

# The Effect of a Workfare Program on Psychological Well-being in India

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## *Abstract*

Poor mental health has been shown to be associated with worse socio-economic outcomes and is of increasing concern in developing countries. Yet, little is known about the effect of poverty alleviation programs on mental health. This paper studies the short-run effect of a workfare program in India, the National Rural Employment Guarantee Scheme, on psychological well-being. Our preferred approach uses a difference-in-difference analysis with variation in district implementation dates and location of residence. We show that in the first year of the program, women in recipient districts were less likely to feel suicidal. We examine heterogeneity by treatment intensity and find that women in high-intensity program districts were also less likely to report low self-esteem. Men, on the other hand, did not experience significant changes in their mental health. We find that the program increased consumption in households of both female and male respondents but only women were significantly more likely to work and also work longer hours and more days per week. This suggests that the main mechanism, at least in the short-run, was likely not reducing poverty and increasing consumption but rather providing women with greater economic security and independence.

## **1. Introduction**

The relationship between poverty and health has been studied extensively over the years. Most of the research, however, has focused on physical health and only recently has attention been paid to the burden of poverty on mental health. The existing evidence on the link between poverty and psychological well-being is mixed. While there is generally a strong negative relationship between food insecurity or financial stress and mental health, the association is less robust with respect to income or consumption (Lund et al. 2010; Das et al. 2009). Yet, mental health is likely both a cause and consequence of poverty, which makes it challenging to identify the causal impact of poverty on psychological well-being. While poverty may increase financial stress and worsen physical health thus affecting psychological well-being, poor mental health may also increase poverty by decreasing labor supply and productivity and worsening physical health because of unhealthy or risky behaviors (Schilbach, Schofield, and Mullainathan 2016; Haushofer and Fehr 2014).

This paper studies the short-run effects of a poverty alleviation program in India, the National Rural Employment Guarantee Scheme (NREGS), on mental health. Our preferred model uses a difference-in-difference identification strategy where the two sources of variation in program influence are the district implementation date and the household location of residence. The phased-in implementation of this public works program allows comparison of households in early districts vs late districts, while variation in location of residence allows for urban households, not eligible to participate in NREGS, to serve as a quasi-control group for the affected rural households. We examine self-reported depressive symptoms as an indicator of mental health as well as other measures of psychological well-being, including having goals for the future, perceived agency, and stress.

Most of the rigorous empirical evidence on the causal linkages between poverty and psychological well-being in developing countries comes from studies of poverty alleviation programs and the results have been mixed. Ozer et al (2011) study the impact of Oportunidades, a conditional cash transfer program in Mexico, on mothers' depressive symptoms and find that participation in the program reduced economic stress and was associated with a significant decrease in depression symptoms. On the other hand, two studies in Nicaragua and Ecuador found no effect of CCTs on maternal depression (Macours, Schady, and Vakis 2012; Paxson and Schady 2010). The difference in findings could potentially be explained by the length of the program as women were enrolled in the Mexican program between 3 and 5 years, while the other two programs only lasted 9 and 17 months respectively. Alternatively, it could be due to the size of the transfers as Oportunidades accounted for a larger proportion of household income (25% vs 10-15% for the other two programs). Another large cash transfer program in Kenya was associated with improvements in recipients' psychological well-being even after only 9 months of program receipt. Haushofer and Shapiro (2014) find that unconditional cash transfers in Kenya that were two to six times the monthly household consumption increased life satisfaction, reduced depression and reduced stress. Similarly, Baird, Hoop, and Ozler (2013) find that adolescent girls in Malawi have better mental health outcomes one year after the implementation of an unconditional cash transfer program although the positive effects seem to dissipate in the long run.

Yet, other research has failed to find conclusive evidence that poverty alleviation reduces mental health burden. Green et al (2016) study the effects of microenterprise assistance (including training and start-up capital) on income and mental health of young men in Uganda. While they find significant increases in income resulting from new business activities 16 months

after the start of the program, the increase in income does not translate to lower incidence of depression symptoms. This finding could potentially be explained by the context in which the study took place – war-ravaged Northern Uganda – or it may be due to the increased stress associated with opening up a business. When individuals in South Africa were randomly given access to credit, those who received a loan reported higher stress levels and there was no effect on depression for women (Fernald et al 2008). Yet, despite the higher stress, men did show a reduction in depressive symptoms within six to twelve months of loan receipt. This finding suggests that the effect of changes in income on mental health may depend not only on the length and size of treatment but also on the levels of stress associated with the program and the effects may differ between men and women.

We provide further evidence on the short-run effects of poverty alleviation programs on mental health in the Indian context. Poor mental health is an especially serious concern in India. One study found that lifetime prevalence of common mental disorders in the state of Goa was 46% (Patel et al 1999). Another study of ultra-poor households in Andhra Pradesh found that 35% of households felt anxious or depressed in the previous year (Ravi and Engler 2015). In addition, the average suicide rate in 2005 was about 18.4 for every one hundred thousand people, making India the twenty-sixth highest-ranked country in the world in terms of suicide rates.<sup>1</sup>

Overall, we find significant positive effects of the public works program on the mental health of women, robust to various specifications, but little effect on men. On average, access to the program decreases women's suicidal tendencies by 8.9 percentage points. Poorer women, who are more likely to take advantage of the program, and women in districts with high program

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<sup>1</sup> [http://www.who.int/gho/mental\\_health/suicide\\_rates/en/](http://www.who.int/gho/mental_health/suicide_rates/en/)

intensity are also less likely to report other symptoms of poor mental health. We examine various mechanisms that may explain the relationship between the program and women's psychological well-being, including consumption, physical health and social interactions. We find that in high intensity districts, the program had strong positive effects on food consumption but no effect on female probability of being underweight and an increase in female physical disability. We also find a marginally significant positive effect on social interactions. Overall, given positive changes in female employment (and no significant changes in male employment), we attribute the effect of the program to greater economic security for women and higher expectations for the future.

The paper is organized as follows. Next, we provide more background on the program. In section 3, we present a conceptual framework that discusses the pathways through which NREGS could affect mental health. Then, we describe the data used for analysis and the identification strategy. Section 6 presents the results of the main analysis and discusses potential mechanisms. Section 7 concludes.

## **2. Background on the National Rural Employment Guarantee Scheme**

The National Rural Employment Guarantee Scheme (NREGS) was first introduced in February 2006 to 200 of the poorest rural districts in India. The second phase of the program expanded access to 130 additional districts in April 2007. A year later, in April 2008, the program was made available to all remaining districts. It is now the largest public works program in the world, accounting for 1% of India's GDP (Subbarao et al 2012). Given the susceptibility of rural households in India to periodic weather shocks and seasonal variations, NREGS has been tailored to meet the objective of livelihood security by reducing the dependence on agricultural wages (Subbarao et al 2012). The program provides households living in rural areas

with 100 days of paid low-skilled work a year in projects including construction of roads and improving irrigation and sanitation at the statutory minimum wage of about Rs. 120 (2 USD) per day. It differs from previous schemes in that it promises employment as an entitlement and there are no eligibility requirements. The act also stipulates that one-third of all beneficiaries should be women. While there has been criticism of the program for its poor implementation, demand rationing, and delayed wage payments (Murgai, Ravallion, and van de Walle 2016; Narayanan et al 2016), it served 21 million households within the first year and 33 million households in its second year of operation.<sup>2</sup> Reddy, Reddy, and Bantilan (2014) estimate that earnings from the program in 2009-2010 accounted for about 12% of the poverty threshold income, suggesting substantial impact on poverty.<sup>3</sup>

Various studies have documented the short-run benefits of NREGS. Imbert and Papp (2015) show that employment and wages in the private sector increased after the program was introduced, especially during the agricultural off-season, although Zimmermann (2014) finds that private sector wages increased only for women and the effects for women were concentrated in the agricultural season. Deininger, Nagarajan, and Singh (2016) further show that the program had a positive impact on agricultural wages, non-farm employment and on-farm self-employment. Again, the wage and employment effects were larger for women (Azam 2012).

