

**Can a Women's Rural Livelihood Program Improve Mental Health? Evidence from
India**

By

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A Thesis Submitted to the Faculty of the
DEPARTMENT OF AGRICULTURAL AND RESOURCE ECONOMICS
In Partial Fulfillment of the Requirements
For the Degree of
MASTER OF SCIENCE
In the Graduate College
The University of Arizona
Year 2016

STATEMENT BY AUTHOR

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ACKNOWLEDGEMENTS

I would like to thank my thesis supervisor Dr. Tauhidur Rahman for providing extremely patient and wonderful guidance that was both analytically and intellectually rich. This work would not have been possible had I not received key inputs from him that delineated the areas I must deeply focus upon before writing my thoughts on paper. I am grateful to Dr. Satheesh Aradhyula and Dr. Russell Tronstad for serving my thesis committee and providing useful comments and suggestions. I certainly cannot leave my friends Chris, Josh, Niloy, Wenjun, Azhar, Daniel, Suhina and Asumi to whom I am quite thankful for their terrific support in terms of mixing work and fun through engaging talks on topics spanning from economics to hollywood to politics. Jeevika members, whose homes I visited and shared stories with, will continue to inspire me all my life for their invincible fight against poverty.

Data used in this study was collected by a team of researchers, from the World Bank and the University of Arizona, led by Dr. Tauhidur Rahman for the project on “Behavioral Impact Evaluation of Jeevika.” I am very thankful to the research team for allowing me to use some of the project data for my thesis research.

My graduate study and this thesis research would not have been possible without the graduate assistantship from the IRAP project, a collaborative research program between the University of Arizona and the International Research Institute of the Columbia University, funded by the National Oceanic and Atmospheric Administration (NOAA) and the United States Agency for International Development (USAID).

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ABSTRACT

There is a significant amount of literature documenting empirical linkages between socioeconomic status and mental health of individuals. While economic studies have found beneficial impacts of anti-poverty programs (e.g., micro-credit programs) on mental and emotional health, non-economic studies have documented the powerful roles of social capital in determining mental and emotional health. In this thesis, we study the impact of a large community-driven development (CDD) women's empowerment program, Jeevika, on mental health. JEEViKA is a rural livelihood program in Bihar, India, which promotes women's livelihood through a network of women's self-help group (SHG). Using data on a sample of 2300 SHG women from matched pairs of 66 high-exposure and low-exposure Jeevika villages, we estimate the causal impact of Jeevika on mental health. The results suggest that mental health improves with increasing age and among socially backward communities in high exposure JEEViKA villages. However, overall both the individual and village level analysis demonstrates no significant impact of JEEViKA on the mental health.

CHAPTER ONE

INTRODUCTION

World Health Organisation (WHO) defines mental health as *a state of well-being in which the individual realizes his or her own abilities, can cope with the normal stresses of life, can work productively and fruitfully, and is able to make a contribution to his or her community*. Mental health is a more serious health concern for socially and economically disadvantaged women, particularly, in patriarchal societies. While mental health refers to different kinds of mental illnesses, depression is the most frequently occurring illness and it is particularly pronounced among women (WHO, 2000).

Therefore, it is not surprising that there are numerous women's empowerment programs across developing countries. Most of these programs are anti-poverty programs involving components such as cash transfers, creation of women's self-help groups, or gender-based affirmative action programs. It is usually the case that these programs are studied for their impacts on the targeted economic and social outcomes. However, there are strong reasons to believe that such programs may also improve mental and emotional health of women. An anti-poverty program may also generate differences in expectations, aspirations, and achievements, beyond their economic and social impacts. This will be particularly more applicable to programs that attempt to promote non-traditional and challenging roles for women. Such changes can have bearings on the mental health of women.

Mental health is an important aspect of health because it also affects educational outcomes, productivity, and relationships. (WHO, 2005). The United Nations Millennium Development Goals (MDG) has also stressed on the importance of the subjective well-

being in the “3-D model of individual well-being” (McGregor, A., & Sumner, A., 2010). However, the global figures for issues related to mental health, especially among women, present a dismal picture. Depression has been found to be more common among women than men, demonstrated consistently in both high and low income countries, where it has been claimed that the higher risk of depression in women cannot be explained by biological differences (Piccinelli and Wilkinson, 2000).

India, being a middle-income developing country, is however currently going through serious mental health crisis with young women playing central role. Recent WHO statistics suggests that, in India, the burden of depression is 50% higher in females than males that puts Indian women as a more depressed group. In a cross-country comparison, Choudhary (2013) finds that Indian women feel depressed for 31.9 years compared to 18.8 years in China and 22.7 years in the USA during their life span.

The high figures of depression seem to go along with the prevalence of suicides also, as India registers highest number of estimated suicides in the world (WHO, 2012). Indeed, as per the recent report by the National Crime Records Bureau (NCRB, 2014), suicide happens to be the top reason for the unnatural death among Indian women, in which over half of them were married and three quarters were among the poorest class of India. Housewives alone comprise of around 20% of all suicide cases in India, the highest for any group - even more than the farmers (less than 12%) burdened under indebtedness who often face huge agricultural losses under bad monsoon - and it has made suicide to surpass maternal mortality as the leading cause of death among young Indian women. The major reasons cited for such astronomically high number of suicides include ‘health’,

‘economic’ and ‘family matters’ which is broken down into illness, depression, unemployment, debt and distress among young women caught between traditional roles and opportunities from modernizing India (NCRB, 2014).

Social inclusion, freedom from discrimination and violence and access to economic resources are considered to be important determinants of mental health of individuals and communities (WHO, 2005). To promote community mental health, Kermode et al (2007) recognize empowerment of women by income generation, education, and reduction of caste or sex-based discrimination as a potential strategic method of development. Hence, in the light of inadequate opportunities and social barriers faced by women, more prominently in rural India, Self Help Groups (SHGs) are being formed on a large scale among poorer communities to carry out the necessary social change through gender awareness and multipronged approach to empowerment. These SHGs have been created on the model of community-driven development (CDD), a development initiative supported by the World Bank, that stresses on the adequate participation of involved communities by facilitating their active role in designing, managing and implementing the project for sustainable benefits. Given the close association between the poverty, empowerment and mental well-being, in this thesis, we have explored this relationship through studying a rural development program.

The remainder of this thesis is organized as follows. In section 2, we summarize the relevant literature. In section 3, we present JEEViKA program, while focusing on potential linkages between Jeevika and mental and emotional health. In section 4, we present the data and then empirical strategy is discussed. In section 5, we discuss the results. Finally, in Section 6, concluding remarks are provided including further analyses.

CHAPTER TWO

RELEVANT LITERATURE AND MOTIVATION

Studies in economics, medical, epidemiology and psychology have documented linkages between poverty and socio-economic status with the cognitive function, overall health and mental health of an individual. The major challenge in most of these studies has been to establish one way and causal relationship as the expected relationship seems to be bidirectional. That is, it might be possible that higher income is leading to better health but at the same time better health might also be pushing an individual further to earn higher income through enhanced capability. Yet, there is growing body of literature that points to the socio-economic status being a major contributing factor towards persistence of depression. Along with discussing this phenomenon, we will also review few other studies that have tried to capture the effect of microcredit or similar types of programs on the health and well-being of the poor. This discussion would be valid for this study as microcredit is one of the important services offered through the JEEViKA program. Lastly, we will also mention few studies that have analyzed the importance of social capital, group effort and lending as an important contributor in mental health.

