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Cash transfers, maternal depression and emotional well-being: Quasi-experimental evidence from India's Janani Suraksha Yojana programme

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ABSTRACT

Maternal depression is an important public health concern. We investigated whether a national-scale initiative that provides cash transfers to women giving birth in government health facilities, the Janani Suraksha Yojana (JSY), reduced maternal depression in India's largest state, Uttar Pradesh. Using primary data on 1695 women collected in early 2015, our quasi-experimental design exploited the fact that some women did not receive the JSY cash due to administrative problems in its disbursement – reasons that are unlikely to be correlated with determinants of maternal depression. We found that receipt of the cash was associated with an 8.5% reduction in the continuous measure of maternal depression and a 36% reduction in moderate depression. There was no evidence of an association with measures of emotional well-being, namely happiness and worry. The results suggest that the JSY had a clinically meaningful effect in reducing the burden of maternal depression, possibly by lessening the financial strain of delivery care. They contribute to the evidence that financial incentive schemes may have public health benefits beyond improving uptake of targeted health services.

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1. Introduction

Mental illness accounts for 7.3% of the global burden of disease (WHO, 2014). Depression is a leading contributor to the global burden, generating losses of 61 million disability-adjusted life years (DALYs) in low- and middle-income countries, and 15 million DALYs in high-income countries (WHO, 2014). Despite the presumed economic and social costs of these disorders in developing countries (Das et al., 2009), investment in prevention and treatment remains inadequate (Collins et al., 2011).

Women disproportionately suffer from depression (Piccinelli and Wilkinson, 2000), with gender disparities emerging in adolescence then becoming most stark during the childbearing years (Kessler et al., 1993). Maternal depression is an important public health concern not only because of its high prevalence (Chandran et al., 2002; Patel et al., 2002) and impact on mothers

but also because of the implications for the child (Poobalan et al., 2007). In most settings, women are the primary caregivers of children and depressive symptoms can hinder a mother's ability to nurture and interact with children. Indeed, growing international evidence shows that maternal depression is associated with adverse birth outcomes and poor child development (Parsons et al., 2012; Patel et al., 2004).

Poverty is an important risk factor for mental health disorders and it is argued that the two interact in a negative cycle (Lund et al., 2011). According to the social causation hypothesis, conditions of poverty increase the risk of mental illness through heightened stress, social exclusion, decreased social capital, malnutrition, and increased obstetric risks, violence, and trauma (Fisher et al., 2007; Lund et al., 2010; Patel and Kleinman, 2003). Cross-sectional studies in low- and middle-income countries show an association between measures of poverty and risk of mental disorders (Lund et al., 2010; Patel and Kleinman, 2003).

More rigorous examination of the relationship and the direction of causality has been addressed by intervention studies and natural

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experiments. The large majority of such studies find that increases or decreases in poverty lead to changes in psychological well-being (Haushofer and Fehr, 2014). The mental health benefits of poverty alleviation interventions have mostly been studied in the context of cash transfer programmes. At least three studies have looked specifically at maternal depression. One of the largest and earliest conditional cash transfer programmes, *Oportunidades* in Mexico, was associated with a reduction in maternal depression (Ozer et al., 2011). By contrast, two randomised experiments of cash transfers in Nicaragua (Macours et al., 2012) and Ecuador (Paxson and Schady, 2010) showed no effect on maternal depression.

In this paper, we study whether cash transfers reduce maternal depression in the context of one of the world's largest demand-side financial incentive programmes. Since 2005, India's Janani Suraksha Yojana (JSY) has provided one-off cash payments to women who give birth in a health facility. The programme remains ongoing with over 11 million beneficiaries each year (MHFW, 2011). In Uttar Pradesh, the setting of this study, women are offered 1400 INR in rural areas and 1000 INR in urban areas. To put these amounts into perspective, households in our sample spent on average 560 INR on delivery care in the public sector and GDP per capita in the state was 37,250 INR in 2014.

Like cash transfer programmes in other countries, the goal of the JSY is not to improve the mental health of mothers. It seems plausible, however, that an increase in income in the form of a one-off cash payment could improve the mental health and well-being of its recipients. Such findings could represent an important unintended benefit of the JSY, contributing further to the evidence on the programme (Hunter et al., 2014; Powell-Jackson et al., 2015).

2. Data

2.1. Study sample and data collection

The study was conducted in Uttar Pradesh, India's most populous state, with 200 million people. We collected data from six districts (Kannauj, Kanpur Nagar, Kanpur Dehat, Auraiya, Etawah, and Fatehpur) of Uttar Pradesh with a combined population of 13.7 million. A household survey was administered to women in 180 sampled villages between 13th January and 5th February 2015 (Pereira et al., 2015). Figure A1 in the online supplementary material shows six demographic variables across census clusters in the entire state ($n = 98,729$), our study districts ($n = 5415$), and our sample of selected clusters within the study districts ($n = 180$) to give a sense of the external validity of our findings.

