the day over a 2-week period, while the

liberal diagnosis is based primarily on having experienced symptoms at least half of the day over a 2-week period. We used the liberal measure as our main outcome, but conducted robustness checks using the conservative measure and found similar results.

2.5. Control variables

We adjusted for a range of factors that have been identified in the literature as being predictive of economic circumstances and related to the risk of depression. Following three previous papers that examined linkages between maternal mental health and socioeconomic status (Corman et al., 2016; Reichman et al., 2015; Rokicki et al., 2022), we controlled for maternal demographic characteristics (age, race/-ethnicity, marital status and foreign-born status), measures of socio-economic status at delivery (education and household poverty category), medical history (history of any adverse experiences, which included history of family instability, suspected parenting inadequacy unwanted pregnancy, domestic violence, or sexual abuse; and prior diagnosis of mental health conditions), and infant characteristics (child sex, birth interval, and multiple birth). In addition, because health during pregnancy has been shown to be related to risk of postpartum depression, we also adjusted for delivery complications, substance use during pregnancy, prenatal care, insurance status, and whether the newborn had a neonatal intensive care unit (NICU) stay (Blom et al., 2010; Koutra et al., 2018). Variables derived from the mother's medical records include medical history, delivery complications, birth interval, and NICU stay; all others were derived from the mother's interview at delivery.

All of the above factors were time-invariant and measured prior to the first assessment of depression at one year postpartum to mitigate against the potential for reverse causality. For variables derived from the mother's interview that were missing, we included a separate category indicating a missing response to that variable. For cases with missing medical record information (n = 1449), we coded each of the medical record variables as 0 and included a separate indicator to denote absence of this information. As described below, missing information on any time-invariant covariates does not affect the estimates from fixed effects models. In the fixed effects models, we included the following time-varying factors: month of interview, survey wave, mother's age (which was not perfectly collinear with survey wave, as there was variation in when the surveys were administered within waves), and mode of interview (by phone or in person).

While we followed previous studies of maternal depression that used the FFWCS to guide us in our selection of control variables (Noonan et al., 2016; Corman et al., 2016; Curtis et al., 2014; Reichman et al., 2015; Guerrero et al., 2020), we also verified that estimates were insensitive to using fewer controls. We did not control for potential outcomes of depression, such as relationship status; doing so could bias estimates of the associations between depression and economic outcomes.

2.6. Analysis

We first produced descriptive statistics for baseline sample characteristics, economic outcomes, and exposure variable. We then conducted longitudinal regression analysis, covering 5 survey waves from 1 to 15 years postpartum. A strength of our data is the inclusion of repeated observations on the same individuals over time. However, when analyzing the data, it is important to take account of the fact that the observations are not independent; that is, the characteristics of a person at one time point are likely to be similar to those of the same person at another time point. Some of these characteristics may be unmeasured. Statistically, these individual differences can be partly modelled using person-specific intercepts. In what follows, we describe the different approaches we took for adjusting for this feature of the data, which is crucial for accounting for unmeasured confounders.

We pooled data from all survey waves and first tested whether each individual required their own intercept using a Breusch-Pagan Lagrange multiplier test, which determines whether the variance of the intercepts is distinguishable from 0 (Breusch and Pagan, 1980). Using this test, we compared a pooled model with a single intercept (pooled OLS) to a model which included a separate intercept for each individual. While a single intercept is more efficient and has fewer parameters to be estimated, it may not provide a good fit for the observed data. In our case, we rejected the null hypothesis associated with the Breusch-Pagan test and thus concluded that a pooled model with a single intercept was not appropriate. We therefore considered two alternatives – a random effects (RE) model and a fixed effects (FE) model.

In the RE models, individual-specific intercepts (also referred to as random effects) are drawn from a normal distribution and assumed to be uncorrelated with control variables. The linear predictor specification for this model is summarized in Equation (1):

$$Economic\ Outcome_{i,t} = \alpha_i + \beta_1 Depression_{i,t} + X_{i,}\gamma_1 + Z_{i,t}\delta_1 + \varepsilon_{i,t} \qquad \text{(EQ 1)}$$

where the outcome for individual i at time t is a function of a binary indicator of depression status at time t, an individual-specific intercept α_i, time-invariant control variables (X_i), time-varying control variables $(Z_{i,t})$, their corresponding parameter vectors (γ_1 and δ_1), and an idiosyncratic error term $(\varepsilon_{i,t})$. For consistency across outcomes, we used a linear probability model to estimate risk differences (McGovern et al., 2016), but for binary outcomes we also conducted conditional logit models and estimated odds ratios. We tested our first hypothesis that depression is associated with outcomes of interest based on estimates of the regression coefficient β_1. Standard errors were adjusted for clustering at the individual level (Rokicki et al., 2018).

In the FE approach, an individual-specific intercept, which is conceptually similar to incorporating an indicator variable for each person in the sample, is included in the model. Doing so eliminates all factors common to respondents that do not change over time (Gunasekara et al., 2014; McGovern and Rokicki, 2022). To formally test our second hypothesis regarding the role of unobserved confounders, we used a Hausman test. If there were time-invariant unobserved confounders associated with both maternal depression and the outcomes, we would expect the FE estimates to be (asymptotically) unbiased and the RE estimates to be (asymptotically) biased under the maintained assumptions (the data generating process is linear in parameters, observations are independent across individuals, relevant variance and co-variances are finite and homoscedastic, and the idiosyncratic error terms $\varepsilon_{i,t}$ are uncorrelated with explanatory variables in each time period for the same individual). On the other hand, if time-invariant unobserved confounders were absent, we would expect both the RE and FE estimates to be (asymptotically) unbiased. Therefore, if RE and FE estimates differed systematically, it would imply that time-invariant unobserved confounders were present. We used the Hausman test to evaluate whether sets of coefficients in both FE and RE models were statistically different (Hausman, 1978; Kaiser, 2014).