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<sup>2</sup> Ministry of Rural Development, Mahatma Gandhi National Rural Employment Guarantee Act 2005 Report to the People 2nd Feb. 2006 - 2nd Feb 2010.

<sup>3</sup> Although other studies have argued the impact of the program on poverty is small and the program is not as cost effective once foregone earnings are considered (Murgai et al 2016; Alik-Lagrange and Ravallion 2015).

Bose (2017) finds that within a year of the program implementation household per capita consumption increased between 6.5% and 10% and even more so for disadvantaged groups. NREGS also led to a more intensive use of irrigation and to planting of more risky crops (Deininger et al 2016) and a switch away from labor-intensive agriculture technologies and toward more labor-saving technologies (Bhargava 2014), suggesting potentially even larger long-run benefits.

Better employment opportunities and higher wages are likely to improve health of rural households through better nutrition and healthcare and more income security. For example, Bose (2017) shows that consumption of child goods increased in households with children and Thomas (2015) finds increased investment in infant health and reduced child and maternal mortality. Dasgupta (2017) studies the effect of the program on mitigating negative shocks in childhood and finds that access to the program reduces the negative impact of drought on height for age z-scores. Similarly, Balakrishnan (2014) shows that the program served as a buffer against income shocks more broadly, particularly for boys, significantly improving their height for age z-scores. She finds that children in households with small landholdings tend to have better outcomes, further showing that the program is effective in targeting the poor.

Yet, little is known about the effects of the program on adult physical or mental health. One study which uses only one district in the state of Andhra Pradesh examines the health effects of the program and finds that NREGS was associated with a significant decline in the index of mental health problems and anxiety over two years (Ravi and Engler 2015). Ravi and Engler (2015) also find an improvement in physical health although the results on physical health were not statistically significantly different between beneficiary and non-beneficiary households.

Our study complements and extends this previous work using nationally representative data from six states and 111 districts to test the impact of the program on several different measures of psychological well-being. In the next section, we discuss a conceptual framework for some of the pathways through which NREGS could affect adult mental health.

### 3. Conceptual Framework

The effect of NREGS on adult mental health could be captured using a simple production function for mental health. Mental health has been shown to be affected by physical health. For example, a longitudinal study of Indian women shows that women with chronic physical health conditions or gynecological problems are more likely to develop mental health problems (Patel et al 2006). Social capital is also well known to affect psychological well-being (Kawachi and Berkman 2001). In addition, economic insecurity may increase the risk of psychological disorders, lower self-esteem and decrease subjective well-being (Catalano 1991; World Bank 2013). Thus, we present mental health as a function of physical health,  $H$ , social interactions,  $S$ , and economic stress,  $R$ :  $M = f(H, S, R)$ .

The physical health production function is determined by health endowments, as well as investments in curative and preventive health,  $I$ , and nutrition,  $C$ , subject to a budget constraint:  $C + I \leq Y$ . Social interactions are determined by social norms and environmental factors as well as individual time spent socializing,  $leisure$ , subject to a time constraint:  $e + hrs + leisure = T$ , where  $e$  is hours spent working on own farm and  $hrs$  is hours spent working in casual labor. Finally, stress is a function of the individual perceived risk vulnerability, determined by the level of income,  $Y$ , and the expected size of the agricultural shocks,  $\epsilon$ .

Before NREGS was introduced, rural households had two main sources of income. They could earn income from agricultural production,  $g$ , determined by hours worked, land

productivity,  $A$ , and weather shocks. They could also work as casual laborers for wage  $w$ . With the introduction of NREGS, rural households had another income source and an income generating equation as follows:  $= g(A, e, \epsilon) + w * hrs + w_{nregs} * hrs_{nregs}$ .

As previously discussed, the availability of the NREGS program is likely to increase total household income in the short-run for two main reasons. First, it provides additional source of employment, especially for women and disadvantaged castes who may not have had full access to other employment previously. Second, wages under the NREGS program were generally higher than wages in similar casual employment, especially for women, and thus people could earn higher income even if they worked the same number of hours. Further, the competition from NREGS increased private wages as well.

This simple framework shows that availability of NREGS could affect mental health in at least three important ways. First, by increasing disposable income, NREGS could lead to higher investment in health and nutrition and thus improve physical health. On the other hand, work under NREGS could serve as a negative physical health shock, thus leading to deterioration in health.<sup>4</sup> Another possible channel of influence is through social interactions. Social connectedness could improve as a result of NREGS if people spend more time outside of the house and become more engaged in their communities. This could be particularly true for

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<sup>4</sup> While work under NREGS is generally considered to be similar to other types of casual employment available in rural areas, the work is low-skilled and hard. Reddy, Reddy, and Bantilan (2014) report that workers find the work to be “very difficult” or “moderately difficult”.

women who may not have had as many opportunities to interact with others before.<sup>5</sup> On the other hand, given the time constraint, if people have less leisure, then NREGS may have a negative effect on social capital. Finally, NREGS provides insurance against agricultural shocks as people know they have the right to 100 days of paid work every year, which provides them more security than uncertain casual work in the private sector even if demand is rationed.<sup>6</sup> This insurance mechanism is likely to reduce perceived risk and economic stress and thus improve individuals' mental health whether they participate in the program or not.

Overall, while there is reason to believe that NREGS may have a positive effect on mental health, the sign of the effect is theoretically ambiguous and the question needs to be answered empirically. Next, we describe the data used in the empirical analysis.

#### **4. Data**

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<sup>5</sup> There is little evidence on changes in female social capital, associated with NREGS. Some exceptions are studies based on qualitative surveys that find that in some areas women are more likely to attend a village (gram sabha) meeting and to speak at one (Pankaj and Tankha 2010), as well as to participate in vigilante committees (Khera and Nayak 2009).

<sup>6</sup> Appendix Table 1 shows NREGS demand and use in the first two years of the program for the six states in our sample. In both years, more than 95% of households who demanded work received it, although the average number of work days per household ranged between 85 and 14 in the first year and between 77 and 23 in the second year with Rajasthan having the lowest and West Bengal having the highest rationing rate in both years. It is also Rajasthan that has the highest proportion of work days by women (67% and 69% in 2006-2007 and 2007-2008, respectively).

This paper uses data from the WHO’s Study on global AGEing and adult health (SAGE), administered in 136 districts across six states (Assam, Karnataka, Maharashtra, Rajasthan, Uttar Pradesh and West Bengal) selected to be nationally representative (Arokiasamy et al. 2013). The survey took place between February and August of 2007 – after NREGS was rolled out to the first two sets of districts but before the third phase of implementation – and is thus well positioned to allow us to compare the effects of the program in early vs late districts. About 91% of the survey participants were interviewed before July and following previous research studying the effects of NREGS during the agricultural season and off-season separately, we restrict the sample to individuals who were interviewed between February and June of 2007 – the agricultural off-season.<sup>7</sup> We also include only districts that were targeted for treatment and have rural populations. The final sample includes households from 111 districts.

The survey contains information on various individual and household characteristics for select individuals older than 18, including age, caste, religion, marital status, individual employment status and household consumption. In addition, the survey includes detailed questionnaires on various health outcomes, including both physical and mental health. Mental health is evaluated using self-reported symptoms. The survey questionnaire allows diagnosing depression according to the ICD-10 diagnostic criteria for depression. Respondents are first asked if they have felt sad, lost interest or lacked energy for more than two weeks in the last twelve months. If they answered “Yes” to either one of the three key symptoms, they were asked follow-up questions on associated symptoms of disturbed sleep, poor concentration, low self-confidence, poor appetite, suicidal thoughts or acts, agitation or slowing of movements, and

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<sup>7</sup> Results are robust to including all interview months.

hopelessness. If a person meets at least four of the symptoms, then he is considered to have depression. In our analysis, we consider the ICD-10 depression diagnosis as well as a simple binary indicator for having depression symptoms if respondents reported all of the key depression symptoms (feeling sad, losing interest or lacking energy).