Fig. 1 shows the derivation of the analytical sample. We enumerated all households in selected villages (30,049 households) one month before the household survey and listed every household member to identify 5473 eligible women. Eligible respondents included all women aged 15–49 years who gave birth in the previous two years, including those who had a stillbirth or whose child had died since childbirth. Using this sampling frame, 3966 eligible women were randomly selected for interview and 3600 women completed the interview (90.1% response rate). In our sample 1968 of interviewed women gave birth in a government facility, of which 206 women were never offered the JSY cash and 67 women had missing data on JSY exposure or psychological distress. Our analytical sample therefore comprises 1695 women.

We used data from a broader study that received ethical approval from the Indian Council of Medical Research (Ref: HMSC/2014/10/HSR), Public Healthcare Society in India (Ref: 10/Nov/2013) and the London School of Hygiene and Tropical Medicine in the UK (Ref: 8610). Women identified as having symptoms of severe depression were referred to the nearest appropriate health provider.

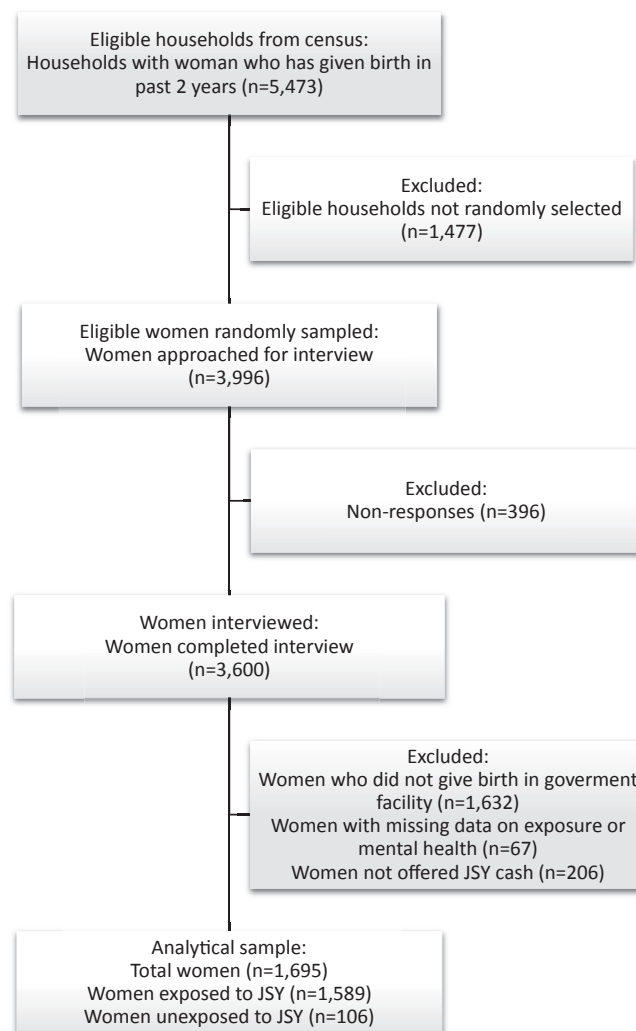


Fig. 1. Derivation of analytical sample.

2.2. Measures of maternal depression and well-being

Our measures of mental health come from the 10-question Kessler Psychological Distress Scale, or K10. It is a short questionnaire developed to screen for depression, with or without anxiety, by determining a composite score based on 5-point answers from respondents ranging from “none of the time” to “all of the time.” It is an internationally validated measure of non-specific psychological mental distress (Andrews and Slade, 2001; Kessler et al., 2003), ideal for monitoring the prevalence of depressive symptoms on a large scale. It has strong psychometric properties and ability to distinguish cases from non-cases. The wording is simple, with short questions and clear response categories. The tool has been validated in India against a gold standard of clinical diagnosis and shown to be a highly accurate instrument (Patel et al., 2008). Based on the optimal cut-off score, the proportion of cases correctly classified was 87%, sensitivity was 54%, specificity was 93%, and the positive predictive value was 62%.

Our primary measure of mental health was the continuous K10 score, ranging from 10 to 50. Internal consistency was good ($\alpha = 0.91$). Because the K10 score was heavily skewed we followed standard practice to log-transform the score for the purposes of analysis. To identify clinical levels of depressive symptoms, we

defined two binary variables based on different thresholds: severe depression (30 or greater) and moderate depression (16 or greater). While these cut-off scores are fairly standard (Tripathy et al., 2010), we examined the sensitivity of the result to different thresholds.

We also collected data on measures of emotional well-being. Women were asked whether they experienced any feelings of happiness, worry, and depression the previous day, using a five-point Likert scale that ranged from “none of the time” to “all of the time” (OECD, 2013). We converted the values to z-scores. Other study outcomes examined were measures of financial strain that included out-of-pocket spending on delivery care, whether the household had to borrow money to pay for delivery care, and whether the household was still in debt having borrowed money.

2.3. Covariates

We sought to address the most important sources of potential confounding. In particular, we recognised the possibility that some women might make return visits to the facility in which they gave birth to claim their money. For this reason, we were careful to control for the proximity of the facility where the woman gave birth, how long ago she gave birth, and the length of stay in the facility. In addition, we used data on characteristics of the woman and her households as potential confounders: urban residence, caste, religion, health insurance, maternal education, birth parity, multiple births, and asset wealth.