There is rich literature to show the impact of socio economic background on the mental health of an individual (Ettner, 1996; Mani et al, 2003; Adler & Ostrove, 1999; Case & Deaton, 2005; Case 2009; Ardington & Case, 2010). Multiple studies also point to the epidemiological evidence showing association of social determinants, such as poverty and gender disadvantage, as a major contributor to the risk of depression (Patel and Kleinman, 2003 and Patel et al., 2006).

Ettner (1996) tried to establish the causal effect of income on health by using both ordinary and instrumental variable (IV) technique and concluded that higher income has salutary effect on mental and physical health. The statistically significant effects were found to be robust to the choice of identifying instruments and also under ordinary estimation methods assuming exogeneity of income. However, the study did not outline the possible mediating factors that would explain the relationship but it was one of the primary economic studies that established the causal link.

Mani et al (2013) noted that poverty takes much of mental space of the individuals which further affects their decision making and other capabilities related to different tasks. They experimentally found that the cognitive performance of the poor turns out to be lower than the well off individuals. This study also suggested that changes in financial situation among farmers before and after the harvest, triggered different cognitive capacity which presents a case how socio economic status or poverty takes a toll on mental health and anxiety level. Case and Deaton (2005) compared the health and wealth among the poor in India and South Africa and found that in India, the number of durable goods possessed significantly improves the self-reported health status, while household total expenditure per head does not. They also note that the presence of hunger, in the form of reports of meals missed for the lack of money, has significant effect on reported depression. In a similar study, while analyzing the effects of South African pensions on health status, Anne Case (2009) documented that doubling of income is associated with positive improvement in self-reported health status. Then, another study by Ardington and Case (2010) found the socioeconomic status, measured by household expenditure per person and household asset, to be significant negative

correlates of mental depression. They also mentioned education to have positive effect on the mental health while adults at later ages showed more symptoms of depression and lower mental health.

Lorant et al (2002) carried out a meta-analysis of 51 prevalence studies, five incidence studies and four persistence studies related to depression and found that the low socio-economic status (SES) individuals had higher odds of being depressed. In another 7-year longitudinal study, Lorant et al (2007) note that the lowering of material standard of living was associated with increases in depressive symptoms where life circumstances like ceasing to cohabit with a partner increased depressive symptoms and improving those circumstances reduced them. Everson et al (2002) presented epidemiological evidence which suggested the effects of economic disadvantage to be cumulative that led individuals under sustained hardship over time to be under greatest risk of poor mental and physical health.

Rahman et al (2012) conclude that household debt and lack of financial resources are important maintaining factors of depression in low income countries. and their locally developed interventions, 'The Thinking Healthy Programme', which was based on culturally adapted cognitive-behavioral therapy (CBT) principles, worked effectively to tackle it. Therein, they suggest that reduction of debts and financial empowerment of the women are strongly associated with reducing depression.

Patel & Kleinman (2003) wrote a critical review of eleven studies exploring the association between poverty and mental disorder in six low- and middle-income countries and found the perpetuating association between the two especially in low levels of education. They suggested that feeling of insecurity and helplessness, rapid social change

and the risks of violence and physical ill-health are possibly the major factors behind higher vulnerability of poor to common mental disorders. Indicating the direct and indirect costs of mental disorders on the income generating capability, they stated about the vicious cycle of poverty and mental disorder which might be tackled by some external interventions with provisions of microcredit or education. Similarly, in a qualitative study, Kermode et al (2007) found the women respondents to have acknowledged that independent earning, freedom of movement and greater participation in decision making led to an increased sense of competence and control that helped them in reducing their mental stress.

As far as the effect of microcredit based programs on mental health is concerned, there are very few studies that have investigated this relationship (Mohindra and Haddad, 2005; Ahmad and Chowdhury, 2001; Fernald et al, 2008). The cheaper and easier access to credit makes poor more productive through increased choices and thus Mohindra and Haddad (2005) argue for better health outcomes due to the microcredit program. They employ the concept of capability approach (Sen, 1999; Nussbaum, 2000), Grossman's health production theory (1972) and other key determinants of population health to establish a conceptual framework showing how microcredit program would lead to enhanced health capabilities and health functioning of the participating women. While analyzing the effect of microcredit program in Bangladesh, Ahmad and Chowdhury (2001) explored the experience of emotional stress by poor rural women involved in credit-based income generating activity. They found that poverty or chronic deficit of daily necessities was the major reason behind their emotional stress. For example, landholding status was found to be negatively associated with emotional stress where

landlessness was significant predictor of higher stress. Their findings conclude that although socioeconomic status has direct and positive association with emotional well being but at the early stage of program implementation, the microcredit program did little to influence the emotional stress positively. They mention other factors such as marital status, number of living children, health status, distress selling of household assets, and disputes with neighbors as strong predictor of women's emotional state. Fernald et al (2008) used the method of randomized control trial to find the impact of small individual loans on mental health among poor in South Africa. They randomly assigned "second look" to the loan applicants who were first rejected by a lender and this randomized encouragement led to 53% of otherwise rejected applicants receiving a loan. In the combined sample of women and men, they found the credit access to have stronger effect on men than women in terms of perceived stress, but positive effect on only men and no effect on women for reduced depressive symptoms.

Finally, some research has been done to understand the impact of group-lending and group support programs. There are mixed evidences in this body of research, but most studies point in the direction of positive effect of such group based programs on its beneficiaries at least in terms of building "social capital", social network and increasing household consumption, if not improving socio-economic status (Feigenberg et al, 2010; Pitt & Khandker, 1998). Much relevant to our analysis, Deininger et al (2009) studied the role of Self Help Groups (SHGs) in mobilizing savings and empowering communities at the local level and they found its positive impacts on empowerment and nutritional intake in program areas, along with the evidence of higher consumption. They also find heterogeneous impacts between members of pre-existing and newly formed groups, as

well as non-participants. While the positive impact even on non-participants suggested positive externalities due to the program in the area, the heterogeneous impacts between older and newer members demonstrated the varying impact of the program on its beneficiaries with time.

The capability approach (Alkire, 2002; Nussbaum, 2000; Iversen, 2003; Robeyns, 2003a) makes a case about the effect of group-based processes or social norms on choices and well-being of the individuals. For example, Nussbaum (1998, 2000) discusses how women's collective in India affected their well-being. And similarly capabilities related to community membership direct towards better health prospect through multiple channels, for example, Nussbaum (2000) terms the group affiliation as an architectonic capability, Alkire (2002) emphasizes on the relationships and participation, and Robeyns (2003a) focuses on the importance of social relationships.

Based on above literature we find that gender gap, household debt, lack of financial resources, inability to contribute in decision making and lack of social exposure or support are correlates of mental depression. The JEEViKA program, owing to its unique multi-dimensional design, focuses on most of these aspects of economic and social empowerment of women through multiple vertical interventions. And, this leads us to our hypothesis regarding the positive benefits of this large scale program on the mental health of its female beneficiaries.

CHAPTER THREE

CONTEXT

A. Jeevika Program

Bihar is one of the poorest states of India situated in the north-eastern Gangetic plains of the country. Bihar, ranked 21 out of total 23 in terms of Human Development Index (HDI) rank among Indian states, also happens to be doing worse than the national average in terms of many other development indicators like poverty, gender empowerment measures, literacy rate and global hunger index (UNDP, 2011). JEEViKA, a rural livelihood program, was started in 2007 by an autonomous body Bihar Rural Livelihoods Promotions Society (BRLPS) under the Govt. of Bihar, India and was initially funded by the World Bank. Since then, JEEViKA project is being carried forward under the supervision of national government body, National Rural Livelihoods Mission (NRLM) with the support of Ministry of Rural Development, India and Govt. of Bihar. The main objective of this program has been to mobilize women from economically and socially marginalized households into self-managed community based organizations for socio-economic growth, awareness and exposure with sustainable livelihood (JEEViKA project objective).