Finally, to test our hypothesis that associations between the exposure and outcomes of interest were strongest for those who experienced persistent depression, we estimated linear regression models predicting economic outcomes at 15 years as a function of experiencing depression at previous time points. These models exploit the temporal ordering of experiences of depression and economic outcomes that can be established with our data. We hypothesized that long-term (15 year) outcomes for respondents who experienced persistent depression (defined as depressive symptoms that occurred during the postpartum year and re-occurred at one or more of the subsequent observed time points) would be worse than those of respondents who had transient depression (defined as depressive symptoms that were limited to the postpartum year). Specifically, we estimated models that regressed outcomes at 15 years on a categorical variable for whether the mother did not experience depression at any time point, experienced depression only at one

year postpartum but not at any further time points, did not experience depression at one year postpartum but experienced depression in at least one of the 4 subsequent time points, or experienced depression at one year postpartum and also in at least one subsequent time point. These models allowed us to test our second hypothesis by assessing the extent to which the associations between depression at year 1 and economic outcomes 15 years later can be partly explained by persistence of depression (i.e., whether those who experience postpartum depression may have worse economic outcomes in the future because they are also more likely to experience depression in the future). The linear predictor specification for this model is summarized in Equation (2):

$$Economic\ Outcome_{i,t=15} = \beta_2 Depression\ Pattern_i + X_i\gamma_2 + \varepsilon_i \quad \text{(EQ 2)}$$

where the outcome at year 15 is a function of the depression pattern and a set of baseline characteristics (X_i). Again, we did not adjust for later characteristics that are potential outcomes of depression. Because the outcome and exposures are time-invariant, this model involves one observation per respondent (precluding the fixed effects approach described above).

3. Results

3.1. Descriptive data

Table 1 shows baseline characteristics of the analytical sample of 4717 respondents who participated in the survey at one year postpartum. Descriptive statistics for economic outcomes and depression in each survey wave are shown in Table A1. Of the 4717 mothers, 3575 participated in the study at 15 years postpartum and 1142 did not participate. In what follows, we refer to these groups as "stayers" and "leavers", respectively. Table 1 also shows the characteristics of stayers. Baseline characteristics of the mothers who participated at year 1 and those who stayed in the study at year 15 were very similar.

We also examined the characteristics of leavers, by regressing an indicator for not being present in the final wave on the control variables. Of the statistically significant coefficients, we found that the leavers were more likely to be foreign born, have lower levels of education, begin prenatal care later, and have a history of adverse experiences, but were not more likely to experience depression at year 1. We adjusted for these baseline characteristics in our models but were not able to account for potential selective attrition based on unobserved factors. We explored this issue in our robustness checks.

Table 1
Descriptive statistics, measured at birth.

	Analytical sample (n = 4717)		Sub-sample of stayers (n = 3575)	
	%	N	%	N
Mother's age less than 20 years old	18%	824	18%	630
Mother's race/ethnicity: non-Hispanic Black	48%	2244	50%	1789
Mother's race/ethnicity: Hispanic	27%	1285	25%	877
Household income <100%FPL	36%	1695	35%	1251
Mother's education: HS or less	65%	3051	64%	2279
Mother was born in the US	84%	3930	87%	3091
Mother was married to father of child	24%	1149	24%	861
Education of father of child : HS or less	31%	1312	29%	954
Mother was on Medicaid or uninsured	65%	3049	63%	2260
Mother took drugs during pregnancy	10%	451	9%	327
Mother drank alcohol during pregnancy	14%	664	14%	499
Mother smoked during pregnancy	23%	1072	23%	808
Mother had a history of mental health conditions	10%	459	9%	332
Mother had a history of adverse experiences	10%	457	9%	324
Mother had delivery complications	49%	2296	50%	1781
Newborn went to NICU	9%	436	9%	330
Infant was female	48%	2256	48%	1722
Multiple birth	2%	90	2%	71
Infant was mother's first birth	57%	2678	56%	2008
Prenatal care began 1st trimester	60%	2813	60%	2161

Notes: Analytical sample is composed of those who participated in the year 1 interview and completed the depression questions. Sub-sample of stayers consists of those among the analytical sample who also participated and completed the depression questions in the year 15 interview. FPL = federal poverty limit; HS = high school; NICU = neonatal intensive care unit.

Among those who completed the depression screener at year 1, approximately one quarter of respondents were Hispanic, almost half were non-Hispanic Black, and the remaining quarter were non-Hispanic White, Asian, or other race-ethnicity. 18% of women were less than 20 years old at the time of birth. The majority (84%) were born in the U.S. Almost one quarter (24%) were married to the biological father at baseline. Almost two-thirds (65%) had a high school education or less, and over one-third (36%) had household incomes below the FPL. From the linked medical records, 10% of the mothers had a history of mental health conditions, 10% had a history of adverse experiences, and 49% had any labor/delivery complication.

Fig. 1 presents rates of depression over time, for both the analytical sample of 4717 and a sub-sample of those who screened positive for depression at year 1 (15.5%, n=676). While rates of depression across all years in the analytical sample remained in a narrow range between 15% and 21%, rates for respondents who screened positive at one year postpartum were much higher throughout. Over 50% of respondents who screened positive for depression at 1 year also screened positive at 3 years; that figure declined to 34% by 15 years.

3.2. Regression results

Table 2 presents key estimates from FE and RE models, which include a full set of control variables as indicated in the table notes. For all outcomes, the Breusch-Pagan Lagrange multiplier test rejected a single intercept (Breusch and Pagan, 1980). The Hausman test rejected that the RE and FE estimates were statistically the same, which implies the presence of time-invariant unmeasured confounders. Estimates were somewhat attenuated in the FE models, but still had confidence intervals that excluded 0 and remained substantive in magnitude.