3. Empirical strategy

3.1. Study design

It is widely reported that the JSY programme has suffered administrative problems in getting the cash to women in a timely and reliable manner (Powell-Jackson et al., 2015; UNFPA, 2009). We exploited the fact that some women who registered for the JSY and gave birth in a government facility did not receive the cash to which they were entitled for administrative reasons. We designed our household survey to identify three groups of women according to whether they received the JSY cash: i) woman received the JSY cash; ii) woman has yet to receive the JSY cash due to administrative problems; and iii) woman never offered the JSY cash. Not all women registered for the JSY programme during antenatal care which partly explains why women in the third group were not offered the JSY cash.

The study compared women in the first group (exposed) with women in the second group (unexposed) on the basis that administrative factors influencing the receipt of the JSY cash were unlikely to be correlated with characteristics of the woman. To be precise, we postulated that administrative factors would have an effect on maternal depression only through access to the JSY cash. Differences in the maternal depression of women in the two groups would thus reflect the influence of the JSY rather than other determinants of mental health.

Since we collected data after implementation of the JSY, our study design provides an unbiased estimate of effect of the JSY on maternal depression only if women in the two groups are similar in their observed and unobserved determinants of mental health. Although this assumption is strictly untestable, we provide evidence on the integrity of the study design by comparing whether the two groups of women were different across an extensive list of covariates that were unlikely to be affected by the JSY and carry out a wide range of sensitivity analyses.

To understand the administration of the payment system under the JSY in Uttar Pradesh, we conducted in-depth interviews of community health workers, known as Accredited Social Health

Activists (ASHA), Auxiliary Nurse Midwives, and women who had recently give birth. These interviews provided us with information on how the payment system is meant to work and what kinds of problems stood in the way of women successfully receiving the cash. During the study period, eligible women were given a cheque from the health facility in which they gave birth. The cheque could be cashed at any bank. Women were not required to fill out any forms but the cheque did require the signature of the in-charge member of staff at the health facility. Respondents stated that this system worked well. From January 2015 onwards, women have been required to have an individual bank account or a joint account into which the JSY cash is paid but our data do not cover this period.

Our respondents identified three main reasons for why eligible women received the JSY cash with delays or not at all. First, the in-charge of the facility was not always available or present to provide a signature for the cheque. Second, the budget of the health facility for the JSY was sometimes depleted which meant cheques could not be given out. Third, on some occasions, bank officials told beneficiaries that the cheques could be cashed only on certain days of the week. These beneficiaries were turned away and told to come back on days of week when JSY cheques were being disbursed.

The factors identified by our respondents relate to administrative (supply-side) problems in the disbursement of the JSY cash. The qualitative evidence thus supports our argument that the reasons for why women did not receive the JSY cash are unlikely to be correlated with determinants of maternal depression. Take, for example, the administrative problem concerning the unavailability of the facility in-charge to sign off on the cheque. It is not obvious to see how this factor could be linked to characteristics of the woman in a way that would confound our estimates.

3.2. Statistical analysis

In the descriptive analysis we calculated the proportion or mean, as appropriate, for measures of mental health and well-being with exposure and other covariates. We then analysed the log of the K10 score using ordinary least squares, regressing the measure of maternal depression on receipt of the JSY cash and a set of covariates. To assess the clinical significance of the relationship, we analysed the binary indicators of mental distress using a Poisson regression to obtain estimates of the relative risk. We adjusted the standard errors for clustering at the community level to account for the survey design. To assess the power of the study, we conducted an ex-post power calculation for our primary measure of maternal depression, the continuous K10 score. Assuming 5% level of significance, and the observed means, standard deviations and sample sizes in the treatment and control groups, we determined that the study had 82% power. All analyses were conducted using Stata 14.1 SE.

After reporting crude associations, we estimated three models. The first model adjusted for birth location and urban residence. In the second model, we additionally controlled for months postpartum and length of hospital stay. In the third model, we further included a range of characteristics of the woman including caste, religion, maternal education, birth parity, multiple births, health insurance, and wealth. We conducted these analyses using all available data. We also examined the sensitivity of the main findings to various robustness checks, the results of which are reported in the [online supplementary material](#). We present results using a sample with complete data on all covariates. We then explored the sensitivity of the estimates to the inclusion of a rich set of additional covariates. Finally, we examined the sensitivity of the estimates to selection on unobservables (Altonji et al., 2005; Oster, 2013).

We conducted several secondary analyses for a better understanding of the robustness and the interpretation of the findings.

First, we checked whether the results for the binary measure of depression were sensitive to the threshold chosen by running separate regressions for different definitions of psychological distress using every score below 30. Second, we examined the association between receipt of the JSY cash and the z-score of our three measures of emotional well-being (happy, worried, and depressed). Third, we explored heterogeneity in the association between the JSY and the continuous measure of mental health with respect to: months postpartum (birth in the last year versus birth one to two years ago); wealth (poorest 40% versus richest 60%); and maternal education (primary education or less versus secondary education or more). Fourth, to provide evidence on potential channels, we examined the association between receipt of the JSY cash and measures of financial strain using the same models described previously.