The JEEViKA program was earlier started in 6 districts of Bihar in 2007, with extensive Self Help Group (SHG) formation drive. The program placement as well as targeting is a phased procedure, and as mentioned in Table 1, the villages are firstly selected on the basis of total population, total number of households and total population of socially marginalized groups like Scheduled Castes and Scheduled Tribes etc. After the village selection, JEEViKA volunteers and staffs visit the village and analyze its

demographic and other socio-economic characteristics. The village level features help in deciding the households that satisfy the criteria of inclusion in the program based on economic and social backwardness decided by the indicators outlined in the program document.

This makes JEEViKA a targeted program in which only one woman from every eligible household can become member of a Self Help Group (SHG). Every SHG consists of 10-15 women, and by majority voting amongst the members of the related SHG, 3 leaders namely President, Secretary and Treasurer are elected as the representatives of the SHG in the bank and other places. All the members of a SHG are required to follow *Panchsutra*, i.e five fixed rules of operation that include weekly meeting attendance, weekly savings, inter-loaning, repayment and management of records. The members mostly save INR 10 (\$0.16), but the weekly saving amount may differ in a very few SHGs where members are unable to save the regular amount. For example, in our sample there were only 2 SHGs that saved INR 5 instead of INR 10.

Given the successful initial operation for six months, the SHG becomes eligible for opening a bank account and the seed money in the form of Initial Capitalization Fund (ICF) of INR 50,000-75000 (\$ 800- \$ 1,100) is deposited in the group bank account by JEEViKA to be used among the group members for inter-loaning purposes. Besides, JEEViKA also facilitates in bank linkage of the SHG through which the group gets an extra line of credit of around INR 60,000 (\$ 900) from the local bank. Simultaneously, this also leads to the federation of SHGs into a Village Organization (VO) which generally consists of 8 to 15 SHGs and requires a monthly meeting of all 3 representatives of each member SHG. The Village Organization (VO) provides village

level support for successful operation of all the linked SHGs by offering a platform for the SHG representatives to discuss and share their experiences related to management, resource building and challenges of their respective SHGs. Around 20-40 VOs are then further federated into a Cluster Level Federation (CLF) that strengthens and supports the VOs, provides credit to VOs, liaisons with banks and markets and helps in assuring entitlements for the VOs. Sustaining these communities based organizations like SHG, VO and CLF under community ownership and participation is the long term objective of JEEViKA program.

The first level of group support to all the participating women comes from the SHG where weekly financial operation of each SHG depends on the weekly savings of the members, the seed money (ICF) and the bank linkage. This provides smooth loaning process where the loan amount varies based on the credit demanded by different members of the SHG. The terms and amount of loans are democratically decided among the group members and the Community Mobilizer (CM), who is a non-member of the concerned SHG working for maintaining the accounts and records of operation. In case, loans of higher amount are demanded by any member and the demand is found to be reasonable, the elected leaders of the group may put a request before the VO stating the details. The higher amount of credit may then be provided by the VO itself or in collaboration with the CLF.

The primary and initially most attractive advantage of this program is an easy access to credit with more flexible repayment terms at much lower interest rates compared to the prevailing market rate. The interest rates for the loans are based on the urgency and purpose of the loan. For example, the normal credit for any private purposes,

including business or other personal reasons, carries an interest rate of 2 % per month but for health purposes the credit is availed at only 1% per month under Health Risk Fund (HRF). For ensuring food security at the household level, the project offers credit without charging any interest and generally the loan for such purposes is availed by providing the food grains bought from the market by the SHG members themselves. Half of the interest earned from all these loans is retained in the group and another half is forwarded above to the Village Organization (VO).

Other benefits are given in terms of skill development, crop insurance, technologically-driven agricultural intervention and support, life insurance, maternal benefits and facilities and group support from other SHG members in times of panic and need. Also, there are many other intangible benefits of the program like higher social exposure, more financial knowledge, group unity and cooperation which can help women to feel a sense of empowerment. The outreach and flexibility of the program can be understood by its multiple interventions in number of areas related to health, microfinance and livelihood generating activities which are done to meet its primary objective of encouraging stable livelihoods and engendering social change.

Thus, the JEEViKA program can be easily summarized as being an institutional platform of SHGs and federation (VOs and CLFs) through which two primary activities, that is, livelihood enhancement and vulnerability reduction, are conducted with intensive community mobilization and continued participation. On the one hand, the livelihood enhancement segment mainly consists of three broad operations, that is, financial inclusion, productivity enhancement and market access, while on the other hand, the vulnerability reduction component ensures access to government based entitlements, food

security and health and nutritional security. The project is equipped with more than 5000 staffs who look after both these operations with a purpose of providing multi-directional methods of capacity building to the vulnerable population to establish and empower sustainable and independent Community Based Organizations (CBOs) like SHGs, VOs and CLFs in the long run.

B. Potential link between JEEViKA and Mental Health

As we discussed in the literature review section of chapter 2, the existing epidemiological and other studies related to mental health suggest there are multiple factors that play deterministic role for the mental health of an individual. Apart from the hereditary, physical health or biological differences of an individual, we find that the economic and social context contribute quite significantly to the mental health status. In the previous section, we also learned that JEEViKA has two important components, that is, livelihood enhancement and vulnerability reduction. So, if we break down the activities and operations conducted under these components, we can find several channels through which JEEViKA can impact mental health.

Firstly, there is no denying to the fact that if communities are given broader space to perform for their own development with the infrastructural support and monetary assistance from the government then the transition towards a sustainable social development becomes smoother and easier. As noted by Mansuri and Rao (2012), community participation in decision making in development process builds capacity for self-reliance and collective action, that is sometimes also called as “social capital”. The inherent part of such community participation process is the building of social capital

which has been defined by Putnam (1996), as “the features of social life — networks, norms, and trust — that enable participants to act together more effectively to pursue shared objectives”. JEEViKA, through its operations of creating self-sustaining community-based organizations, is indeed trying to build social capital. The federated structure of SHG, VO and CLF utilizes the networks, norms and trust and such process of building social capital has been found to improve one’s capability, health and well-being (Thoits, 2011; Nussbaum, 1998, 2000; Alkire 2002; Robeyns 2003a).

Secondly, JEEViKA provides the SHG members a better capability by offering multiple opportunities of leadership and several benefits related to the social aspects of their lives. The very fundamental rule for participation in JEEViKA is for women to meet every week and save a small amount of money to contribute in the group as a weekly saving. Such meetings promote discussion among women which generally includes, and not limited to, talking about personal and social issues. The necessary group meeting coupled with regular savings every week inculcates discipline and requires women to go out from the house at least once a week. In a patriarchal society it is extremely empowering for women to come out of their homes and talk on the matters related to the financial and social aspects of their lives. This can lead to greater autonomy and agency and it should have positive effect on the mental health as it would make women stronger and more confident from within to deal with a number of issues they face in their lives. Also, there is scope of leadership for women who want to lead and represent their SHG at a bigger platform. This is an example of a concerted effort towards social inclusion of women, encouraging their participation in mainstream social activities, which may have positive effect on their mental health (Adler, N. E., & Ostrove, J. M., 1999; WHO, 2005).