Estimates from the FE models indicated that experiencing depression was associated with a 3-percentage point (PP) increase in the risk of not being employed (95% CI 0.01 to 0.05), a 14-PP increase in the risk of any material hardship (95% CI 0.12 to 0.16), and a 4-PP increase in the risk of living in a household below the FPL (95% CI 0.02 to 0.06). It was also associated with a reduction in the ratio of household income to poverty by 0.10 (95% CI -0.16 to -0.04) and a reduction in annual income by

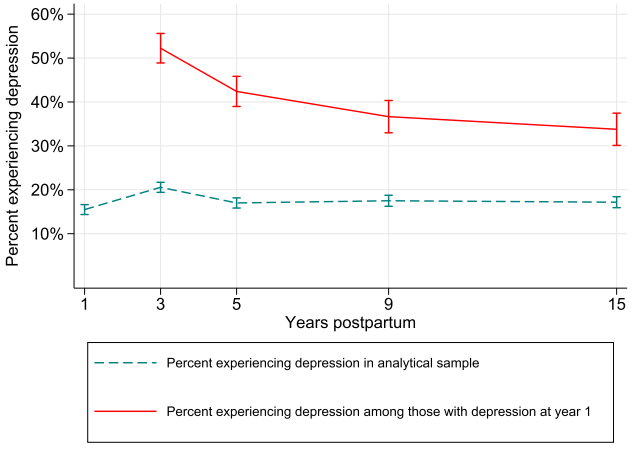

Fig. 1. Percentage of respondents experiencing depression by year, in the analytical sample and among those who met the criteria for depression at one year.

Table 2
Linear probability risk difference panel model estimates of the association between depression and economic outcomes in each survey round.

Variables	Not employed in past week		Any material hardship in past year		Below 100% FPL		Household poverty ratio		Household income	
	Risk Difference (95% CI)		Risk Difference (95% CI)		Risk Difference (95% CI)		Risk Difference (95% CI)		Risk Difference (95% CI)	
	RE	FE	RE	FE	RE	FE	RE	FE	RE	FE
Meets criteria for depression	0.04	0.03	0.20	0.14	0.06	0.04	-0.14	-0.10	-3090	-2114
	(0.03 to 0.06)	(0.01 to 0.05)	(0.18 to 0.22)	(0.12 to 0.16)	(0.04 to 0.07)	(0.02 to 0.06)	(-0.19 to -0.08)	(-0.16 to -0.04)	(-4209 to -1972)	(-3379 to -850)
Observations	19,328	19,328	19,341	19,341	19,305	19,305	19,298	19,298	19,332	19,332
Number of respondents	4706	4706	4707	4707	4704	4704	4704	4704	4707	4707
BP LM Test	p < .01		p < .01		p < .01		p < .01		p < .01	
Hausman Test		p < .01		p < .01		p < .01		p < .01		p < .01

Notes: Adjusted risk differences and cluster robust 95% confidence intervals are shown. FPL = federal poverty limit. RE = random effects. FE = fixed effects. BP LM = Breusch-Pagan Lagrange multiplier test for a common intercept. Hausman = test of systematic difference in coefficients between RE and FE models. The exposure is a binary indicator for whether the respondent met the criteria for major depression (liberal CIDI-SF definition). The full table showing all coefficients is available as Table A2 in the Appendix. N = 4717 respondents in the analytical sample were included in the analysis but the number of observations in any given model is less than this because of missing values on outcomes or exposures. Control variables were obtained from the baseline survey right after the mother gave birth and included mother's age, race/ethnicity, nativity (born in US), marital status, education, household poverty category, education of child's father, health insurance, substance use, history of mental health conditions, history of adverse experiences, trimester of first prenatal care, birth interval, any delivery complications, whether the infant was in a NICU, child's sex, and multiple birth. Time-varying control variables included year and month of interview and mother's current age.

$2114 (95% CI -$3379 to -850).

The full set of coefficients from these models, including control variables, are shown in the appendix (Table A2), and are broadly consistent with the previous literature. Racial disparities are apparent, with non-Hispanic Black mothers being more likely to experience all adverse economic outcomes. Being married, more highly educated, having private insurance, and having lower levels of household poverty at the time of the delivery were all associated with more favorable economic outcomes in the RE models.

Fig. 2 shows results from the analyses described by Equation (2), with predicted values of outcomes at year 15 for respondents in each of four categories indicating the pattern of depression over time. Outcomes were most favorable for those who did not experience depression at any time point. Outcomes were generally the least favorable for individuals who experienced persistent depression (that is, experienced depression at one year postpartum and again at a subsequent time point). For example, those with persistent depression had the highest risk of not being employed and experiencing material hardship and had the lowest ratio of income to poverty. Regression coefficient estimates for this model are shown in Appendix Table A3.

3.3. *Robustness checks*

We conducted several supplementary analyses to assess sensitivity to alternative model specifications and measures. First, odds ratios from logit models for binary outcomes are shown in the Appendix Table A4 and are consistent with the corresponding linear regression results. Next, we used the alternative (conservative) categorization of depression and results were similar to those in the main models (Appendix Table A5).

To assess the extent to which missing medical record information was likely to bias our findings, we compared how depression status in year 1 varied according to whether medical record data was available. We found minimal difference, with 14% (95% CI 12% to 16%) of those missing medical records reporting depression, compared to 16% (95% CI 15% to 17%) of those with medical records. Given the overlapping confidence intervals, there is limited evidence of a difference, but if anything it appears that those without medical records were at lower risk of depression. This pattern of more favorable outcomes for those without medical records was confirmed when we conducted the same analysis for household poverty category. Those with missing medical records were somewhat over-represented in better-off households: 25% (95% CI 23% to 28%) lived in households at≥300% of the FPL, compared to 21% (95% CI 20% to 23%) of those with medical records.