4. Results

4.1. Maternal depression

Table 1 reports the study outcomes and characteristics of the respondents by treatment status. The mean maternal depression score was 13.4 for women who received the JSY and 14.7 for those who did not receive the cash, with higher scores indicating potentially worse mental health. Approximately 1% ($n = 22$) of mothers had severe depression in the treatment group compared with 3% ($n = 3$) of mothers in the comparison group and 20% ($n = 323$) of mothers has moderate depression in the treatment group compared with 29% ($n = 31$) in the comparison group.

The characteristics of women who received the JSY were similar to those who did not receive the cash (Table 2). In terms of birth location, caste, religion, health insurance, maternal education, birth order, multiple birth, wealth, and length of stay, the absolute differences were small and none were statistically significant. Time elapsed in the postpartum period between childbirth and interview was significantly greater in the treatment group. We further assessed covariate balance using a large number of additional variables, as shown in Table A1. In total, we examined differences across 44 covariates, finding significant differences at the 5 percent level in three of them.

Table 3 shows the associations between receipt of the JSY cash and maternal depression. Unadjusted estimates show that the JSY was negatively associated with maternal depression when measured in terms of a continuous score. The point estimates

after adjustment for potential confounders indicate that the JSY was associated with an 8.5% reduction in the K10 score ($p = 0.013$). The next set of results shed light on the clinical significance of the association. In the most stringent specifications, the JSY was associated with a 63% reduction in severe depression ($p = 0.07$) and a 36% reduction in moderate depression ($p = 0.008$).

The main results survived a series of sensitivity analyses. The negative association between the JSY and depression persisted across a wide range of possible threshold scores used to define the binary measure of maternal depression (Fig. 2). The results were not sensitive to the addition of a large number potential confounders (Table A2). The findings remained very similar when we restricted the analyses to a complete case sample instead of using all available data in each model (Table A3).

Fig. 3 plots the point estimates with 95% confidence intervals for various subgroups. There was no strong evidence of heterogeneity in the relationship between the JSY and maternal depression according to wealth, education, and the time elapsed between childbirth and interview. The negative association between the JSY and the K10 score was stronger for women who gave birth in the past year than for those who gave birth two years ago. The negative point estimates were larger for women in the richest 60% of households than for women in the poorest 40% of households. However, in neither case were the differences between subgroups statistically significant.

4.2. Emotional well-being and financial strain

Turning to measures of emotional well-being in Table 4, there was no evidence of an association between receipt of the JSY cash and either happiness ($p = 0.272$) or worry ($p = 0.179$), although estimates were in the expected direction. Consistent with the results in Table 3, the JSY was associated with a reduction of 0.25 standard deviations in the z-score of feelings of depression ($p = 0.01$), providing some validation of the main findings.

Table 5 shows the associations between the JSY and measures of financial strain. Reassuringly there was no association between the JSY and out-of-pocket expenditure on delivery care, for there is no reason why the JSY, if properly implemented, should have influenced how much women have to pay. There was a negative association between the JSY and the probability of having to borrow money to pay for delivery care. In the most demanding model, the JSY was associated with a 34% reduction in borrowing to pay for delivery care expenses ($p = 0.108$). Women who received the JSY

Table 1
Descriptive statistics of study outcomes by receipt of JSY cash.

Variable and category	Received JSY cash ($n = 1589$)	Did not receive JSY cash ($n = 106$)	p value
A. Maternal depression			
K10 score (10–50)	13.4 (5.0)	14.7 (6.2)	0.025
K10 indicator			
Severe depression (30–50)	22/1589 (1%)	3/106 (3%)	0.045
Moderate depression (16–29)	323/1589 (20%)	31/106 (29%)	
No or mild depression (10–15)	1244/1589 (78%)	72/106 (68%)	
B. Subjective well-being			
Happy (1–5)	3.6 (1.2)	3.4 (1.1)	0.296
Worried (1–5)	1.7 (0.9)	1.8 (1.0)	0.257
Depressed (1–5)	1.6 (0.9)	1.8 (0.9)	0.029
C. Financial strain			
Out-of-pocket spending on delivery care	525 (1337)	560 (1108)	0.763
Borrowed money	155/1589 (10%)	14/106 (13%)	0.269
In debt at interview	31/1563 (2%)	6/102 (6%)	0.014

Notes: Data are from a household survey of women aged 15–49 years who gave birth in the previous two years, including those who had a stillbirth or whose child had died since childbirth. Values are n/N (%) for binary outcomes and mean (standard deviation) for continuous outcomes. The p values are from a chi-squared test (binary outcomes) or t -test (continuous outcomes), adjusted for clustering at the community (village) level.

Table 2
Descriptive statistics of characteristics by receipt of JSY cash.