Thirdly, we must look at multiple other livelihood-based interventions of JEEViKA that also secure and to some extent enhance the financial capability of its members. For example, skill development programs or job fair for both the SHG members and male members of their household, crop insurance or farming assistance, providing training and financial support for starting small business are some of the most famous JEEViKA interventions among its members. Then they also get other incentives in terms of cheaper credit access for different purposes that include fulfilling the food supply, meeting the medical needs, covering small losses or indispensable expenses or investing in any small business or profit making initiative. Not only do these activities help the women financially to take care of their personal expenses, but they also make them more aware about financial transactions, bargaining with the existing market powers and understanding the market forces at the local level. This can lead to their broader understanding of business and employment which may lead to better economic prospects for them in multiple ways. Higher economic security, in such cases, can be considered a possible outcome that can also be expected to improve mental health, as mentioned in the literature review section while mentioning the interplay between socio-economic status and mental health.

Fourthly, there are some other operations of JEEViKA under the strategies for vulnerability reduction that directly cater to the health related needs of the members and their families. For an instance, helping in securing access to entitlements related to food security and job opportunities offered by the government and providing constant food supply through the interest-free loans can also have positive effect on mental health status. Nutritional support and awareness, especially to pregnant women and lactating

mothers, is another vital part of vulnerability reduction approach. The pregnant women or lactating mothers receive healthy food at much lower price that helps them to lead a healthy lifestyle. Then, for all the SHG members, faster credit access with special provision for health, referred as Health Risk Fund (HRF), can be expected to provide better quality of health care in less time. Such types of loans and facilities greatly enhance the affordability of women to access health care and health related benefits.

It is true that most of these interventions can be expected to have heterogeneous impact on JEEViKA members depending on the personal agency, ability and other characteristics of women to take advantage of the available opportunities. For an instance, the SHG leaders can be thought of being more agentic and outreaching who would be able to draw much more benefits from the same interventions than a regular member of the SHG. Even though the program allows equal opportunity for all SHG members to act upon the offered opportunities yet one can expect varying response and enthusiasm from the members depending upon their ability to take benefits in their stride. Also, considering the high number of SHGs and the members, it can be argued that the multiple types of support being provided through JEEViKA are not necessarily sufficient and uniform across all SHGs. Similarly, many other arguments like loss in interest and enthusiasm of members towards JEEViKA, failure of JEEViKA in fulfilling higher expectations and aspirations of members etc. which may also present a case of mixed or adverse impact of JEEViKA on mental and emotional health; and that's why it becomes increasingly important to investigate the potential links that we hypothesize here on the basis of existing studies and JEEViKA operations in this context.

CHAPTER FOUR

EXPERIMENTAL DESIGN

A. Sample Design

Since the project was already rolled out in 2007 in a non-randomized fashion therefore quasi-experimental analysis could only be performed to find the effect of the program. In using such method, we try to reduce the selection bias between the treatment and the control group as much as possible. Here, we define the control and treatment group on the basis of time of exposure to the program. For an example, the villages where the program is active for 3-6 years have been considered as a high exposure village or the treatment group compared to the control group or low exposure villages, having been either newly introduced to the program or for less than a year.

Based on the conditions required for the study, 200 high exposure villages and 163 low exposure villages fulfilled the criteria for village selection for this study. We got these 363 villages from the restricted sample of districts where we could find both the high and low exposure villages. These villages were under the regular supervision by the monitoring and evaluation (M&E) team of JEEViKA that ensured the absence of any external intervention by any other organization or development program that could affect the project outcomes. For the calculation of average treatment effect on treated (ATT) at the village level, the treatment and control group villages should be matched by their observational demographic features that could have impact on the program treatment selection and the outcome (mental health). As known from the project operational strategy, we used the same variables to match our treatment and control villages that the project uses to select a village, as given in Table 2. Hence, out of these 363 villages, the

observational demographic variables (Table 2), like size and population of village, number of SC and ST households, female and male literacy rate along with employment etc. were finally used from the Census, 2001 to get 146 villages with 80 treatment and 66 control groups, matched on the basis of propensity score. We used Indian Census 2001 data because we wanted to match the villages on the basis of pre-treatment features that JEEViKA program also uses for villages selection. The OLS and logistic regression of the treatment status on these village level variables is given in Table 7 and 8 respectively. Table 7 shows there is no significant difference between treatment and control group on the given variables. Table 8 presents the logistic regression through which we have calculated the propensity score. The test of mean difference and standardized difference for the total 146 villages between the treatment and control groups for these variables are provided in Table 1 below.

Table 1: Test of mean difference in 146 villages of treatment and control groups

Variables	Treated Mean	Untreated Mean	P Value	Standardized diff.
Average mental health score	18.17	18.09	0.795	0.043
Number of households in village	457.91	662.74	0.012**	-0.415
Total population in village	2705.82	3853.86	0.011**	-0.419
SC population in village	583	814.06	0.033**	-0.346
ST population in village	1.58	13.33	0.096*	-0.264
Percent females literate in village	0.23	0.22	0.701	0.064
Percent population working in village	0.37	0.38	0.759	-0.051
Percent females working in village	0.25	0.25	0.852	-0.031
Percent workers main workers in village	0.74	0.76	0.325	-0.167
Percent working females main workers in village	0.49	0.51	0.566	-0.096

Besides the OLS regression of Table 7, in terms of simple mean difference, we find that the treatment and control villages don't have significant mean difference on maximum of the variables, except the four variables i.e. the number of households, total population, percent SC population and percent ST population. These differences exist because of the situational constraints on the field that forced us to drop some earlier matched villages and thus extra villages were included in the data collection process that compromised our full matching quality. Therefore, in our further analysis, we again use the PSM method on these 146 villages while we try to reduce the standardized differences by utilizing several matching, stratifying and weighting techniques to get the robust estimate of the Average Treatment Effect on Treated (ATT). We discuss these methods in detail in the section of empirical strategy.

After the selection of these 146 villages, the experimental data collection was done in these villages during 2013-2014 by a group of 6 experimenters and 2 operational supervisors, including the author. During this data collection process, firstly, three SHGs were randomly selected out of all SHGs existing in a village. Then, from each SHG, 3 leaders were automatically selected and other 3 members were again randomly selected from the remaining members of the group. Thus, on an average, from each village 18 members of total 3 SHGs participated in the interview with the experimenters in a day. The experiments were then conducted at the respective homes of the respondents or at a place where they could discuss in a calm environment without any interruption. Before the interview, the respondents were already instructed about the duration and type of experiments or discussion they would be participating in. Before starting the process of talking and collecting data, all respondents of each SHG were also informed about a

complimentary gift that would be offered to them after the interview for their kind participation.

B. Empirical Strategy

We use two methods of analysis for analyzing the effect of JEEViKA program on mental health. We start with estimating the following base regression function:

$$Y_i = \alpha + \beta * JEEViKA + \delta * X_i + \varepsilon_i$$

where y_i is a measure of mental health and the primary explanatory variable of interest is JEEViKA, the binary variable indicating the treatment or high exposure. So we are interested in estimating and testing the statistical significance of beta (β). However, as discussed in the preceding section, our data is not generated by the method of Randomized Control Trials (RCT). Therefore, to interpret beta as treatment effect of JEEViKA, we discuss the methodology below for constructing a suitable counterfactual or comparison group.