We also examine three additional measures of psychological well-being – having goals for the future, having agency, and experiencing stress.<sup>8</sup> These measures are channels through which life experiences may affect the likelihood of depression. However, they are also of interest in themselves as they can directly affect socioeconomic outcomes. For example, interventions targeting aspirations and goal setting have been successful in improving socio-economic outcomes (Lybbert and Wydick 2015; Dalton, Ghosal, and Mani 2015). Agency, or self-efficacy, has been shown to affect individual education and labor market outcomes (Almlund et al 2011; Krishnan 2012), while stress affects both cognitive capacity and executive control, hindering people’s ability to make optimal economic decisions for their long-run well-being (Haushofer and Fehr 2014; Schilbach et al 2016).

The survey does not directly ask respondents about expectations or future goals but it does ask people who report at least one of the three key depressive symptoms listed above whether they were suicidal or hopeless and we use those symptoms as indicators of future

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<sup>8</sup> Psychologists define “hope” as a way of thinking. The concept of “hope” contains three core components – goals, agency, and pathways thinking (Snyder 2002). Lybbert and Wydick (2015) review the economic literature linking “hope” and economic outcomes.

thinking.<sup>9</sup> Next, we measure agency by examining whether individuals have low self-esteem and whether they report not being able to control the important things in their lives.<sup>10</sup> The question on self-esteem is again a depression symptom asked about only after an individual reported feeling sad, losing interest or lacking energy (again, we assign a value of zero for people who were not asked this question). The question on control is asked of everyone, irrespective of their depression symptoms. Finally, we study whether an individual reports being anxious or not being able to cope with all the things they had to do.<sup>11</sup> These variables serve as proxies for stress and again, anxiety is one of the depression symptoms asked about of people with key depressive symptoms, while the question on ability to cope is asked of everyone.

In addition to psychological health, we also examine physical health outcomes as one of the mechanisms through which the program may affect mental health. We use anthropometric information collected in the survey to calculate individual BMI and define an indicator for being underweight (BMI lower than 18.5). We also include a measure of overall functioning based on the 12-item WHO Disability assessment schedule (WHODAS), which asks respondents to rate

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<sup>9</sup> We assign a value of zero to these binary indicators for people who were not asked these questions because they did not report having any of the key depressive symptoms.

<sup>10</sup> Participants are asked how often they have felt like they were unable to control the important things in their lives. We create an indicator for “cannot control” if they answered “Fairly often” or “Very often”.

<sup>11</sup> Participants are asked how often they have felt like they were unable to cope with all the things in their lives. We create an indicator for “cannot cope” if they answered “Fairly often” or “Very often”.

the extent of difficulty experienced in six different domains – cognition, mobility, self-care, getting along with others, life activities, and social participation. The score is normalized so that the lowest score of zero shows no disability and the highest score of 100 shows the highest level of disability.

Finally, we also examine the effect of NREGS on social capital. We define social capital as an index, indicating number of social activities (out of 9) that an individual has participated in during the last 12 months.<sup>12</sup>

## **5. Methodology**

### **5.1 Intent-to-treat framework**

Previous work has used several different approaches to identify treatment effects. For example, Ravi and Engler (2015) compare the outcomes of people who applied for the program and received it to those of people who applied but did not receive it. They also use propensity score matching in a triple-difference approach to account for changes in outcomes not caused by the program and for the fact that people self-select into the program. Khanna and Zimmermann (2017), Zimmermann (2014), and Bhargava (2014) use the phased-in implementation of the program in a regression-discontinuity framework proposing an algorithm for program district

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<sup>12</sup> These include: attending public meetings in which there was a discussion of local or school affairs; meeting with a community leader; attending any group or organizational meeting; working with other people in the neighborhood to fix or improve something; having friends over; going to the home of someone who lives in a different neighborhood; socializing with coworkers outside of work; attending religious services (not including weddings and funerals); getting out of the house/your dwelling to attend social meetings or visit friends or relatives.

allocation based on a development ranking by the Indian Planning Commission that had been used for allocation of previous employment programs. Other studies use data before and after the program implementation and estimate difference-in-difference (DiD) models comparing outcomes in treated and non-treated districts before and after program implementation (Imbert and Papp 2015; Azam 2012; Bose 2017).

In this study, we consider districts in Phase 1 (received program starting February 2006) and districts in Phase 2 (received program starting in April 2007) as the early, “treated”, districts, while districts in Phase 3 (received program in April 2008) are the late, “non-treated”, districts. We restrict the sample to districts that received the program in Phase 1, Phase 2 or Phase 3. Since all of the districts in the sample are districts that were targeted for treatment, this reduces the program placement bias. However, the timing of the program across districts was not random as it was targeted to the poorest districts first. Indeed, Table 1 shows that districts in Phase 1 and 2 had significantly higher proportion of scheduled castes (SC) and scheduled tribes (ST), higher illiteracy rates, and higher levels of poverty compared to Phase 3 districts, although labor force participation rates both for males and females were similar across treatment.

[TABLE 1 HERE]

While the exact algorithm for district allocation is not publicly available, previous studies, as mentioned before, have suggested using the development ranking by the Indian Planning Commission (Khanna and Zimmermann 2017; Bose 2017).<sup>13</sup> The rank was based on three indices – proportion of SC and ST population as of the 1991 census, agricultural wages

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<sup>13</sup> Planning Commission, “Report of the Task Force, Identification of Districts for Wage & Self-Employment Programmes”, May 2003.

(1996-1997), and output per agricultural worker (1990-1993). The algorithm works relatively well, although there is some non-compliance. For the six states of the SAGE sample, out of the 81 districts that have a rank below 330 and should have received the program in Phase 1 or 2, 60 were assigned to the program in those first two stages (74%). Seven of the 30 districts that should have received the program in Phase 3 were assigned to receive it earlier. To account for possible endogenous non-compliance, we use the district allocation according to the rank, rather than actual district treatment, to define early and late districts. Then, controlling for the district rank and the three indices in our regression models would reduce bias related to program timing.<sup>14</sup>

We estimate the following OLS regression model for rural individual  $i$  living in district  $j$  in state  $k$ , applying an intent-to-treat framework where all rural households in early districts are considered treated:

$$M_{ijk} = \beta_0 + \beta_1 \text{Early Treatment}_{jk} + X_{ijk}\gamma + Z_{jk}\delta + \eta_k + \epsilon_{ijk}, \quad (1)$$

where  $M$  is the outcome of interest and  $\beta_1$  is the intent-to-treat treatment effect. Given the large inequalities between men and women in India and the fact that NREGS reserved one-third of

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<sup>14</sup> In Appendix Table 2, we provide descriptive statistics for the rural sample and show that rural households in early and late districts, as defined by their rank, are generally similar in terms of age, education, marital status, household size, and land ownership but there is a significantly higher fraction of SC and ST households and lower asset ownership (permanent income) in early than in late districts, reflecting targeted program placement. We control for all of these demographic characteristics in the regression model as well as for district characteristics, as explained below.

jobs for women, we study men and women separately. This is also the approach used in papers by Imbert and Papp (2015) and Zimmermann (2014). In addition, previous work on the effect of access to credit on mental health showed differential (and in fact, opposite) effects for men and women (Fernald et al 2008).

The model controls for individual characteristics,  $X$ , including dummy variables for age categories 30 to 40, 40 to 50 and older than 50 (omitted category is 18 to 30), dummy variables for years of education less or equal to 4, between 5 and 8, between 8 and 12, and equal to 12 (omitted category is “no education”)<sup>15</sup>, dummies for scheduled caste and scheduled tribe (omitted category “other”), dummies for Muslim religion or other religion (omitted category is Hindu religion), dummies for single and widowed marital status (omitted category “married”), household size, household ownership of land, an asset index of permanent income<sup>16</sup>, and month of interview fixed effects. We also control for district-level characteristics,  $Z$ , including the district rank, the three indices used in calculation of the rank, as well as more recent district characteristics from India’s 2004 National Sample Survey (NSS) - fraction of scheduled castes and scheduled tribes, total literacy rate, male and female labor force participation, fraction living under the poverty line. Following Narayanan et al. (2016), we also control for a measure of

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<sup>15</sup> We drop observations with more than 12 years of education since they are less likely to have taken advantage of the low-skilled labor opportunities provided by NREGS and we only keep observations of working-age adults (60 years old or younger) following Zimmermann (2014) and Imbert and Papp (2015).