Variable and category	Received JSY cash (n = 1589)	Did not receive JSY cash (n = 106)	p value
Birth location			
Same village	77/1589 (5%)	4/106 (4%)	0.941
Same block	1159/1589 (73%)	80/106 (75%)	
Same district	329/1589 (21%)	21/106 (20%)	
Same state	11/1589 (1%)	0/106 (0%)	
Different state	1/1589 (0%)	0/106 (0%)	
Don't know	12/1589 (1%)	1/106 (1%)	
Residence			
Urban	116/1589 (7%)	11/106 (10%)	0.212
Rural	1473/1589 (93%)	95/106 (90%)	
Caste			
Scheduled caste	529/1589 (33%)	36/106 (34%)	0.662
Scheduled tribe	50/1589 (3%)	1/106 (1%)	
Other backward caste	704/1589 (44%)	46/106 (43%)	
General caste	295/1589 (19%)	23/106 (22%)	
Religion			
Hindu	1424/1589 (90%)	95/106 (90%)	0.907
Muslim	157/1589 (10%)	11/106 (10%)	
Christian	1/1589 (0%)	0/106 (0%)	
Other	7/1589 (0%)	0/106 (0%)	
Health insurance			
Yes	159/1563 (10%)	9/105 (9%)	0.596
No	1404/1563 (90%)	96/105 (91%)	
Maternal education			
No education	393/1589 (25%)	34/106 (32%)	0.349
Some primary	235/1589 (15%)	15/106 (14%)	
Some secondary	654/1589 (41%)	36/106 (34%)	
Secondary or higher	307/1589 (19%)	21/106 (20%)	
Birth order			
First birth	451/1589 (28%)	32/106 (30%)	0.660
Second birth	470/1589 (30%)	27/106 (25%)	
Third birth	296/1589 (19%)	24/106 (23%)	
Fourth birth	173/1589 (11%)	13/106 (12%)	
Fifth birth or higher	199/1589 (13%)	10/106 (9%)	
Multiple birth			
Yes	12/1589 (1%)	0/106 (0%)	0.348
No	1577/1589 (99%)	106/106 (100%)	
Asset wealth			
Poorest	321/1589 (20%)	20/106 (19%)	0.360
Poorer	328/1589 (21%)	14/106 (13%)	
Middle	301/1589 (19%)	26/106 (25%)	
Richer	308/1589 (19%)	23/106 (22%)	
Richest	331/1589 (17%)	23/106 (22%)	
Months postpartum (months)	11.6 (6.5)	7.0 (6.4)	<0.001
Length of stay postpartum (hours)	28.5 (40.0)	28.0 (35.2)	0.892

Notes: Data are from a household survey of women aged 15–49 years who gave birth in the previous two years, including those who had a stillbirth or whose child had died since childbirth. Values are n/N (%) for binary variables and mean (standard deviation) for continuous variables. The p values are from a chi-squared test (binary variables) or t-test (continuous variables), adjusted for clustering at the community (village) level.

Table 3
Association between JSY and maternal depression.

Outcome	Unadjusted difference (95% CI)	Adjusted difference (95% CI)		
		Model 1	Model 2	Model 3
Continuous score				
Log of K10 depression scale	−0.08 (−0.15 to −0.009)	−0.08 (−0.15 to −0.010)	−0.09 (−0.16 to −0.018)	−0.09 (−0.16 to −0.019)
Binary indicator with threshold				
Severe depression (30–50)	0.49 (0.15–1.60)	0.50 (0.15–1.64)	0.41 (0.13–1.33)	0.37 (0.12–1.08)
Moderate depression (16–50)	0.68 (0.50–0.92)	0.68 (0.50–0.91)	0.66 (0.48–0.90)	0.64 (0.47–0.89)

Notes: Data are from a household survey of women aged 15–49 years who gave birth in the previous two years, including those who had a stillbirth or whose child had died since childbirth. Models for the continuous score outcome were estimated using ordinary least squares. Models for binary outcomes were estimated using a Poisson regression with the relative risk reported. Model 1 adjusted for birth location and urban residence. Model 2 controlled for the same variables as Model 1 as well as months postpartum and length of hospital stay. Model 3 controls for the same variables as Model 2 as well as characteristics of the woman including caste, religion, maternal education, birth parity, multiple births, health insurance, and wealth. We conducted these analyses using all available data. Standard errors are clustered at the community (village) level.

were 68% ($p = 0.008$) less likely to be in delivery care-related debt at the time of interview than those who did not receive the cash.

4.3. Sensitivity to correlations in unobservables

As with any observational study, our estimates could suffer from omitted variables bias such that there is no true effect of the JSY on

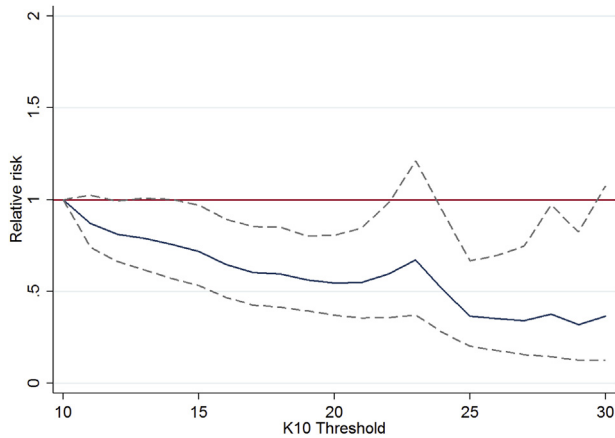


Fig. 2. Association between receipt of JSY cash and depression at various K10 thresholds.