Average Treatment Effect (ATE) is given by, $ATE = E[Y(1) - Y(0)]$, where we find the difference between expected value of outcome of treatment group, $Y(1)$, and control group $Y(0)$. Heckman (1997) notes that finding Average Treatment Effect (ATE) is less relevant for project analysis purposes as it accounts for the effect on those individuals also for whom the project was not intended. In this study, we estimate, Average Treatment Effects on Treated (ATT) given by, $ATT = E[Y(1) - Y(0)|D = 1]$, where D is a treatment indicator with values $D = 1$ for the treatment group and $D = 0$ for the control group. But here we cannot observe $E[Y(0)|D = 1]$, that is, the untreated outcome of treated individuals. So in the absence of clear counterfactual, we try to create one that could ensure the exogeneity of treatment assignment in the second best way.

Hence, we estimate ATT by using the technique of propensity score matching method in which we construct as good counterfactual as possible. This method is derived from the following relationship between ATT and ATE:

$$\begin{aligned}
 ATE &= E[Y(1) - Y(0)] = E[Y(1)|D = 1] - E[Y(0)|D = 0] \\
 &= E[Y(1)|D = 1] - E[Y(0)|D = 1] + E[Y(0)|D = 1] - E[Y(0)|D = 0] \\
 &= E[Y(1) - Y(0)|D = 1] + E[Y(0)|D = 1] - E[Y(0)|D = 0] \\
 &= ATT + Selection\ bias
 \end{aligned}$$

Here random assignment of treatment ensures equality of ATE and ATT under no selection bias, that is, there is no difference between the untreated outcome of individuals from both treatment and control group, which ensures that if individuals would have been non-treated then their outcomes from both groups would have remained same. Therefore, for finding an objective causal inference, Rubin (2008) suggests to design observational studies in such a way that it approximates randomized trial.

Propensity score method, proposed by Rosenbaum and Rubin (1983) and Heckman and Todd (1985), is a quasi-experimental approach to deal with the non-randomization of the selection of the treatment. Under this method, we try to reduce the selection bias by using the already known process of treatment selection or observed covariates for constructing a counterfactual. For example, if it is known that the treatment units are selected on the basis of certain observable variables, then for each treatment unit we can find and match it with the similar value for the same variables in the control units, providing us with a matched pair for comparison. This essentially tries to make sure that the control group villages were as likely to be treated as the treatment villages. The reason behind such methodological process is that the difference in outcomes (mental

health scores) of participants between the treatment group villages and adequately matched control group villages can be then attributed to the treatment assignment (high exposure of JEEViKA).

We have employed the same retrospective propensity score matching (PSM) method which is also adopted by Datta (2013) to find out the socio economic impact of the JEEViKA project. Propensity score based analysis requires three assumptions to be satisfied. Firstly, the strongly ignorable assumption implies that the distribution of covariates are same between the treatment and control group, conditional on the balancing scores. Here propensity score, the probability with which a village is selected for treatment on the basis of covariates, works as the balancing score, expressed as, $e(X) = P(D = 1 | X)$. So, this assumption suggests that, given the observed set of covariates X , it is strongly ignorable when these covariates are combined into propensity score or $e(X)$. In equation form it can be written as: $D \perp\!\!\!\perp X | e(X)$. It means that the pre-treatment variables (X) are balanced across the treatment and control groups given the propensity score $e(X)$.

Secondly, the common support condition requires the overlapping of treatment assignment probability for both the treatment and control groups between bounded value, that is, $0 < e(X) = P(D = 1 | X) < 1$. In our study, this assumption ensures that the villages of both treatment and control groups with same observed covariates have equal and positive opportunity of treatment assignment.

Thirdly, unconfoundedness or conditional independence assumption signifies that the treatment assignment is independent of the outcome conditional on observed covariates, that is, $(Y(1), Y(0)) \perp\!\!\!\perp D | X$. If these three assumptions are satisfied, then the

specification is : $ATT = E[Y(1) - Y(0)|D = 1] = E[Y(1) - Y(0)|D = 1, e(X)]$

Multiple methods like stratification, matching and weighting of propensity score have been suggested in literature to reduce the confoundedness (Austin, 2011). So we have calculated ATT by employing widely used methods like normal nearest neighbor matching both with and without replacement, stratification based nearest neighbor matching and inverse probability weighting (IPTWT) under double robust (DR) method. All analysis is done with fulfilling the common support condition and balancing condition, where the quality of covariate balance has been shown in each case separately by standardized differences.

The PSM analysis is done at the village level where we match the groups on the village level characteristics, pre-treatment covariates (X), obtained from the Census, 2001 and compare on the outcome variable obtained from the experimental data collected by us. We intend to show the robustness of our results under these several methods with an aim of bias reduction, that is, lower standardized differences on all covariates between the treatment and control groups along with lower standard error of the coefficient of causal estimate, ATT. Results are documented and discussed in the next chapter.

Besides other limitations of the PSM estimation, another downside of this approach of village level analysis for our study is that we are not able to use the individual level variables related to the background and other characteristics of the respondents. So, we take 66 pairs of villages matched by the nearest-neighbor matching method without replacement where we used the same variables for matching that we used before in propensity score analysis. Here the idea is to get the maximum perfect pair of control and treatment villages after dropping the villages with extremely high or low

propensity score. Since the number of control villages was only 66 while that of treatment villages was 80, we dropped the extra 14 treatment villages which were not matched, owing to their very high or low propensity score.

We use individual level variables of 66 pairs of villages and we cluster the error terms by each village accounting for intra-village correlation among the individuals. From Table 6, we find that even after matching these 66 pairs of villages there is significant difference between control and treatment villages for 4 variables: age, possess land in her name, number of families living together in one house and husband lived away after marriage. So in our regression, we included the first three variables as the independent variable to control for any effect they might have on mental health. However, we don't use the variable husband lived away after marriage as the independent variable. It is because the correlation between the treatment and the variable signifying husband lived away after marriage is high with significantly less migration in treatment villages which indicates that the JEEViKA program might be reducing the migration.

In the right hand side of the regression equation, we use demographic variables as the explanatory variables that may have impact on mental health but are independent from the treatment selection and operation. The dependent variable, mental health score is the summation of the response given by each respondents for each of the 8 mental health question, as mentioned in the following section. The mental health score variable, takes values from 8 to 32 where higher score indicates lower mental health status. Though, it is a count variable bounded between two values, yet OLS estimation can be adopted considering that there is no discontinuity in the distribution of mental health score as shown in Graph 1. Basic statistics of mental health score is shown in Table 9.

B.1. Measuring Mental and Emotional Health

The experimental survey instrument consisted of the questions related to the respondents' background, recurrence of feeling of depression and their status related to the decision making abilities, their views on social and political environment around them, and their activities apart from the SHG etc. The questions on mental health were asked as per the framework suggested by National Institute of Health (NIH) which has been widely used in many studies. For example, the Langberg survey (1999) used by Case (2004) to study the socio economic impact on the health status in South Africa also contained the same questions to capture the mental health of individuals. There were 8 questions on the basis of which a mental health score is created as per the response, where higher mental health score indicates worse status of mental health. Each respondent was asked in the same order as given below about how often in the past week they

- felt that they could not stop feeling miserable
- felt depressed
- felt sad
- cried a lot
- did not feel like eating
- felt that everything was an effort
- experienced restless sleep
- felt they could not get going

The response for each question was coded under four categories: 1, if the answer

was none of the days; 2, if the answer was one or two days in a week; 3, if the answer was three or four days a week; and 4, if the answer was between five to seven days a week. Then, mental health score was calculated by adding the response for each of 8 questions that ranged from 1 to 4. So, for each individual, mental health score, indicated by the variable *mhscore*, ranges from minimum value of 8 implying highest mental health status (no feelings of depression on any days of week in any of the 8 cases) to maximum value of 32 implying lowest mental health status (feelings of depression on 5-7 days of week in all 8 cases). Village level analysis under PSM method requires mental health score at the village level, so we created another variable, *avgmhscore*, that captured the average mental health score calculated by taking the mean of the individual scores of all the respondents for every village.