<sup>16</sup> The permanent income measure, provided in the survey, is a latent income index based on ownership of 21 assets (for more details, see Appendix 4 in Arokiasamy et al., 2013).

bureaucratic efficiency in the district, based on the degree of success of a sanitation campaign launched in 1999.<sup>17</sup> Finally, we include state fixed effects,  $\eta$ , to absorb any regional variation in program implementation and mental health. Standard errors are clustered at the district level to account for the group treatment.

## 5.2 Difference-in-difference specification

Despite the extensive list of district controls, there is still a possibility of bias arising from district-specific time trends that may be correlated with treatment and not explained by the available district controls. Therefore, we estimate a difference-in-difference model that uses urban households as a comparison group of non-beneficiary households and is more robust to selection bias. Thus, our preferred empirical specification is:

$$M_{ijk} = \beta_0 + \beta_1 \text{Early Treatment}_{jk} + \beta_2 \text{Rural}_{ijk} + \beta_3 \text{Early Treatment}_{jk} * \text{Rural}_{ijk} + X_{ijk}\gamma + Z_{jk}\delta + \eta_k + \epsilon_{ijk}, \quad (2)$$

where  $\beta_3$  is the intent-to-treat treatment effect.

The main identification assumption of this model is that differences between urban households in early vs. late districts can be used to proxy for differences between rural households in early vs. late districts that are not due to the program. Any remaining differences for rural households in early vs. late districts is then attributed to the program. To test this assumption, we use data from the World Health Survey (WHS), which took place in 2003, prior

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<sup>17</sup> The sanitation campaign is known as Nirmal Bharat Abhiyan (NBA). We use data on the percentage of targeted facilities announced in 1999 that were completed by FY 2005-2006. Data is available at: <https://data.gov.in/catalog/nirmal-bharat-abhiyan-year-wise-district-level-achievements> and [tsc.gov.in/tsc/NDSAP/StatewiseDistrictwisePhysicalProgress.xml](https://tsc.gov.in/tsc/NDSAP/StatewiseDistrictwisePhysicalProgress.xml).

to NREGS, in the same enumeration areas as the SAGE survey.<sup>18</sup> The WHS survey does not contain all of the mental health measures from the SAGE survey but we can test the identification assumption for the measure of depression symptoms and the indicators for inability to cope and control. We also examine working status, household expenditures and probability of being underweight. In the absence of the program, there should be no significant differences between urban and rural households by future district treatment status. The results, presented in Table 2, show no significant differences between urban and rural households by treatment, providing support for using urban households as a comparison group.

[TABLE 2 HERE]

Another assumption of this identification strategy is that urban households are not affected by the program. While the program is not available to urban households, changes in rural-to-urban migration due to the program may affect urban livelihoods as well. Das (2015) studies one district in West Bengal and finds that, on average, household participation in the program does not affect migration decisions, although the intensity of program use reduces short-term migration. Other studies have also shown that the program reduces rural out migration,

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<sup>18</sup> The SAGE survey was designed to follow a cohort of respondents over 50 years of age from the 2003 World Health Survey. While the WHS interviewed one person over 18 from each household, the SAGE survey included additional older respondents from the same households. In addition, a sample of 4,600 younger adults (18 to 49) from these households was also included with a higher proportion of women in the younger sample because of a nested study which aimed to examine the reproductive health of women. In few cases, some non-WHS households were included in the SAGE sample as well.

especially in high-intensity districts (Imbert and Papp 2016; Ravi, Kapoor, and Ahluwalia 2013). Ravi et al (2013) find that this reduces urban unemployment and underemployment but find no significant effect on urban wages, while Imbert and Papp (2016) show an increase in urban wages for manual labor. Overall, it seems that even if the program affected urban households indirectly, this is likely to bias our estimates downward, as it improved economic conditions for urban households, potentially reducing their psychological distress.

### 5.3 Extensions

We provide two extensions of the basic model, exploring the heterogeneity in the treatment effect considering that in the intent-to-treat framework, the measured program effects should increase with the fraction of households receiving the program. First, we test if poorer households (that are more likely to use the program) experience larger changes in mental health outcomes. Thus, we add the following interaction terms to model 2 above:

*Permanent Income \* Early Treatment*, *Permanent Income \* Rural*, and *Permanent Income \* Rural \* Early Treatment*. Given the asset-based nature of this poverty measure, we do not expect permanent income to have been affected by the program directly in the short-run. Nevertheless, this analysis should be interpreted with caution as it may not be causal and should only serve as supportive evidence for the main empirical strategy.

Finally, we examine if households living in districts with high intensity of treatment have larger treatment effects. Appendix Table 3 shows that out of the 81 districts that should have been treated in Phase 1 and Phase 2 according to their district rank, 59 provided NREGS to households by the end of the 2007-2008 fiscal year, but only 41 provided NREGS by June 2007 (the study period) and there was significant variation in the intensity of treatment. We create an indicator for high intensity districts, measuring districts in the top 25<sup>th</sup> percentile of total work

days (reflecting both number of households receiving the program and average number of work days per household) between February 2006 and June 2007 and we estimate the following regression model:

$$M_{ijk} = \beta_0 + \beta_1 High\ Intensity\ Treatment_{jk} + \beta_2 Rural_{ijk} + \beta_3 High\ Intensity\ Treatment_{jk} * Rural_{ijk} + X_{ijk}\gamma + Z_{jk}\delta + \eta_k + \epsilon_{ijk}, \quad (3)$$

where  $\beta_3$  is the intent-to-treat treatment effect. Sixteen out of the 81 districts that should have received treatment in Phase 1 and Phase 2 are defined as high intensity districts and they are all districts that received the program in Phase 1.<sup>19</sup>

It is important to note that the degree of program intensity is likely not exogenous and may be correlated with other district characteristics that could affect mental health and that we are not already controlling for. Yet, the use of the DiD framework should account for that if intensity is determined by district-level characteristics that are shared by urban and rural households. In any case, this analysis serves to provide support for the main identification strategy of section 5.2.

## 6. Results

### 6.1 Effect of NREGS on employment

The conceptual model presented in section 3 shows that NREGS could affect mental health in two main ways – through increasing employment and through providing insurance against income shocks. While we cannot test people’s perceptions of their risk vulnerability, we could examine the effect of the program on actual employment. Table 3 presents the results from

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<sup>19</sup> The 16 districts are distributed as follows: 3 in Assam, 1 in Karnataka, 2 in Rajasthan, 6 in Uttar Pradesh, and 4 in West Bengal.

the analysis testing this first-stage relationship. We find that while women living in early districts are, on average, less likely to work compared to women living in late districts, rural women from early districts are 17.7 percentage points more likely to report currently working compared to rural women from late districts. Rural women in early districts also work an average of 0.86 hours more a day and 1.23 days more a week. Rural men in early districts, on the other hand, have worse employment outcomes than rural men in late districts, although the size of the effect is small relative to the effect for women and the differences are not statistically significant.

[TABLE 3 HERE]

Overall, this analysis suggests that the program improved employment prospects of women even within the short time frame we are considering. While men did not experience a significant change in probability of working, they could still be affected by the program if households pool resources and men benefit from their wives working more. In addition, men's employment could still be affected by the program if men are switching away from casual labor in the private sector to labor in NREGS because of higher wages. However, the data does not allow us to investigate this possibility further. Either way, both men and women could also benefit from the program providing additional income security, whether their household is actively using the program or not.

Next, we examine the effect of the program on mental health outcomes.

## **6.2 Effect of NREGS on mental health**

Table 4 presents the raw means of the mental health outcomes in urban and rural households across early and late districts. Examining columns 4, 5, and 6, we find that rural women in early districts have lower probability of feeling suicidal compared to rural women in late districts (significant at the 10% level). Rural men in early districts are significantly more

likely to report not being able to control the important things in life and not being able to cope with everything in life than are rural men in late districts. Column 7 shows the estimate of the double difference, considering differences across districts for urban households, as well. Overall, the raw DiD estimates show that the program was effective in reducing female self-reported depression, hopelessness, suicidal thoughts, low self-esteem and anxiety. Men, on the other hand, did not experience any significant changes in mental health symptoms with the exception of increased inability to control the important things in life and cope with life.