Notes: Data are from a household survey of women aged 15–49 years who gave birth in the previous two years, including those who had a stillbirth or whose child had died since childbirth. The solid blue line shows adjusted relative risk estimates from Poisson regressions that include the full set of covariates (model 3). The point estimates are generated from separate regressions in which clinical maternal depression is defined using every threshold below a score of 30. The dotted lines indicate the 95% confidence intervals. Standard errors are clustered at the community (village) level.

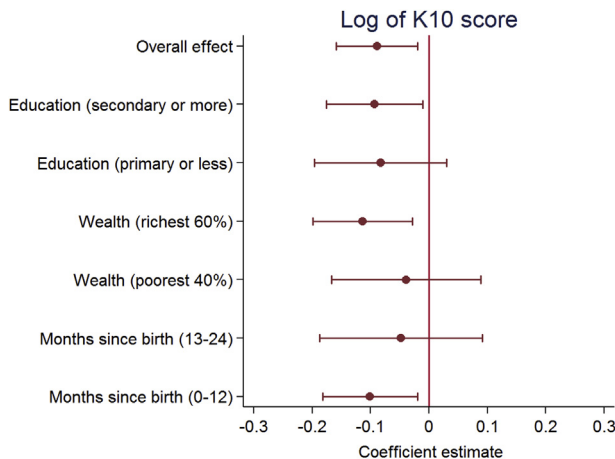


Fig. 3. Subgroup (fully adjusted) estimates of the association between the JSY and maternal depression.

Notes: Data are from a household survey of women aged 15–49 years who gave birth in the previous two years, including those who had a stillbirth or whose child had died since childbirth. The figure shows the point estimate and the 95% confidence intervals for each subgroup. Estimates are based on ordinary least squares regressions that include the full set of covariates (model 3). Standard errors are clustered at the community (village) level.

Table 4
Association between JSY and measures of emotional well-being.

Outcome	Unadjusted difference (95% CI)	Adjusted difference (95% CI)		
		Model 1	Model 2	Model 3
Happy (z-score)	0.11 (–0.097 to 0.32)	0.11 (–0.094 to 0.32)	0.13 (–0.084 to 0.35)	0.12 (–0.094 to 0.33)
Worried (z-score)	–0.12 (–0.32 to 0.086)	–0.12 (–0.32 to 0.084)	–0.13 to (–0.34 to 0.075)	–0.14 (–0.35 to 0.065)
Depressed (z-score)	–0.22 (–0.41 to –0.02)	–0.21 (–0.41 to –0.021)	–0.23 (–0.42 to –0.035)	–0.25 (–0.44 to –0.058)

Notes: Data are from a household survey of women aged 15–49 years who gave birth in the previous two years, including those who had a stillbirth or whose child had died since childbirth. Models were estimated using ordinary least squares. Model 1 adjusted for birth location and urban residence. Model 2 controlled for the same variables as Model 1 as well as months postpartum and length of hospital stay. Model 3 controls for the same variables as Model 2 as well as characteristics of the woman including caste, religion, maternal education, birth parity, multiple births, health insurance, and wealth. We conducted these analyses using all available data. Standard errors are clustered at the community (village) level.

maternal depression. Before examining the sensitivity of findings to correlations in unobservables, we note that the addition of controls in our regressions shift the point estimates away from zero. If unobserved determinants of receipt of the JSY cash and maternal depression explained our results, the influence of these factors would need to be in the opposite direction to the ones we observe. This we regard as unlikely.

We examined how large the correlation between the unobserved factors that determine receipt of the cash and maternal depression would have to be for various assumptions of the true effect of the JSY programme (Oster, 2013). Specifically, we present values of δ (the ratio of selection on unobservables to selection on observables) that correspond to different assumptions about the true effect of the programme on maternal depression. A value of over 1 for δ implies that selection on unobservables would need to be larger than selection on observables to explain away the result. To implement the test, we assume a maximum R-squared of 1. See the online supplementary material for more details.

A common problem with this type of sensitivity analysis is that it is hard to judge whether the degree of selection on unobservables required to explain the full effect of the JSY should be considered large. In our setting, however, we have estimates from a ‘naïve’ analysis in which the comparison group comprises women who were never offered the JSY cash (group 3). Our view is that use of this alternative control group is flawed and likely to generate results that are subject to considerable omitted variable bias even with the inclusion of a rich set of covariates. Women in group 3 self-selected out of the JSY (even though they were in principle eligible for the scheme) for reasons that we are unlikely to observe in the data.

The results of the sensitivity analysis for our primary outcome are shown in Table 6. To explain the estimated effect under the null of no “true” effect, δ would have to be –1.98 using our preferred study design and –0.84 using the ‘naïve’ comparison of women. In other words, the degree of selection on unobservables would have to be not only in the opposite direction to the selection on observables but also two times greater in our preferred approach than in the naïve approach. Neither possibility seems plausible. Of the three scenarios, a true effect of a 10 percent reduction in maternal depression seems the most plausible. The values of δ are consistent with our assertion that there is considerable selection on unobservables in the naïve comparison of groups ($\delta = 5.86$) but little in our preferred approach ($\delta = 0.06$).