It is important to note that we adjusted for these important potentially confounding factors in our models and that medical history is time-invariant, and therefore implicitly adjusted for in the FE models. For the RE analyses, we compared estimates from models that did not control for these variables to those from our main models (which did control for these factors), and found that the results were indistinguishable.

Finally, we assessed the potential impact of attrition.. Attrition and the resulting potential risk of bias should be weighed against the advantages of having 15 years of follow-up data. We know of few other US datasets that follow individual mothers longitudinally over an extended time period. It is also important to bear in mind that the study oversampled unmarried women, who are disproportionately disadvantaged in the U.S. and thus are a harder to reach population, by design. While 1142 participants were not in the sample at year 15, only 187 (4%) of the year 1 sample had depression status measured at only one point in time. Therefore, we were able to include 96% of the year 1 sample in our main analysis in Table 2.

Nevertheless, we conducted several supplementary analyses to assess potential bias from sample attrition. To investigate whether the impact of maternal depression might differ for those present in all waves compared to the analytical sample, we estimated our main models restricting to mothers with measures of depression at all 5 time points (n

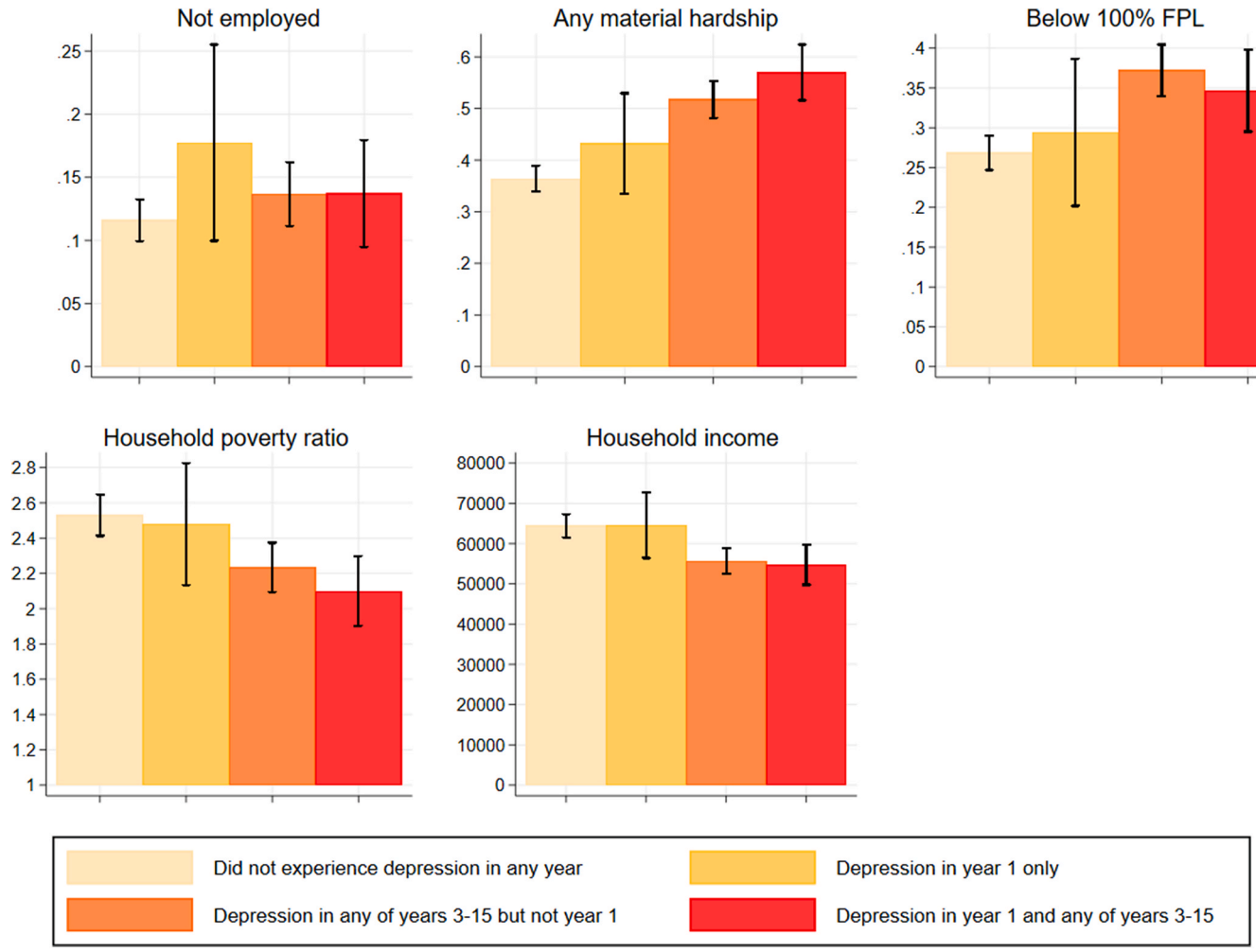

Fig. 2. Predicted economic outcomes at year 15 by depression pattern (adjusted).

= 2762). Results were nearly identical to those in Table 2 (Appendix Table A6). In addition, we estimated our main models restricting to those who were absent for at least one time point (n = 1994), and again found that estimates were similar. While we cannot definitively rule out that non-participation is biasing our estimates, these robustness checks strengthen our confidence in the results.