CHAPTER FIVE

RESULTS AND FINDINGS

5.1 Propensity Score Based Findings

From the propensity score method, our results suggest that, on an average the JEEViKA program has no significant effect on the mental health of the beneficiaries (Table 13, 15, 20 and 21). This result is robust to different methods of matching, weighting and stratification methods utilizing propensity score. While using normal nearest neighbor matching method, we estimated ATT both with and without replacement (Table 12 and 14). Here, using 5 neighbors with replacement, which is widely used method in practice, gives us lower standardized difference and standard error compared to the estimation on 60 pairs without replacement under common support. The results are statistically insignificant in both methods.

Stratification method, suggested by Rosenbaum and Rubin (1983a), follows the same strategy of nearest neighbor matching, but now it is done under each block separately where the suitable number of blocks are created on the basis of quantiles of estimated propensity score. The balance test is also done for all covariates for each of blocks separately and we find that all the covariates are balanced in all 4 blocks created. Table 17, 18 and 19 show the propensity score distribution and the stratification blocks, where we lose only 6 control villages that fell in block 1 without any treatment village. In this method, both the standardized difference and standard error of estimation is higher than the normal (without stratification) nearest neighbor matching with replacement (Graph 6). Though, the results still remain statistically insignificant (Table 20).

Another widely accepted, double robust (DR) with inverse probability treatment weighting (IPTWT) method has also been adopted. Under IPTWT method (Hirano et al, 2000, 2001) treatment villages are weighted by $1/e(X)$, and control villages are weighted by $[1/[1 - e(X)]]$, that is each unit is weighted by the inverse of their probability of treatment which ensures unconfoundedness between the newly created inverse-treatment-probability-weighted units and covariates. But under DR method, hidden selection effects of confounding is further adjusted by combining inverse probability weighting with regression adjustment which increases efficiency of the estimator as well as solves the problem of misspecification (Lunceford et al (2004); Emsley et al, 2008). The benefit of this method is that it requires correct specification of either the postulated propensity model or the regression model under the assumption of no unmeasured confoundedness. It is to be noted here that the weights are normalized here to sum to 1 before balance checking. Under DR method, we find the lowest standardized difference (Graph 7) between the variables of treatment and control groups with lowest standard error of estimation (Table 20). Results are however still statistically insignificant (Table 21) too.

5.2 OLS Based Findings

From the OLS analysis, we have got four major results. First, in Table 12, we see that the coefficients for the treatment indicator and for the socially disadvantaged groups are insignificant; but for the interaction variables of treatment with age and with the binary variable for socially disadvantaged groups, their corresponding coefficients are negative and significant at 1% and 5% level of significance respectively. Here positive (negative) coefficients signify negative (positive) impact on the mental health. These

results are very interesting and suggest that, if all its members are considered together then, although, the JEEViKA program does not seem to have any significant impact on the mental health on an average, but it is working quite well for relatively older members and socially disadvantaged groups by improving their mental health significantly. Such results demonstrate heterogeneous impact of JEEViKA on its members where the more vulnerable groups tend to be more comforted in terms of their mental health.

Examining these results further and looking at the OLS coefficients of treatment and of its interaction with age and social disadvantaged group, we find that JEEViKA contributes positively towards better mental health as the age of respondent increases. The coefficients of interaction variable of treatment with age and socially disadvantaged groups lead us to say that, in general, JEEViKA positively improves mental health of all the older women but for the socially disadvantaged individuals, it is true for the women of younger age also. It is mention worthy here that around half of our total sample consists of women younger than the age of 35 and three quarters are below the age of 44 (Table 10), Hence, the most wonderful aspect of this finding is that the relatively younger women, even after getting no improvement in their mental and emotional health, yet contribute and keep the program running that is largely benefitting more to the older and socially disadvantage population in terms of mental health. Here, JEEViKA is being a magnificent example of a program that is building truly inclusive and accommodative social institution.

There can be multiple reasons behind overall insignificant impact of JEEViKA. It might be possible that the project operation in high exposure villages has become more intense due to various number of vertical interventions, requiring greater engagement

from the women members. Due to the higher productivity and opportunity costs, greater aspiration or better capability to respond, the members of relatively younger age groups and higher social status probably face a lopsided higher burden. Such increased burden could lead women to be caught between obligations of JEEViKA work and their personal or family related duties which might further cause increasingly recurrent thoughts of helplessness and anxiety, especially under patriarchal family structure. Hence, such negative feeling among younger cohorts of SHG might cancel out the positive effects on older and disadvantaged people and thus leading to overall insignificant result on an average. However, anything cannot be stated with certainty about this result, but the reasons like these do seem to be compelling under given activities performed by ever-expanding JEEViKA in high exposure villages.

But it is critically important to mention here that the village level analysis by PSM method presented in previous section also showed no significant impact of JEEViKA on mental health. So, the studies that have argued for better mental health status under credit access and socio-economic empowerment seem to have found support under certain member groups of JEEViKA only, but it still remains puzzling why the overall effect on an average would be insignificant. The operational activities of the project along with its aims and objectives give credence to the expected positive relationship on the mental health but there seems to be some gap in materializing the effect on important individual outcomes. Inadequate support and focus towards the mental health of a woman in JEEViKA can be a valid reason but there are some other challenges that the younger women in treatment villages tend to face more often than the control villages, which is dominating the positive changes.

Another possible reason behind insignificant effect of JEEViKA would be non-seriousness or irregular attendance of members in the meeting. During the data collection process, we came across a good number of cases where in some SHGs women were not very regular in the meeting or other activities, even though they were able to fulfill other obligations of savings etc. This becomes quite prevalent in the crop growing or harvesting season when the SHG meeting used to be ignored by some of the members of JEEViKA due to time constraints. This type of trend would lead to insignificant treatment difference between high and low exposure villages and that's why the difference in expected outcomes may also be expected to be insignificant.

As the second result, we find the positive contribution of education and negative effect of increasing age towards the mental health of individuals, irrespective of JEEViKA treatment. This is quite consistent with the literature also found by several other studies. But we also find evidence of positive contribution of leadership roles at SHG, having any child and being married and living with husband leading to improved mental health status. It is again quite intuitive and encouraging to find such impact that probably underscores the importance of confidence and mental peace coming from the leadership role at JEEViKA and from having a child with a happy married life.

Thirdly, even though we find having at least one child improves mental health yet quite surprisingly we find statistically significant and adverse impact of JEEViKA on the mental health of women who at least have one child, captured by the positive coefficient of the interaction variable of treatment and having a child. This may be attributed to the fact that younger women compared to older ones generally worry more about the future of their children who also happen to be young. Quite possibly, younger women with a

child/children might not be taking full benefits of JEEViKA as it requires them to invest time and efforts to earn any direct monetary rewards from JEEViKA while they are already pressed with giving time to their children and family. Our previous results also showed that the high exposure of JEEViKA seems to have no significant positive impact on the mental health of relatively younger women compared to the older ones, so it might be corroborative restatement of the same result where having any child generally improves mental health for all except younger women in high exposure villages.