[TABLE 4 HERE]

Next, we examine these findings in a regression framework, controlling for individual and district characteristics. The results of our preferred DiD regression specification, presented in Table 5, are largely consistent with the raw means.

[TABLE 5 HERE]

We find that, on average, the program did not affect the probability of a depression diagnosis or depression symptoms for either men or women significantly. The program also did not affect other mental health outcomes with the exception of suicidal tendencies for women and lack of control for men. Women were 8.9 percentage points less likely to report feeling suicidal if they had access to the program, significant at the 5% level. Men, on the other hand, were 10 percentage points more likely to report feeling like they cannot control the important things in their life, although the result is only significant at the 10% level. Results are robust to Bonferroni adjustment for multiple hypotheses testing.

The results for model (1), estimating the effect of the program in the rural sample, without the difference-in-difference framework, are qualitatively similar to the DiD model (Appendix Table 4). As expected, the DiD estimates are larger than the simple OLS estimates,

which suggests that early treatment is positively correlated with district-level unobservable characteristics that are associated with worse mental health outcomes (such as poverty or lack of access to healthcare). Appendix Table 4 shows that program availability is associated with a 5.4 percentage point decrease in female probability of feeling suicidal and no significant effect on males.

One potential explanation for the gender differences in the treatment effect is that intrahousehold allocation of resources may have changed as a result of the program and men's power in the household may have been threatened when women started working. Prior research has found some support for this hypothesis, showing that NREGS was associated with increase in domestic violence as men struggled to control resources (Amaral, Bandyopadhyay, and Sensarma 2015). Unfortunately, our data does not allow us to study intrahousehold behaviors more closely as the survey interviews two respondents per households in only a small subset of older households.<sup>20</sup>

### **6.3 Heterogeneity analyses**

Next, we perform a heterogeneity analysis examining the impact of the program by the permanent income level of the household. Overall, since poorer households were more likely to take advantage of the program, we expect to find bigger effects for households with lower permanent income.<sup>21</sup> The results in Table 6 provide support for this hypothesis. The interaction term between permanent income, early program district and rural residence is positive and

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<sup>20</sup> In addition, a very small proportion of respondents in our sample are not married, which does not allow studying the heterogeneity of the treatment effect by marital status.

<sup>21</sup> The permanent income measure has a mean of about 0.6 and a standard deviation of about 0.5.

significant for most mental health outcomes for women suggesting that women living in households with higher permanent income experience lower reduction in mental distress. Specifically, if rural women experience an average decrease in probability of depression symptoms of 12.4 percentage points associated with the program, then women who have permanent income of one standard deviation below the mean experience an 18.9 percentage points decrease in likelihood of depression symptoms, while women who have permanent income of one standard deviation above the mean experience a 5.9 percentage points decrease.<sup>22</sup> Once again, we find no significant effects on the mental health of men.

[TABLE 6 HERE]

Next, we examine if the treatment effect is larger when treatment is defined by high program intensity. As expected, the results in Table 7 show larger effects for both women and men compared to the main specification in Table 5.

[TABLE 7 HERE]

Rural women in high-intensity districts experience a significant improvement in mental health on almost all dimensions compared to rural women in low-intensity or late districts. They are 15.0 percentage points less likely to have a depression diagnosis based on the ICD-10 criteria, 13.4 percentage points less likely to report depression symptoms, 8 percentage points less likely to feel hopeless, 10.8 percentage points less likely to feel suicidal, 16.2 percentage points less likely to have low self-esteem and 11.7 percentage points less likely to feel anxious,

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<sup>22</sup> Given a standard deviation of 0.5 for the permanent income measure, the effect of a one-standard deviation decrease in income is -6.5. The total effect is thus  $-12.4 - 6.5 = -18.9$ . Similarly, the total effect associated with an increase in income is:  $-12.4 + 6.5 = -5.9$ .

all significant at the 5% level, with the exception of hopelessness significant at the 10% level. Treated rural men are significantly less likely to report depression symptoms, although they report an increased probability of low self-esteem. However, the results for males are not robust to correcting for multiple hypotheses testing, while the effect of the program on women's suicidal tendencies and low self-esteem remains significant after Bonferroni correction.

#### **6.4 Mechanisms**

Finally, we examine the potential mechanisms that may explain how NREGS availability may affect mental health. The conceptual framework in section 3 suggested that mental health is a function of physical health, social interactions and risk vulnerability. While we do not have information on household perception of risk vulnerability, we could examine the effects on physical health and social interactions. Table 8 presents the results from this analysis for the high-intensity treatment.

[TABLE 8 HERE]

Overall, we find no significant effect of the program on women's probability of being underweight, which may be due to health effects taking longer to show, although we do find that men are significantly less likely to be underweight. We also examine total household per capita expenditures and food per capita expenditures. We find that both total and food expenditures in the households of female and male respondents increase significantly as a result of the program. While women may be benefitting from higher household consumption, they also report higher disability (significant at the 10% level). Finally, we examine the effect of the program on social capital. In column 5, we find that rural women in high intensity districts increase the number of social activities they participate in by about 0.54 compared to rural women in low-intensity or

late districts, significant at the 10% level. While the effect on men is similar in size, the changes in social participation for men are not statistically significantly different from zero.

Overall, we find weak evidence for the social participation mechanism. We find some support for the health mechanism although the health outcomes studied show potentially conflicting effects on mental health. In addition, while total and food expenditures increase, households of both female and male respondents see higher expenditures but males experience little change in their mental health. Considering the increase in female employment and the fact that secure jobs have been found to have a positive effect on happiness and life satisfaction (World Bank 2013), we believe that, at least in the short-run, NREGS affected women's mental health mostly through increased economic security and independence. This hypothesis is supported by previous work which found that women's earnings under NREGS constituted an average of 14% of total household income, increasing women's self-worth and importance (Pankaj and Tankha 2010). Importantly, Pankaj and Tankha (2010) show that women retained control over at least some of the NREGS wages and used them for household consumption as well as for daily personal needs, reducing dependence on husbands and other relatives.

## **7. Conclusion**

As low-income countries increase health care access and sanitation and improve disease prevention, they have seen significant improvements in physical health, lower childhood mortality rates and higher life expectancy. Increasingly, more attention is being paid to mental health and the link between income and psychological well-being. There is little rigorous empirical evidence, however, on the causal effect of poverty on mental distress. In this paper, we study the effects of a poverty alleviation program - India's National Rural Employment Guarantee Scheme – on the psychological well-being of rural adults. We find that in the first

year of the program, women in recipient districts were less likely to feel suicidal. We examine heterogeneity by treatment intensity and further show that women in high-intensity program districts were also less likely to have low self-esteem. Men, on the other hand, were not significantly affected by the program. We further examine mechanisms that may underlie the relationship between the program and women's mental health. We find that the program increased consumption in households of both female and male respondents but only women were significantly more likely to work and also work longer hours and more days per week. This suggests that the main way in which NREGS influenced mental health, at least in the short-run, was through providing women with greater economic security and independence.

Overall, our research shows that large-scale public works programs have the potential to improve psychological well-being especially for disadvantaged members of society, although more research is necessary on the potential cost in terms of deterioration in physical health. The study also shows the importance of considering the distribution of program gains by gender and the changes in intrahousehold composition that may result from the program.

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Tables

Table 1: District Characteristics - NSS 61st round (2004/2005)

	Received NREGS in Phase 3	Received NREGS in Phase 1 or Phase 2	P-value
ST fraction	0.04	0.11	0.006
SC fraction	0.18	0.22	0.025
Proportion Illiterate	0.4	0.45	0.059
Female employment rate	0.25	0.25	0.938
Male employment rate	0.59	0.6	0.372
Proportion under poverty line	0.2	0.26	0.026
Number of districts	44	67	

Source: India's 2004 National Sample Survey (NSS).