4. Discussion

In this study, we used a quasi-experimental approach to examine the association between maternal depression and economic well-being over a 15-year time horizon. Our empirical strategy allowed us to adjust for time-invariant unobserved confounders, including history of depression before childbirth, and assess the extent to which unobserved confounders could explain the associations. We found that maternal depression was strongly associated with a range of adverse economic outcomes, including not being employed, material hardship, and poverty. Our results are consistent with previous literature demonstrating a relationship between maternal depression and child and household economic outcomes (Noonan et al., 2016; Corman et al., 2016; Curtis et al., 2014; Reichman et al., 2015; Guerrero et al., 2020; Garg et al., 2015; Rokicki et al., 2022). While the point estimates in our FE models were somewhat lower than the corresponding RE specifications, the overall conclusion that maternal outcomes are strongly related to depression was not substantively affected by adjusting for time-invariant unmeasured factors. In terms of our first research question, our results indicate that previous descriptive findings on maternal outcomes associated with depression are unlikely to reflect unmeasured confounding (Ammerman et al., 2016; Rokicki et al., 2022; Casey et al., 2004; Reading and Reynolds, 2001; Hope et al., 1999).

We also examined persistent vs transient experiences of depression. In our sample, more than 50% of those who screened positive for depression in year 1 also screened positive in year 3. Regarding our second research question, we found that women who were most adversely affected in terms of economic well-being were those who experienced persistent or recurring depression across multiple years. These findings are consistent with the literature on the impacts of chronic maternal depression on child outcomes (Netsi et al., 2018; Tainaka et al., 2022; De Oliveira et al., 2019; Horwitz et al., 2009), but indicate that the impacts on women themselves are also important.

The magnitudes of the associations between maternal depression and economic outcomes were large. For example, the coefficient for experiencing depression for the outcome of not being employed in the FE model was 0.03, implying an increase in the risk of not being employed by 3 percentage points, which is a 14% increase compared to the average in year 1. Similarly, the coefficient for experiencing depression for the outcome of household income implies a depression-associated reduction in annual household income of around $2111. Given that $2111 is almost 7% of mean household income at year 1 in our sample, the magnitude of the association between depression and household income is substantial.

There are several potential pathways through which maternal depression may affect economic outcomes. Depression is a debilitating condition, affecting an individual's emotional well-being and social-

emotional functioning (Layard, 2013; Kupferberg et al., 2016). Depressive symptoms like fatigue, hopelessness, irritability, and trouble concentrating can interfere with an individual's daily functioning and productivity, including ability to procure skills and training, seek a new job, and maintain stable employment (Smith and Mazure, 2021). In the general population, mental health conditions are associated with poor work performance, low income, and unemployment (Whooley et al., 2002; Zabkiewicz and Schmidt, 2007; Mojtabai et al., 2015; Frijters et al., 2014). For example, previous papers have documented that depression among Australian adults is associated with a reduction in employment (Frijters et al., 2014), and that mental health conditions among children are associated with later-life reductions in employment and earnings in the UK and the U.S. (Smith and Smith, 2010; Egan et al., 2015; Goodman et al., 2011) Our study contributes to this growing literature by finding a strong relationship between maternal depression and a broad range of women's economic outcomes that have implications for maternal well-being and child health and development. Moreover, persistence of depressive symptoms is an important factor in the relationship between mental health and economic outcomes (Hammen and Brennan, 2003; Seto et al., 2005). Further work to elucidate causal pathways underlying linkages between maternal depression and economic outcomes is needed.

Findings from this study add to our understanding of the role of social determinants in perpetuating health disparities . Previous literature has emphasized that social and economic factors such as social support, housing, income, and employment status are predictors of depression (Riumallo-Herl et al., 2014; Daly and Delaney, 2013; Mousteri et al., 2020; Reeves et al., 2016; Baranyi et al., 2020; Melchior et al., 2018). Our results suggest that depression may exacerbate existing socioeconomic inequalities by increasing the probability that affected individuals will experience economic hardship in the future. Moreover, our analysis of impacts of persistent versus transient maternal depression suggests that future depression is a potential mechanism through which maternal depression affects long-run economic outcomes. This apparent bidirectional negative relationship is consistent with the broader literature on mental health and unemployment (Smith and Mazure, 2021). Efforts to increase access to mental health support services could potentially disrupt this cycle by not only improving mental health outcomes but also leading to increases in employment and income.

This study has several limitations. First, reverse causality is always a concern when considering economic effects of mental health. Our results show that mental health conditions are a risk factor for adverse economic outcomes, but we also know that socioeconomic status is a risk factor for depression (Laaksonen et al., 2007; Riumallo-Herl et al., 2014). In modelling the association between depression at year 1 and economic outcomes 15 years later (Fig. 2), we were able to leverage the temporal ordering of the data; however, we were not able to use the FE approach in this analysis to control for potential unmeasured time-invariant confounders. Second, while we controlled for all time-invariant factors in the FE models, it is possible that there are time-varying confounders that impact estimates. Future research should adopt alternative identification approaches that investigate the role of potential time-varying confounding factors. Third, not all respondents were interviewed in every wave, and for this reason, the samples at year 1 and year 15 are not identical. Although we adjusted for baseline characteristics that predicted non-participation in our models and supplemental analyses suggested minimal differences between stayers and leavers, it is not possible to definitively rule out that selective attrition based on unobserved factors biased our estimates. Future research should explore the relationships we document in this paper using alternative datasets. Finally, we cannot directly assess the potential mediating effect of treatment for depression. While our models incorporating patterns of depression over time point to the importance of addressing recurring and persistent symptoms, future research should directly assess the long-term benefits of treatment.

5. Conclusions

Our results underscore the importance of addressing maternal depression as a public health imperative. In addition to its impact on maternal quality of life, mother-infant bonding, and child health and development, our results indicate that maternal depression also has a significant impact on women's economic well-being. Results of our study strengthen the case for viewing mental health support services as interventions that can also foster economic well-being. Assessments of the cost-effectiveness of such interventions should include the economic benefits alongside previously documented impacts on the health of women and their families, likely increasing their feasibility.

Credit author statement

Mark McGovern: Conceptualization, Methodology, Formal analysis, Writing – original draft, Writing – review & editing, Visualization. **Slawa Rokicki:** Conceptualization, Methodology, Formal analysis, Writing – original draft, Writing – review & editing. **Nancy E. Reichman:** Conceptualization, Methodology, Writing – original draft, Writing – review & editing.