Our fourth result deals with the negative factors where we find that having suffered any economic loss in past one year and parents living in the same panchayat (same locality) are contributing towards lower mental health of the respondents. The negative effect of any economic loss on mental health is quite obvious and expected but having parents living in same panchayat leading to lower mental health status of SHG members tells about the role of family related anxieties in the daily lives of the women. This can be interpreted in many ways but the prominent reason seems to be the increased worry of rural females about their parents living nearby that enables them to visit or know about their parents' well-being on a more frequent basis. This adds to their day-to-day worries they face at their home or in-laws place, rendering them more anxious and less productive.

CHAPTER SIX

CONCLUDING REMARKS

JEEViKA, on an average, turns out to have no significant effect on mental health when all women members are considered together, but with increasing age and for socially disadvantaged members, we find strong positive effect. This seems to be a remarkable achievement for a program like JEEViKA to have countered the negative effect of age and social disadvantage on the mental health. At the same time, the varying impact of JEEViKA on different community groups implies that there exist some procedural, infrastructural or operational lacunae that is inhibiting the project from translating socio-economic empowerment to better mental health status for all.

This study stands out as the first investigative analysis that uses experimental data of a large sample size to measure the impact of a large scale, multi-dimensional, community-driven development program on the mental health of beneficiaries. But the analysis is not done under the method of Randomized Control Trials (RCT), generally considered the gold standard for program analysis. Therefore, this study also shares the problems prevailing among observational studies which construct an ideal counterfactual relying on observable variables. Even though, we controlled for observational demographic characteristics that the program uses to select a village, yet there can be many other factors that could impact the outcome leading to the selection bias. Some observable and unobservable determinants of mental health that could lead to different outcomes among treatment and control villages could stem from any of the economic and social context like village distance from the nearest town or administrative block, presence of government run health centers or schools, better village infrastructure in

terms of roads, irrigation and electricity, more discriminatory attitude of upper class and upper caste village population against lower caste, environmentally more vulnerable village etc. Even though the population we are doing our comparison on belong to extremely poor group due to the targeting strategy of JEEViKA, yet these variables that affect socio-economic background and economic opportunities available to the village population can bring significant differences between our treatment or control group which we are not controlling for. The effect can be in any direction depending on which group gets significant imbalance. However, in our individual level analysis through OLS, we are able to control for most of the individual level heterogeneity yet we fail to capture many other factors that could have influenced the outcome.

It can also be stated that we have used only one method of capturing mental health while other epidemiological, psychological and anthropological studies employ different and multiple methods. For example, Fernald et al (2008) used Center for Epidemiological Studies – Depression (CES-D) Scale and Cohen’s Perceived Stress Scale to capture mental and emotional health. As common in the studies based on self reported feelings and health status, the results sometimes seem to be influenced by the method we capture the variable of interest. We would welcome such future studies which would utilize multiple methods of measuring mental health possibly leading to more robust results.

It is extremely crucial to understand the subjective changes that a development program can bring and the current status of developing countries regarding the mental health of its population is quite abysmal. We tried to analyze the effect of a multi-dimensional anti-poverty program that constantly engages community in the decision

making process to empower them and we found its promising and positive impact on the mental health of more vulnerable or needy communities, even though the overall effect still remains unexciting. This can embolden the policy makers to pursue a more balanced approach when designing a development policy and to consider simultaneously the mental and emotional well-being of individual beneficiaries as an important indicator for measuring the success of the program. We welcome further research that could deal with the empirical issues faced in this study and a better design of JEEViKA with a reoriented focus on mental health can support the evolving body of literature in this area of analysis.

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APENDIX

Table 2: Variables used to match villages with definitions (Source: Census, 2001)

Variable name	Variable definition
no_hh	Number of households in village
tot_p	Total population in village
p_sc	SC population in village
p_st	ST population in village
pctflit	Percent females literate in village
pctwork	Percent population working in village
pctfwork	Percent females working in village
pctmainwork	Percent workers main workers in village
pctfmainwork	Percent working females main workers in village

Table 3: Other variables and their definitions (Source: Experimental survey data, 2013)

Variable name	Variable definition
avgmhscore	Average mental health score for a village
hexpos	Treatment indicator for high exposure
mhscore	Mental health score of individual
Age	Age
education	Education level
Leader	Leader in SHG = 1 or Non-leader = 0
married	Married = 1, Widowed, Divorced or Separated = 0
muslim	Muslim = 1 or Non-muslim = 0
Scebc	Socially disadvantaged group (SC/EBC) = 1, else = 0
Loss	Economic loss in last one year = 1, No loss = 0
pgram	Parents living in same gram panchayat = 1, else = 0
child	Have at least one child = 1, else = 0
Land	Possess land in her name =1, else = 0
nofamily	Number of families living together in one house
amaway	Husband lived away after marriage = 1, else = 0
hexposage	Interaction variable between treatment and age
hexposedu	Interaction variable between treatment and education
hexposlead	Interaction variable between treatment and leader
hexposmarried	Interaction variable between treatment and married
hexposmuslim	Interaction variable between treatment and muslim
hexposscebc	Interaction variable between treatment and socially disadvantaged group
hexposloss	Interaction variable between treatment and economic loss in last year
hexpospgram	Interaction variable between treatment and parents living in same gram panchayat
hexposchild	Interaction variable between treatment and having at least one child
hexposland	Interaction variable between treatment and having land in her name
hexposnofamily	Interaction variable between treatment and number of families living together
hexposamaway	Interaction variable between treatment and husband lived away after marriage

Table 4: Summary statistics of village level variables (Total 146 villages)

Variables	Obs	Mean	Std. Dev.	Min	Max
Treatment indicator for high exposure	146	0.547945	0.499409	0	1
Average mental health score	146	18.13309	1.929279	13.38889	23.05882
Number of households in village	146	550.5068	496.9532	13	2732
Total population in village	146	3224.801	2758.983	131	14337
SC population in village	146	687.4521	659.7537	0	3909
ST population in village	146	6.890411	42.69154	0	353
Percent females literate in village	146	0.226316	0.097033	0.041667	0.584492
Percent population working in village	146	0.372957	0.082546	0.222029	0.727273
Percent females working in village	146	0.247727	0.13737	0.016173	0.633803
Percent workers main workers in village	146	0.750303	0.153631	0.196911	1
Percent working females main workers in village	146	0.499667	0.277038	0	1

Table 5: Summary statistics of individual level variables (66 pairs of matched villages)

Variables	Obs	Mean	Std. Dev.	Min	Max
Treatment indicator for high exposure	2360	0.497458	0.5001	0	1
Mental health score of individual	2347	18.18364	5.922987	8	32
Age	2360	36.66822	10.73349	15	90
Education level	2359	1.859262	3.316578	0	15
Leader in SHG	2360	0.432203	0.495487	0	1
Married	2360	0.958051	0.200516	0	1
Muslim	2360	0.094492	0.292573	0	1
Socially disadvantaged group (SC/ST/EBC)	2360	0.612712	0.487234	0	1
Economic loss in last one year	2345	0.646482	0.478164	0	1
Parents living in same gram panchayat	2316	0.069085	0.253653	0	1
Have at least one child	2356	0.971986	0.165047	0	1
Possess land in her name	2359	0.101738	0.302368	0	1
Number of families living together in one house	2358	1.841815	1.140156	1	10
Husband lived away after marriage	2356	0.607385	0.488436	0	1

Table 6: Test of mean difference for individual level variables between treatment and control groups (66 pairs of matched villages)