Table 2: Pre-program tests using World Health Survey from 2003

	Depression Symptoms		Cannot cope		Cannot control		Total per capita expenditures		Food per capita expenditures		Currently working		Underweight	
	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]	[10]	[11]	[12]	[13]	[14]
<i>Panel A: Females</i>														
Rural*Early Treatment	-0.042 (0.0699)	-0.03 (0.0473)	0.085 (0.0845)	0.084 (0.0624)	0.028 (0.0672)	0.026 (0.0469)	157.938 (304.9071)	202.584 (231.6088)	-44.622 (71.8904)	-40.014 (35.0158)	0.011 (0.0836)	0.064 (0.0612)	0.024 (0.0594)	0.042 (0.0536)
Early Treatment	-0.01 (0.0730)	-0.002 (0.0604)	-0.122 (0.0932)	-0.105 (0.0822)	-0.038 (0.0707)	-0.033 (0.0684)	-200.068 (314.6582)	-184.387 (226.5535)	-5.478 (80.2401)	39.819 (38.1548)	0.051 (0.0797)	-0.085 (0.0945)	-0.038 (0.0479)	-0.051 (0.0622)
Rural	0.036 (0.0437)	-0.004 (0.0352)	-0.025 (0.0744)	-0.062 (0.0520)	0.004 (0.0529)	-0.025 (0.0333)	-320.631 (261.5046)	-130.483 (191.6720)	-51.284 (55.6752)	-8.901 (26.7651)	0.033 (0.0627)	0.033 (0.0537)	0.051 (0.0426)	0.026 (0.0396)
Individual Controls	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes
District controls	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes
Number of observations	2245	2208	2291	2254	2291	2254	2166	2129	2325	2284	2301	2263	2177	2142
<i>Panel B: Males</i>														
Rural*Early Treatment	0.028 (0.0528)	0.013 (0.0354)	0.118 (0.1105)	0.083 (0.0766)	-0.07 (0.0799)	-0.041 (0.0543)	65.747 (152.8554)	69.808 (80.9676)	44.075 (116.9060)	41.286 (68.0531)	-0.093 (0.0590)	-0.067 (0.0504)	0.032 (0.0867)	0.051 (0.0816)
Early Treatment	-0.043 (0.0531)	-0.015 (0.0486)	-0.135 (0.1208)	-0.062 (0.0994)	0.033 (0.0845)	-0.023 (0.0637)	-132.532 (160.8442)	0.367 (84.0150)	-103.62 (118.7268)	-31.854 (64.9297)	0.107* (0.0566)	0.082 (0.0499)	-0.068 (0.0838)	-0.119 (0.0958)
Rural	0.03 (0.0437)	-0.002 (0.0249)	-0.074 (0.0890)	-0.102 (0.0655)	0.047 (0.0475)	0.026 (0.0301)	-271.939** (122.0651)	-205.764*** (66.4757)	-172.948 (107.4820)	-131.459** (61.1400)	0.074 (0.0557)	0.049 (0.0444)	0.069 (0.0738)	0.015 (0.0706)
Individual Controls	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes
District controls	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes
Number of observations	1885	1851	1914	1882	1914	1882	1796	1767	1947	1912	1930	1894	1843	1812

## Notes:

[1] District controls include rank and indices from the Indian Planning Commission, as well as fraction ST and SC, fraction illiterate, female and male employment rates, and fraction under poverty line separately for the whole district and for the rural areas of the district - calculated from NSS 61. It also include the measure of bureaucratic efficiency based on the performance of the NBA program.

Individual controls include dummies for age 30 to 40, 40 to 50, and greater than 50, dummies for years of education under 4, between 5 and 8, between 8 and 12, and 12, as well as marital status, and asset ownership (phone and bike/moped) and household size.

[2] Standard errors in parentheses, clustered at the district level. Number of districts=111.

[3] \* denotes significance at the 10% level, \*\* denotes significance at the 5% level, and \*\*\* denotes significance at the 1% level.

Table 3: Program effect on employment

	Currently work	Hours Worked a Day	Days worked a Week
	[1]	[2]	[3]
<i>Panel A: Females</i>			
Rural*Early Treatment	0.177** (0.0704)	0.856** (0.4261)	1.234*** (0.4698)
Early Treatment	-0.220** (0.0882)	-0.976* (0.5454)	-1.458** (0.5813)
Rural	0.006 (0.0522)	0.326 (0.3092)	-0.033 (0.3508)
Number of observations	2472	2472	2472
<i>Panel B: Males</i>			
Rural*Early Treatment	-0.07 (0.0750)	-0.876 (0.5626)	-0.433 (0.4605)
Early Treatment	0.08 (0.0746)	0.484 (0.6542)	0.504 (0.4760)
Rural	0.04 (0.0584)	0.226 (0.4673)	0.286 (0.3303)
Number of observations	1428	1428	1423

Notes:

[1] Regressions include individual and district controls: rank and indices from the Indian Planning Commission, as well as fraction ST and SC, fraction illiterate, female and male employment rates, and fraction under poverty line separately for the whole district and for the rural areas of the district - calculated from NSS 61, and measure of bureaucratic efficiency based on the performance of the NBA program; dummies for age 30 to 40, 40 to 50, and greater than 50, dummies for years of education under 4, between 5 and 8, between 8 and 12, and 12, as well as marital status, household permanent income, household size, land ownership, caste, and religion.

[2] Standard errors in parentheses, clustered at the district level. Number of districts=111.

[3] \* denotes significance at the 10% level, \*\* denotes significance at the 5% level, and \*\*\* denotes significance at the 1% level.

Table 4 - Raw mean difference in differences

	Urban			Rural			DiD	
	Late districts	Early districts	p-value	Late districts	Early districts	p-value	([5]-[4])-( [2]-[1])	p-value
	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]
<i>Panel A: Females</i>								
Depression - ICD-10 diagnosis	0.05	0.17	0.001	0.14	0.15	0.724	-0.11	0.009
Depression symptoms	0.04	0.13	0.008	0.1	0.11	0.514	-0.08	0.034
Hopeless	0.03	0.14	<0.001	0.07	0.09	0.204	-0.09	0.007
Suicidal	0	0.08	0.002	0.08	0.05	0.065	-0.11	0.000
Low self-esteem	0	0.12	<0.001	0.07	0.09	0.201	-0.1	0.004
Cannot control	0.29	0.21	0.099	0.22	0.22	0.991	0.08	0.127
Anxious	0.04	0.16	0.001	0.13	0.13	0.873	-0.12	0.007
Cannot cope	0.28	0.23	0.309	0.21	0.25	0.110	0.09	0.110
<i>Panel B: Males</i>								
Depression - ICD-10 diagnosis	0.13	0.12	0.891	0.12	0.12	0.975	0.01	0.890
Depression symptoms	0.06	0.09	0.561	0.09	0.07	0.314	-0.05	0.343
Hopeless	0.06	0.06	0.989	0.05	0.06	0.482	0.01	0.787
Suicidal	0.05	0.06	0.810	0.03	0.04	0.409	0	0.931
Low self-esteem	0.05	0.06	0.810	0.06	0.07	0.549	0.00	0.968
Cannot control	0.25	0.15	0.091	0.13	0.22	0.002	0.19	0.005
Anxious	0.13	0.1	0.639	0.1	0.1	0.671	0.03	0.537
Cannot cope	0.24	0.2	0.513	0.17	0.25	0.006	0.12	0.089

Notes:

[1] Raw sample means for the analysis sample.