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Availability of data

All data used in this paper are anonymized survey data publicly available online from available from Princeton University's Office of Population Research (OPR) data archive (opr.princeton.edu/archive), and can be accessed by researchers after registration.

Code availability

Stata code for this paper is available from the authors.

Ethics approval

This study has been granted ethical approval by Rutgers Biomedical Health Sciences IRB and granted an exemption as secondary data analysis.

Declaration of competing interest

The authors have no relevant financial or non-financial interests to disclose.

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.socscimed.2022.115017.

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Online Appendix

Table A1. Descriptive statistics for economic outcomes and depression (liberal criteria) in each survey round

Outcome	Mean	N	Outcome	Mean	N
Material hardship at year 1	0.42	4,363	Household income at year 1	32,020	4,364
Material hardship at year 3	0.46	4,230	Household income at year 3	35,624	4,231
Material hardship at year 5	0.44	4,133	Household income at year 5	37,509	4,139
Material hardship at year 9	0.51	3,513	Household income at year 9	44,999	3,508
Material hardship at year 15	0.43	3,140	Household income at year 15	60,463	3,142
Not employed at year 1	0.22	4,360	Household poverty ratio at year 1	1.83	4,364
Not employed at year 3	0.2	4,220	Household poverty ratio at year 3	1.94	4,231
Not employed at year 5	0.18	4,129	Household poverty ratio at year 5	1.92	4,139
Not employed at year 9	0.17	3,510	Household poverty ratio at year 9	1.99	3,475
Not employed at year 15	0.13	3,134	Household poverty ratio at year 15	2.39	3,139
Household income under FPL at year 1	0.44	4,364	Met depression criteria at year 1	0.15	4,362
Household income under FPL at year 3	0.42	4,231	Met depression criteria at year 3	0.21	4,221
Household income under FPL at year 5	0.41	4,139	Met depression criteria at year 5	0.17	4,129
Household income under FPL at year 9	0.37	3,482	Met depression criteria at year 9	0.18	3,502
Household income under FPL at year 15	0.31	3,139	Met depression criteria at year 15	0.17	3,575

Notes: FPL=100% federal poverty level. Material hardship is an indicator for difficulties meeting payments for food, bills, housing, utilities, and medical reasons. The depression measure is whether the respondent met the criteria for depression (liberal CIDI-SF definition).

Table A2. Linear probability risk difference panel model estimates of the association between depression and economic outcomes in each survey round (full table)

	Not Employed Risk Difference		Any material hardship Risk Difference		Federal poverty limit Risk Difference		Household poverty ratio Risk Difference		Household income Risk Difference	
Variables	**RE**	**FE**	**RE**	**FE**	**RE**	**FE**	**RE**	**FE**	**RE**	**FE**
Meets criteria for depression	0.04***	0.03***	0.20***	0.14***	0.06***	0.04***	-0.14***	-0.10***	-3,092.78***	-2,113.96***
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.03)	(0.03)	(570.68)	(645.14)
Wave (Omitted = 2)										
Wave 3	-0.07***	-0.05**	-0.02	-0.05*	-0.03	0.02	0.19**	0.05	4,116.09***	2,508.75
	(0.02)	(0.03)	(0.02)	(0.03)	(0.02)	(0.03)	(0.08)	(0.11)	(1,432.48)	(2,414.13)
Wave 4	-0.06*	-0.01	-0.08**	-0.17***	-0.10***	0.01	0.27*	-0.02	7,755.65***	4,278.34
	(0.03)	(0.05)	(0.04)	(0.06)	(0.04)	(0.06)	(0.16)	(0.22)	(2,826.30)	(4,868.43)
Wave 5	0.03	-0.17	0.04	-0.13	-0.06	-0.06	0.13	0.64	11,075.14***	15,941.98
	(0.04)	(0.12)	(0.05)	(0.14)	(0.05)	(0.13)	(0.18)	(0.61)	(3,574.01)	(11,665.77)
Wave 6	-0.13**	-0.50**	-0.32***	-0.71***	-0.23**	-0.19	0.35	1.09	28,072.61***	33,989.81*
	(0.05)	(0.20)	(0.10)	(0.25)	(0.10)	(0.22)	(0.29)	(1.00)	(7,856.75)	(19,316.57)
Mother's Age at Birth (Omitted = <20)										
Age at birth category = 2, 20-24	-0.03*		0.00		0.00		-0.03		-1,425.73	
	(0.01)		(0.02)		(0.02)		(0.06)		(1,214.37)	
Age at birth category = 3, 25-29	-0.02		-0.03		-0.01		-0.09		-1,721.63	
	(0.02)		(0.03)		(0.03)		(0.12)		(2,417.22)	
Age at birth category = 4, 30-34	0.01		-0.08*		-0.01		-0.12		-2,088.24	
	(0.03)		(0.04)		(0.04)		(0.19)		(3,986.86)	
Age at birth category = 5, >=35	0.03		-0.14**		-0.02		0.36		6,216.48	
	(0.04)		(0.06)		(0.05)		(0.29)		(5,608.39)	
Mother's race - ethnicity (Omitted = non-Hispanic White)										
Non-Hispanic Black	0.08***		0.06***		0.09***		-0.54***		-12,286.80***	
	(0.01)		(0.01)		(0.01)		(0.07)		(1,338.64)	
Hispanic	0.01		-0.01		0.04***		-0.44***		-8,713.04***	
	(0.01)		(0.02)		(0.01)		(0.08)		(1,475.59)	
Other/Missing	0.05***		0.03		0.04**		-0.03		537.45	
	(0.02)		(0.03)		(0.02)		(0.16)		(3,176.98)	
Born in USA (Omitted = No)										
Born in USA = 1, Yes	0.01		0.06***		-0.01		0.07		980.10	
	(0.01)		(0.02)		(0.01)		(0.06)		(1,257.67)	
Born in USA = 99, Missing	0.12*		-0.07		0.15**		-0.39		-9,634.78**	
	(0.07)		(0.09)		(0.07)		(0.27)		(4,534.19)	
Mother married to biological father	-0.00		-0.08***		-0.06***		0.41***		10,577.02***	
	(0.01)		(0.01)		(0.01)		(0.06)		(1,197.07)	