5. Discussion

By exploiting administrative problems in the disbursement of cash in India’s JSY programme, this study examined the association between a one-off cash payment and maternal depression in Uttar Pradesh. Receipt of the JSY cash was associated with an 8.5% reduction in maternal depression as measured by the K10 score.

Table 5
Association between JSY and measures of financial strain.

Outcome	Unadjusted difference (95% CI)	Adjusted difference (95% CI)		
		Model 1	Model 2	Model 3
Delivery care expenditure (INR)	−34.4 (−259 to 190)	−44.2 (−269 to 180)	−23.2 (−269 to 222)	−12.1 (−262 to 237)
Borrowed	0.74 (0.43–1.25)	0.75 (0.44–1.27)	0.70 (0.41–1.19)	0.66 (0.40–1.09)
In debt at interview	0.34 (0.14–0.82)	0.34 (0.14–0.83)	0.32 (0.13–0.77)	0.32 (0.14–0.75)

Notes: Data are from a household survey of women aged 15–49 years who gave birth in the previous two years, including those who had a stillbirth or whose child had died since childbirth. Models for continuous outcomes were estimated using ordinary least squares. Models for binary outcomes were estimated using a Poisson regression with the relative risk reported. Model 1 adjusted for birth location and urban residence. Model 2 controlled for the same variables as Model 1 as well as months postpartum and length of hospital stay. Model 3 controls for the same variables as Model 2 as well as characteristics of the woman including caste, religion, maternal education, birth parity, multiple births, health insurance, and wealth. We conducted these analyses using all available data. Standard errors are clustered at the community (village) level.

With regards to the clinical significance of the association, the findings showed that the JSY was associated with a 36% reduction in moderate depression. Although the precise mechanisms are difficult to identify, we note that receipt of the JSY was associated with a lower risk of delivery care-related debt. This mechanism is consistent with the social causal hypothesis of mental illness and empirical evidence on poverty and mental health in low- and middle-income country settings. A systematic review identified financial stress as one of the factors associated with common mental disorders (Lund et al., 2010). There was no evidence of a relationship with two of the three measures of emotional well-being, namely happiness and worry.

Why do cash transfers affect mental health but not happiness? The first reason may lie in the fact that mental health and happiness, while closely related, are not one and the same. Mental ill health is one of biggest determinants of misery (Layard et al., 2013) and in our data the two measures are indeed highly correlated. However, the relationship is far from straight forward (Das et al., 2009) suggesting that it is not automatic cash transfers should influence happiness if they affect mental health. Second, the K10 has been validated by studies showing the tool to be strongly predictive of clinical diagnoses of depression and anxiety disorders. While there are reasons for caution in the use of tools to screen for common mental disorders (Kagee et al., 2013), no similar validation is available for subjective measures of well-being. These measures are known to be susceptible to adaptation (Clark et al., 2008) and context effects (Deaton and Stone, 2013). Third, there is evidence to suggest that happiness does not vary with income (Easterlin, 1995; Kahneman and Deaton, 2010).

Our study relates primarily to the literature on cash transfers and mental health. The closest antecedent to our paper by Ozer et al. (2009) finds participation in the Mexican CCT programme was associated with a 10% reduction in (the continuous score of) maternal depression. The effect size is very similar to ours despite important differences between the study populations and cash transfer programmes. Ozer et al. (2009) find that reductions in

perceived stress may have been the primary channel through which increases in income improved maternal mental health. Although we do not have the data to complement this finding, our result of a reduced risk of delivery care-related debt is consistent with such a channel. Given what is known about the relationship between debt and stress, it seems plausible that the JSY cash reduced financial-related stress thereby improving the mental health status of mothers.

While research on other cash transfer programmes has found no evidence of a link with maternal depression (Macours et al., 2012; Paxson and Schady, 2010), the broader literature on sudden changes to income and mental health is more encouraging (Baird et al., 2013; Banerjee et al., 2015; Costello et al., 2003; Fenske et al., 2014; Fernald et al., 2008, 2009; Fernald and Gunnar, 2009; Haushofer and Shapiro, 2013; Ssewamala et al., 2009). The findings of a systematic literature review that “the mental health effect of poverty alleviation interventions was inconclusive” may require reassessment in the light of the emerging evidence (Lund et al., 2011).

We also connect to a second literature on the relationship between income and measures of subjective well-being. The most relevant of these was a randomised trial in Kenya that found large cash transfers substantially increased happiness and life satisfaction (Haushofer and Shapiro, 2013). Evidence from other types of income shocks is mixed. Positive results have been found in the context of a natural experiment in Botswana that exploited a sudden and unanticipated currency devaluation (Hariri et al., 2015). Similarly, a randomised evaluation of micro-credit in Mexico found a small increase in happiness (Angelucci et al., 2015).