Table 5: Main results

	Depression ICD-10 diagnosis	Depression symptoms	Hopeless	Suicidal	Low Self- esteem	Cannot control	Anxious	Cannot cope
	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]
<i>Panel A: Females</i>								
Rural*Early Treatment	-0.032 (0.0539)	-0.019 (0.0396)	-0.042 (0.0400)	-0.089*** (0.0302)	-0.044 (0.0375)	-0.014 (0.0748)	-0.044 (0.0477)	-0.005 (0.0614)
Early Treatment	-0.012 (0.0568)	0.001 (0.0427)	0.029 (0.0406)	0.035 (0.0295)	0.03 (0.0402)	-0.076 (0.0889)	0.009 (0.0493)	-0.056 (0.0630)
Rural	0.035 (0.0369)	0.018 (0.0254)	0.028 (0.0266)	0.057** (0.0227)	0.025 (0.0219)	-0.02 (0.0694)	0.045 (0.0322)	-0.026 (0.0543)
Number of observations	2469	2469	2469	2469	2469	2471	2469	2471
<i>Panel B: Males</i>								
Rural*Early Treatment	0.019 (0.0523)	-0.032 (0.0446)	0.022 (0.0453)	0.005 (0.0292)	0.011 (0.0449)	0.100* (0.0556)	0.035 (0.0477)	0.004 (0.0568)
Early Treatment	-0.032 (0.0603)	0.011 (0.0530)	-0.014 (0.0479)	-0.007 (0.0325)	0.004 (0.0503)	-0.098 (0.0694)	-0.02 (0.0562)	0.004 (0.0751)
Rural	-0.028 (0.0401)	0.015 (0.0248)	-0.028 (0.0297)	-0.012 (0.0224)	-0.005 (0.0342)	-0.117*** (0.0376)	-0.053 (0.0364)	-0.069* (0.0355)
Number of observations	1427	1427	1427	1427	1427	1427	1427	1426

## Notes:

[1] Regressions include individual and district controls: rank and indices from the Indian Planning Commission, as well as fraction ST and SC, fraction illiterate, female and male employment rates, and fraction under poverty line separately for the whole district and for the rural areas of the district - calculated from NSS 61, and measure of bureaucratic efficiency based on the performance of the NBA program; dummies for age 30 to 40, 40 to 50, and greater than 50, dummies for years of education under 4, between 5 and 8, between 8 and 12, and 12, as well as marital status, household permanent income, household size, land ownership, caste, and religion.

[2] Standard errors in parentheses, clustered at the district level. Number of districts=111.

[3] \* denotes significance at the 10% level, \*\* denotes significance at the 5% level,

Table 6: Heterogeneity by household poverty

	Depression ICD-10 diagnosis	Depression symptoms	Hopeless	Suicidal	Low Self- esteem	Cannot control	Anxious	Cannot cope
	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]
<i>Panel A: Females</i>								
Rural*Early Treatment	-0.135* (0.0800)	-0.124** (0.0524)	-0.128** (0.0583)	-0.184*** (0.0537)	-0.108* (0.0554)	0.115 (0.1487)	-0.166** (0.0683)	0.113 (0.1075)
Rural*Early Treatment*Permanent Income	0.134* (0.0789)	0.130** (0.0610)	0.110* (0.0608)	0.130*** (0.0497)	0.086 (0.0550)	-0.147 (0.1251)	0.162** (0.0697)	-0.141 (0.0938)
Early Treatment*Permanent Income	-0.098 (0.0751)	-0.128** (0.0593)	-0.102* (0.0551)	-0.075* (0.0397)	-0.06 (0.0479)	0.181 (0.1217)	-0.122* (0.0680)	0.129 (0.0861)
Rural*Permanent Income	-0.062 (0.0482)	-0.051 (0.0341)	-0.034 (0.0366)	-0.066** (0.0301)	-0.024 (0.0289)	0.12 (0.1064)	-0.092*** (0.0344)	0.095 (0.0809)
Early Treatment	0.065 (0.0747)	0.104** (0.0521)	0.109** (0.0534)	0.091** (0.0458)	0.076 (0.0522)	-0.226 (0.1511)	0.102 (0.0645)	-0.162 (0.1024)
Rural	0.079 (0.0502)	0.056** (0.0255)	0.052 (0.0372)	0.102*** (0.0351)	0.039 (0.0335)	-0.124 (0.1299)	0.109*** (0.0349)	-0.103 (0.0964)
<i>Panel B: Males</i>								
Rural*Early Treatment	-0.027 (0.1339)	-0.074 (0.1120)	0.033 (0.1009)	-0.057 (0.0968)	-0.05 (0.0990)	0.157 (0.1125)	-0.01 (0.1296)	0.116 (0.1360)
Rural*Early Treatment*Permanent Income	0.053 (0.1234)	0.052 (0.1129)	-0.012 (0.0851)	0.075 (0.0946)	0.077 (0.0810)	-0.093 (0.1211)	0.051 (0.1177)	-0.158 (0.1323)
Early Treatment*Permanent Income	-0.071 (0.1139)	-0.061 (0.1025)	0.005 (0.0810)	-0.072 (0.0924)	-0.065 (0.0704)	-0.013 (0.1115)	-0.085 (0.1079)	0.003 (0.1255)
Rural*Permanent Income	0.095 (0.0817)	0.074 (0.0698)	0.096* (0.0549)	-0.002 (0.0553)	0.025 (0.0595)	0.096 (0.0887)	0.095 (0.0816)	0.239*** (0.0813)
Early Treatment	0.024 (0.1329)	0.058 (0.1107)	-0.02 (0.1014)	0.055 (0.0951)	0.058 (0.0946)	-0.076 (0.1122)	0.048 (0.1278)	0.005 (0.1452)
Rural	-0.107 (0.0965)	-0.047 (0.0637)	-0.108* (0.0634)	-0.009 (0.0549)	-0.027 (0.0749)	-0.180** (0.0695)	-0.131 (0.0936)	-0.252*** (0.0646)

Notes:

[1] Regressions include individual and district controls: rank and indices from the Indian Planning Commission, as well as fraction ST and SC, fraction illiterate, female and male employment rates, and fraction under poverty line separately for the whole district and for the rural areas of the district - calculated from NSS 61, and measure of bureaucratic efficiency based on the performance of the NBA program; dummies for age 30 to 40, 40 to 50, and greater than 50, dummies for years of education under 4, between 5 and 8, between 8 and 12, and 12, as well as marital status, household permanent income, household size, land ownership, caste, and religion.

[2] Standard errors in parentheses, clustered at the district level. Number of districts=111.

[3] \* denotes significance at the 10% level, \*\* denotes significance at the 5% level, and \*\*\* denotes significance at the 1% level.

Table 7: Results for high intensity districts

	Depression ICD-10	Depression symptoms	Hopeless	Suicidal	Low Self- esteem	Cannot control	Anxious	Cannot cope
	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]
<i>Panel A: Females</i>								
Rural*High intensity	-0.150** (0.0593)	-0.134** (0.0526)	-0.080* (0.0428)	-0.108*** (0.0369)	-0.162*** (0.0514)	-0.013 (0.0749)	-0.117** (0.0521)	-0.074 (0.0654)
High intensity	0.076 (0.0665)	0.066 (0.0533)	0.004 (0.0438)	0.028 (0.0411)	0.072 (0.0591)	0.128* (0.0743)	0.032 (0.0601)	0.167** (0.0722)
Rural	0.016 (0.0251)	0.008 (0.0193)	0.002 (0.0207)	0 (0.0151)	0 (0.0184)	-0.03 (0.0396)	0.018 (0.0215)	-0.027 (0.0344)
<i>Panel B: Males</i>								
Rural*High intensity	-0.063 (0.0693)	-0.130** (0.0548)	0.052 (0.0455)	-0.045 (0.0334)	0.089** (0.0431)	-0.114 (0.0785)	0.073 (0.0579)	-0.064 (0.0767)
High intensity	0.023 (0.0765)	0.08 (0.0678)	-0.076 (0.0485)	0.012 (0.0361)	-0.139*** (0.0514)	0.193*** (0.0679)	-0.092 (0.0592)	0.021 (0.0750)
Rural	-0.013 (0.0325)	0.001 (0.0310)	-0.018 (0.0260)	-0.007 (0.0231)	-0.006 (0.0244)	-0.041 (0.0304)	-0.036 (0.0286)	-0.062* (0.0364)

Notes:

[1] Regressions include individual and district controls: rank and indices from the Indian Planning Commission, as well as fraction ST and SC, fraction illiterate, female and male employment rates, and fraction under poverty line separately for the whole district and for the rural areas of the district - calculated from NSS 61, and measure of bureaucratic efficiency based on the performance of the NBA program; dummies for age 30 to 40, 40 to 50, and greater than 50, dummies for years of education under 4, between 5 and 8, between 8 and 12, and 12, as well as marital status, household permanent income, household size, land ownership, caste, and religion.