Mother's Education (Omitted = < High School)					
High School	-0.07***	-0.01	-0.12***	0.19***	3,711.37***
	(0.01)	(0.01)	(0.01)	(0.03)	(666.47)
Some College	-0.11***	0.03*	-0.21***	0.53***	10,193.43***
	(0.01)	(0.01)	(0.01)	(0.04)	(903.88)
College Degree	-0.09***	-0.09***	-0.21***	2.33***	44,003.17***
	(0.01)	(0.02)	(0.02)	(0.14)	(2,737.74)
Missing	0.00	0.19***	0.00	-0.06	-2,215.03
	(0.07)	(0.06)	(0.16)	(0.26)	(4,577.45)
Mother's household poverty category (Omitted = <50%)					
50-99%	-0.02*	0.01	-0.08***	0.11***	2,149.48***
	(0.01)	(0.02)	(0.01)	(0.03)	(711.89)
100-199%	-0.05***	0.01	-0.18***	0.23***	4,398.34***
	(0.01)	(0.01)	(0.01)	(0.04)	(748.54)
200-299%	-0.07***	-0.00	-0.29***	0.45***	8,093.86***
	(0.01)	(0.02)	(0.02)	(0.05)	(1,062.99)
300%+	-0.09***	-0.09***	-0.35***	1.49***	27,262.23***
	(0.01)	(0.02)	(0.02)	(0.07)	(1,348.51)
Mother's father's education (Omitted = high school)					
Did not finish high school	0.01	0.02	0.03***	-0.16***	-2,813.35***
	(0.01)	(0.01)	(0.01)	(0.03)	(652.81)
Missing	0.04***	0.03	0.08***	-0.22***	-4,500.24***
	(0.01)	(0.02)	(0.02)	(0.04)	(904.78)
Public insurance/uninsured during pregnancy	0.03***	0.04***	0.07***	-0.30***	-5,908.63***
	(0.01)	(0.01)	(0.01)	(0.04)	(831.78)
Took illegal drugs during pregnancy	0.06***	0.02	0.06***	-0.12**	-2,312.17**
	(0.02)	(0.02)	(0.02)	(0.05)	(1,029.97)
Drank alcohol during pregnancy	0.01	0.04***	0.02*	0.06	822.76
	(0.01)	(0.01)	(0.01)	(0.07)	(1,363.32)
Smoked during pregnancy	0.03***	0.09***	0.02	-0.11**	-2,770.67***
	(0.01)	(0.01)	(0.01)	(0.05)	(926.05)
Pre-pregnancy diagnosis of mental health conditions	0.02	0.03	0.01	-0.15**	-3,961.22***
	(0.01)	(0.02)	(0.02)	(0.06)	(1,259.95)
History of any adverse experiences	0.02	0.00	-0.01	0.04	843.03
	(0.01)	(0.02)	(0.02)	(0.06)	(1,208.71)
Trimester PNC began (omitted = 1st trimester)					
2nd trimester	0.02**	0.00	0.02	-0.17***	-2,652.46***
	(0.01)	(0.01)	(0.01)	(0.04)	(706.36)
3rd trimester or missing	0.04***	0.02	0.04**	-0.13**	-2,182.78**

	(0.01)		(0.02)		(0.02)		(0.05)		(1,010.42)	
Time since last birth (Omitted = first birth)										
Less than 2 years	0.01		0.02		0.05***		-0.19***		1,021.54	
	(0.01)		(0.02)		(0.01)		(0.05)		(1,118.08)	
2 years or more	-0.01		0.02**		0.01		-0.17***		570.29	
	(0.01)		(0.01)		(0.01)		(0.05)		(1,018.57)	
Delivery complication	0.02***		-0.01		0.01		0.09*		482.30	
	(0.01)		(0.01)		(0.01)		(0.05)		(892.22)	
Newborn in NICU	-0.01		-0.02		-0.00		-0.03		-903.53	
	(0.01)		(0.02)		(0.01)		(0.08)		(1,460.82)	
Female infant	0.00		-0.00		0.01		-0.03		-630.38	
	(0.01)		(0.01)		(0.01)		(0.04)		(799.23)	
Multiple birth	0.03		0.01		0.04		-0.48***		-5,510.41**	
	(0.02)		(0.03)		(0.03)		(0.12)		(2,320.18)	
Mother's age	-0.00**	0.01	0.01**	0.03**	0.00	-0.00	0.00	-0.03	-55.25	-353.79
	(0.00)	(0.01)	(0.00)	(0.01)	(0.00)	(0.01)	(0.01)	(0.05)	(270.26)	(980.68)
Constant	0.29***	-0.08	0.19***	-0.26	0.60***	0.61**	1.35***	2.32*	24,876.58***	35,713.77
	(0.05)	(0.24)	(0.07)	(0.29)	(0.06)	(0.27)	(0.27)	(1.31)	(5,503.18)	(23,918.49)
Observations	19,328	19,328	19,341	19,341	19,305	19,305	19,298	19,298	19,332	19,332
R-squared		0.01		0.02		0.02		0.02		0.11
Number of respondents	4,706	4,706	4,707	4,707	4,704	4,704	4,704	4,704	4,707	4,707