Our study relates to a third literature on the JSY programme by providing evidence on an important yet unintended benefit of the programme (Hunter et al., 2014). Previous research on the early impacts of the JSY has shown that the programme was associated with an increase in facility births but no statistically significant reduction in neonatal mortality (Powell-Jackson et al., 2015). The same study also found that the JSY was associated with crowding

Table 6
Ratio of selection on unobservables to selection on observables to generate assumed estimates of JSY effect on maternal depression.

Outcome	Adjusted marginal effect (95% CI)	Ratio of selection on unobservables to selection on observables (δ) to generate specified effect estimate (α)		
		$\alpha = 0$	$\alpha = -0.05$	$\alpha = -0.1$
Dependent variable is log of K10 score				
Group 1 versus Group 2 women (preferred)	−0.097 (−0.16 to −0.04)	−1.98	−1.09	0.06
Group 1 versus Group 3 women (naïve)	−0.012 (−0.06 to 0.03)	−0.84	2.74	5.86
Implied ratio		2.3	−0.4	0.01

Notes: Data are from a household survey of women aged 15–49 years who gave birth in the previous two years, including those who had a stillbirth or whose child had died since childbirth. The table reports estimates of δ (the ratio of selection on unobservables to selection on observables) for various assumptions of the true effect estimate. The model includes controls for birth location, urban residence, months postpartum, length of hospital stay, caste, religion, maternal education, birth parity, multiple births, health insurance, wealth, type of facility attended, neonatal death, caesarean section, whether during delivery the woman was shouted at, slapped, refused care for inability to pay, held in the facility for inability to pay, or “felt disrespected,” an index of physical health, and village fixed effects.

out of the private sector, better breastfeeding practices and an increase in pregnancies. It thus seems that the JSY financial incentives are an imprecise tool in the sense that they impact on a broad range of outcomes, including the mental health of the recipient.

Several limitations of the study should be acknowledged. First, there is a possibility that our main result was driven by the “disappointment” of women in the control group not getting the JSY cash. Although we are unable to completely rule out such an interpretation, it would be incompatible with the evidence we provided on delivery care-related debt as the mechanism through which the JSY reduced maternal depression. We also note that the K10 score falls over the post-partum period for women who gave birth in a private facility without exposure to the JSY, suggesting there is a natural tendency for depression to decrease over the post-partum period. While a very similar negative trend is observed for women in the control group, the trend is constant over time in the treatment group. This pattern in the data does not fit well with an interpretation based on women being disappointed since it is the treatment group, not the control group, that defies the secular trend in the K10 score.

Second, caution is required when making causal interpretations based on observational studies. Two sources of potential confounding are of concern: 1) discrimination by health workers in the disbursement of cash; and 2) persistent families making repeated attempts to get the cash. While both types of behaviour were unobserved in the data, we found convincing evidence that women in the two groups were similar in their observed characteristics and estimates were generally stable across a wide range of specifications. Moreover, while evidence from a randomised controlled trial would have more internal validity, implementation of such a design would be enormously challenging in the context of a national government programme like the JSY.

Third, the findings were based on data collected in Uttar Pradesh, and caution should be exercised when generalising to other states and types of cash transfer programmes. Uttar Pradesh has one of the poorest populations in India and in better-off states, where the amount of cash in the JSY is smaller relative to household income, the association with mental health may be weaker. The lack of power to detect differences in the sub-group analyses limits our ability to make judgements about the relationship in different population groups. Such results could have been predictive of whether the JSY cash improves mental health in other states of India.

The JSY has a high profile not only in India, but it has also attracted immense international interest. Our findings give policymakers additional information to consider the value of the JSY beyond its narrow remit of increasing facility births and reducing maternal mortality. We show that receiving JSY cash reduced moderate levels of maternal depression. These results are important because of the high prevalence of maternal depression and the potential impact on the well-being of mothers and children. However, the duration of the effect of the JSY on mental health is unclear. The JSY is a one-time transfer made at the time of delivery, so it is questionable whether the reductions in depression were sustained. Although we have some evidence that the association between receipt of the JSY and depression was stronger for women who gave birth in the past year than for those who gave birth two years ago, the sub-group analysis lacked the power to shed light on this question.

It is difficult to attach a value to the mental health effect of the JSY. Psychosocial interventions involving non-specialist primary healthcare workers are recommended to address maternal depression in low- and middle-income country settings. The positive mental health effect of the JSY was within the range of the effects reported in a systematic review of such psychosocial

interventions (Rahman et al., 2013) and especially similar to the effect size of women’s groups in Jharkhand and Orissa (Tripathy et al., 2010). This suggests that cash transfers could complement recommended prevention and treatment interventions for maternal depression.

Our results provide evidence from one setting that demand-side financial incentives can have public health benefits in addition to improving the uptake of targeted health services. Conclusions as to the role of cash transfers in improving mental health in low- and middle-income countries should draw on a critical assessment of the cumulative evidence across a range of contexts and programmes.

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Appendix A. Supplementary data

Supplementary data related to this article can be found at <http://dx.doi.org/10.1016/j.socscimed.2016.06.034>.

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