[2] Standard errors in parentheses, clustered at the district level. Number of districts=111.

[3] \* denotes significance at the 10% level, \*\* denotes significance at the 5% level, and \*\*\* denotes significance at the 1% level.

Table 8: Mechanisms

	Underweight	Total per capita	Food	WHO Disability	Social Index
	[1]	[2]	[3]	[4]	[5]
<i>Panel A: Females</i>					
Rural*High intensity	0.031 (0.0821)	260.759*** (54.1217)	43.000*** (11.7192)	5.333* (3.0899)	0.540* (0.2791)
High intensity	0.006 (0.0723)	-213.002*** (53.0464)	-29.749** (12.3661)	-8.880** (3.4218)	-0.263 (0.2472)
Rural	0.086*** (0.0309)	-62.516** (31.0674)	-6.899 (6.6910)	1.341 (1.6543)	0.333*** (0.1048)
<i>Panel B: Males</i>					
Rural*High intensity	-0.196*** (0.0704)	172.335*** (48.3947)	49.213*** (10.4084)	3.269 (2.5777)	0.465 (0.3681)
High intensity	0.177** (0.0792)	-148.353*** (50.5028)	-37.873*** (12.2237)	-6.344** (3.1057)	-0.185 (0.3466)
Rural	0.067 (0.0460)	-79.168*** (28.1973)	-4.948 (4.9708)	-1.767 (1.3475)	0.343** (0.1517)

Notes:

[1] Regressions include individual and district controls: rank and indices from the Indian Planning Commission, as well as fraction ST and SC, fraction illiterate, female and male employment rates, and fraction under poverty line separately for the whole district and for the rural areas of the district - calculated from NSS 61, and measure of bureaucratic efficiency based on the performance of the NBA program; dummies for age 30 to 40, 40 to 50, and greater than 50, dummies for years of education under 4, between 5 and 8, between 8 and 12, and 12, as well as marital status, household permanent income, household size, land ownership, caste, and religion.

[2] Standard errors in parentheses, clustered at the district level. Number of districts=111.

[3] \* denotes significance at the 10% level, \*\* denotes significance at the 5% level, and \*\*\* denotes significance at the 1% level.

Appendix Tables

Appendix Table 1: State-level availability and use of NREGS

State	FY 2006-2007					FY 2007-2008				
	%		Total Persondays	% Women Persondays	Average Persondays per Household	%		Total Persondays	% Women Persondays	Average Persondays per Household
	Households Demanded Employment	Households Provided Employment				Households Demanded Employment	Households Provided Employment			
ASSAM	798,179	99.3	57,292,000	31.7	72.3	1,448,243	96.9	48,761,000	30.9	34.8
KARNATAKA	548,532	99.4	22,201,000	50.6	40.7	554,002	99.3	19,778,000	50.3	36.0
MAHARASHTRA	384,944	100.0	15,928,000	37.1	41.4	474,695	100.0	18,486,000	40.0	38.9
RAJASTHAN	1,175,172	100.0	99,887,000	67.1	85.0	2,173,122	99.9	167,838,000	69.0	77.3
UTTAR PRADESH	2,678,700	96.1	82,291,000	16.6	32.0	4,104,283	99.8	136,306,000	14.5	33.3
WEST BENGAL	3,242,594	95.1	44,008,000	18.3	14.3	3,919,996	98.0	96,880,000	17.0	25.2

Source:

[1] The NREGA fiscal year (FY) ends in March.

[2] Source: DMU reports, <http://mnregaweb4.nic.in>

Appendix Table 2: Descriptive statistics of household characteristics

	Rural		P-value
	Late districts (Phase 3)	Early districts (Phase 1 and Phase 2)	
	[4]	[5]	[6]
Female	0.64	0.63	0.596
Age 18 to 30	0.06	0.07	0.247
Age 30 to 40	0.2	0.22	0.162
Age 40 to 50	0.2	0.21	0.433
Age above 50	0.54	0.49	0.017
No education	0.5	0.57	0.001
Less than 4 years of education	0.1	0.11	0.734
Years of education between 4 and 8	0.16	0.16	0.868
Years of education between 9 and 12	0.01	0.01	0.606
Years of education equal to or more than 13	0.23	0.15	0.000
Widowed	0.06	0.06	0.747
Currently married	0.93	0.93	0.892
Single	0.01	0.01	0.651
SC caste	0.16	0.22	0.000
ST caste	0.05	0.11	0.000
No caste	0.14	0.14	0.926
Other caste	0.65	0.52	0.000
Hindu	0.86	0.83	0.019
Muslim	0.12	0.14	0.149
Other religion	0.02	0.03	0.029
Permanent income	0.69	0.53	0.000
Household size	6.04	6.02	0.834
Household has land	0.89	0.9	0.668
Number of Observations	752	2600	

Notes:

[1] Raw sample means for analysis sample.

Appendix Table 3: NREGS availability and use for the districts in the study sample

	Number of districts in SAGE data			Number of households provided work		Average number of Persondays per Household	
	with Rank<=330 <sup>1</sup>	Provided NREGS in FY 06-07 and FY 07-08 <sup>2</sup>	Provided NREGS in FY 06-07 and FY 07-08 up to June'07	in FY 06-07	in FY 07-08 up to June'07	in FY 06-07	in FY 07-08 up to June'07
	[1]	[2]	[3]	[4]	[5]	[6]	[7]
State							
ASSAM	7	6	3	399,586	214,334	67	24
KARNATAKA	10	6	4	347,515	18,068	37	89
MAHARASHTRA	13	9	6	211,668	77,315	42	36
RAJASTHAN	14	5	5	572,027	800,868	85	34
UTTAR PRADESH	25	22	12	1,830,057	349,925	30	22
WEST BENGAL	12	11	11	2,075,256	1,433,770	15	10

Note:

[1] Rank <=330 indicates that the district should have been treated in Phase 1 or Phase 2 if using the development index as an allocation rule.

[2] The NREGA fiscal year (FY) ends in March.

[3] Source: DMU reports, <http://mnregaweb4.nic.in>

Appendix Table 4: ITT estimates using rural sample only

	Depression ICD-10 diagnosis	Depression symptoms	Hopeless	Suicidal	Low Self- esteem	Cannot control	Anxious	Cannot cope
	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]
<i>Panel A: Females</i>								
Early treatment	-0.05 (0.0327)	-0.026 (0.0257)	-0.025 (0.0242)	-0.054** (0.0252)	-0.02 (0.0271)	-0.082 (0.0498)	-0.04 (0.0294)	-0.041 (0.0434)
Number of observations	2109	2109	2109	2109	2109	2111	2109	2111
<i>Panel B: Males</i>								
Early treatment	-0.037 (0.0343)	-0.036 (0.0317)	-0.008 (0.0162)	-0.01 (0.0187)	-0.004 (0.0213)	0.01 (0.0484)	-0.013 (0.0315)	0.018 (0.0482)
Number of observations	1239	1239	1239	1239	1239	1239	1239	1239

Notes:

[1] Regressions include individual and district controls: rank and indices from the Indian Planning Commission, as well as fraction ST and SC, fraction illiterate, female and male employment rates, and fraction under poverty line separately for the whole district and for the rural areas of the district - calculated from NSS 61, and measure of bureaucratic efficiency based on the performance of the NBA program; dummies for age 30 to 40, 40 to 50, and greater than 50, dummies for years of education under 4, between 5 and 8, between 8 and 12, and 12, as well as marital status, household permanent income, household size, land ownership, caste, and religion.

[2] Standard errors in parentheses, clustered at the district level. Number of districts=111.

[3] \* denotes significance at the 10% level, \*\* denotes significance at the 5% level, and \*\*\* denotes significance at the 1% level.