Notes: Adjusted risk differences and cluster robust standard errors in parentheses are shown. FPL = federal poverty limit. RE = random effects. FE = fixed effects. ICU = neonatal intensive care unit. The summary table showing only the coefficient on depression is Table 2 in the main text. N = 4,717 respondents in the main sample were included in the analysis but the number of observations in any given model is less than this because of missing values on the outcome and/or exposure. The coefficient on a binary indicator for whether the respondent met the criteria for depression (liberal CIDI-SF definition) is shown. Material hardship is an indicator for difficulties meeting payments for food, bills, housing, utilities, and medical reasons. *** p<0.01, ** p<0.05, * p<0.1;

Table A3. Linear probability risk difference estimates of the association between economic outcomes at year 15 and prior depression status

Variables	Not employed Risk Difference Year 15	Any material hardship Risk Difference Year 15	Federal poverty limit Risk Difference Year 15
Prior depression status (omitted = did not experience depression in any year)			
Depression in year 1 only	0.04	0.10**	0.01
	(0.04)	(0.05)	(0.04)
Depression in any of years 3-15 but not year 1	0.02	0.15***	0.09***
	(0.01)	(0.02)	(0.02)
Depression in year 1 and any of years 3-15	0.04**	0.20***	0.08***
	(0.02)	(0.03)	(0.03)
Control Variables	**Y**	**Y**	**Y**
Number of respondents	2,952	2,958	2,958
R-squared	0.08	0.13	0.20

Variables	Household poverty ratio Regression coefficient Year 15	Household income Regression coefficient Year 15
Prior depression status (omitted = did not experience depression in any year)		
Depression in year 1 only	-0.12	-3,094.13
	(0.17)	(3,965.38)
Depression in any of years 3-15 but not year 1	-0.26***	-7,682.65***
	(0.08)	(1,936.99)
Depression in year 1 and any of years 3-15	-0.34***	-7,670.93***
	(0.12)	(2,817.44)
Control Variables	**Y**	**Y**
Number of respondents	2,958	2,961
R-squared	0.38	0.37

Notes: Pooled data from 5 survey round on 4,717 respondents in main analysis sample. The depression measure is whether the respondent met the criteria for depression (liberal CIDI-SF definition). Control variables are the same as in Table A2. Predicted values from these models are shown as Figure 3 in the main text. Cluster robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Table A4. Logit odds ratio panel model estimates of the association between depression and economic outcomes in each survey round

	Unemployed Odds Ratio		Any material hardship Odds Ratio		Federal poverty limit Odds Ratio	
Variables	**RE**	**FE**	**RE**	**FE**	**RE**	**FE**
Meets criteria for depression	1.41***	1.28***	3.37***	2.29***	1.50***	1.31***
	(0.08)	(0.09)	(0.20)	(0.15)	(0.09)	(0.09)
Control variables	Y	Y	Y	Y	Y	Y
Observations	19,305	8,546	19,341	11,710	19,305	9,860
Number of respondents	4,706		4,707		4,704	

Notes: Adjusted odds ratios and cluster robust standard errors are shown. RE = random effects. FE = fixed effects. N = 4,717 respondents in the main sample were included in the analysis but the number of observations in any given model is less than this because of missing values on the outcome and/or exposure. The depression measure is whether the respondent met the criteria for depression (liberal CIDI-SF definition). Control variables are the same as in Table A2. *** p<0.01, ** p<0.05, * p<0.1

Table A5. Linear probability risk difference panel model estimates of the association between depression and economic outcomes in each survey round (conservative definition of depression)

	Unemployed Risk Difference		Any material hardship Risk Difference		Below 100% FPL Risk Difference		Household poverty ratio Regression coefficient		Household income Regression coefficient	
Variables	RE	FE	RE	FE	RE	FE	RE	FE	RE	FE
Meets conservative criteria for depression	0.04***	0.03***	0.18***	0.12***	0.04***	0.02**	-0.13***	-0.09***	-2,657.76***	-1,673.37**
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.03)	(0.03)	(612.16)	(679.69)
Control variables	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Observations	19,300	19,300	19,313	19,313	19,277	19,277	19,270	19,270	19,304	19,304
Number of respondents	4,706	4,706	4,707	4,707	4,704	4,704	4,704	4,704	4,707	4,707

Notes: Adjusted risk differences and cluster robust standard errors are shown. RE = random effects. FE = fixed effects N = 4,717 respondents in the main sample were included in the analysis but the number of observations in any given model is less than this because of missing values on the outcome and/or exposure. The depression measure is whether the respondent met the criteria for depression (conservative CIDI-SF definition). Control variables are the same as in Table A2. *** p<0.01, ** p<0.05, * p<0.1

Table A6. Linear probability risk difference panel model estimates of the association between depression and economic outcomes in each survey round (sample without missing outcomes)

	Unemployed Risk Difference		Any material hardship Risk Difference		Below 100% FPL Risk Difference		Household poverty ratio Regression coefficient		Household income Regression coefficient	
Variables	RE	FE	RE	FE	RE	FE	RE	FE	RE	FE
Meets criteria for depression	0.03***	0.03***	0.18***	0.13***	0.06***	0.04***	-0.15***	-0.12***	-3,091***	-2,330***
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.03)	(0.04)	(686.76)	(724.15)
Control variables	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Observations	13,552	13,552	13,557	13,557	13,537	13,537	13,531	13,531	13,551	13,551
Number of respondents	2,762	2,762	2,762	2,762	2,762	2,762	2,762	2,762	2,762	2,762

Notes: Adjusted risk differences and cluster robust standard errors are shown. RE = random effects. FE = fixed effects N = 4,717 respondents in the main sample were included in the analysis but the number of observations in any given model is less than this because of missing values on the outcome and/or exposure. The depression measure is whether the respondent met the criteria for depression (liberal CIDI-SF definition). Control variables are the same as in Table A2. *** p<0.01, ** p<0.05, * p<0.1