Variables	Treated Mean	Untreated Mean	P Value
Mental health score of individual	18.2	18.16	0.854
Age	37.86	35.46	0***
Education level	1.84	1.88	0.755
Leader in SHG	0.43	0.43	0.84
Married	0.96	0.97	0.209
Muslim	0.09	0.1	0.763
Socially disadvantaged group (SC/ST/EBC)	0.61	0.61	0.944
Economic loss in last one year	0.63	0.66	0.195
Parents living in same gram panchayat	0.07	0.06	0.441
Have at least one child	0.97	0.98	0.396
Possess land in her name	0.11	0.09	0.037**
Number of families living together in one house	1.78	1.91	0.004***
Husband lived away after marriage	0.54	0.68	0***

Table 7: OLS regression of treatment status on village-level characteristics (146)

VARIABLES	Treatment indicator for high exposure
Number of households in village	4.55e-05 (0.000742)
Total population in village	-3.72e-05 (0.000136)
SC population in village	-3.28e-05 (0.000103)
ST population in village	-0.00134 (0.00101)
Percent females literate in village	0.163 (0.494)
Percent population working in village	-0.628 (1.943)
Percent females working in village	0.267 (1.165)
Percent workers main workers in village	-0.438 (0.478)
Percent working females main workers in village	0.143 (0.264)
Constant	1.063* (0.567)
Observations	146
R-squared	0.066

Standard errors in parentheses
 *** p<0.01, ** p<0.05, * p<0.1

Table 8: Logit regression of treatment status on village-level characteristics (146 villages)

VARIABLES	Treatment indicator for high exposure
Number of households in village	0.000112 (0.00308)
Total population in village	-0.000141 (0.000562)
SC population in village	-0.000180 (0.000458)
ST population in village	-0.00812 (0.00737)
Percent females literate in village	0.677 (2.073)
Percent population working in village	-2.631 (8.104)
Percent females working in village	1.066 (4.885)
Percent workers main workers in village	-1.989 (2.067)
Percent working females main workers in village	0.643 (1.104)
Constant	2.486 (2.397)
Observations	146

Standard errors in parentheses
 *** p<0.01, ** p<0.05, * p<0.1

Table 9: Summary of mental health score at individual level:

	Percentiles	Smallest		
1%	8	8		
5%	9	8		
10%	10	8	Obs	2347
25%	13	8	Sum of Wgt.	2347
50%	18		Mean	18.18364
		Largest	Std. Dev.	5.922987
75%	22	32		
90%	27	32	Variance	35.08178
95%	28	32	Skewness	0.137779
99%	31	32	Kurtosis	2.21994

Table 10: Age distribution of full sample (66 pairs of villages)

		Age		
	Percentiles	Smallest		
1%	19	15		
5%	22	16		
10%	25	16	Obs	2360
25%	29	17	Sum of Wgt.	2360
50%	35		Mean	36.66822
		Largest	Std. Dev.	10.73349
75%	44	70		
90%	50	73	Variance	115.2078
95%	58	80	Skewness	0.710379
99%	65	90	Kurtosis	3.328958

Table 11: Age distribution of only socially disadvantaged group (66 pairs of villages)

		Age		
	Percentiles	Smallest		
1%	19	15		
5%	21	16		
10%	24	17	Obs	1446
25%	28	17	Sum of Wgt.	1446
50%	35		Mean	35.84647
		Largest	Std. Dev.	10.62001
75%	42	70		
90%	50	70	Variance	112.7847
95%	56	70	Skewness	0.743931
99%	65	80	Kurtosis	3.271218

Graph 1: Histogram of mental health score at individual level:

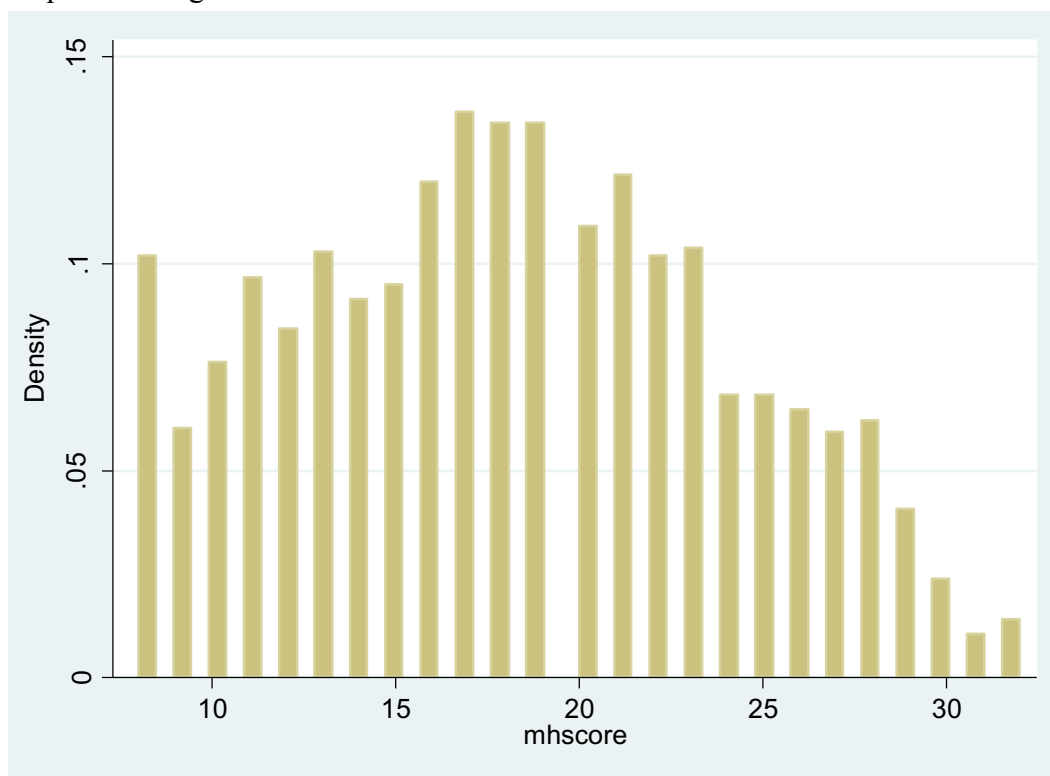


Table 12: OLS estimate of the mental health score on individual variables (66 pairs of matched villages with errors clustered at village level)

VARIABLES	Mental health score of individual
Treatment indicator for high exposure	1.613 (1.120)
Age	0.0941*** (0.0160)
Education level	-0.211*** (0.0522)
Leader in SHG	-0.668** (0.331)
Married	-3.178*** (0.908)
Muslim	0.554 (0.611)
Socially disadvantaged group (SC/ST/EBC)	0.497 (0.337)
Economic loss in last one year	2.132*** (0.370)
Parents living in same gram panchayat	1.435* (0.800)
Have at least one child	-2.377** (1.044)
Possess land in her name	-1.021 (0.669)
Number of families living together in one house	0.139 (0.133)
Interaction between treatment and age	-0.0660*** (0.0226)
Interaction between treatment and education	-0.0689 (0.0740)
Interaction between treatment and leader	0.113 (0.477)
Interaction between treatment and married	-0.257 (1.058)
Interaction between treatment and muslim	-0.0298 (0.849)
Interaction between treatment and socially disadvantaged group	-0.950** (0.479)

Interaction between treatment and economic loss	-0.517 (0.490)
Interaction between treatment and parents living in same panchayat	-1.018 (1.010)
Interaction between treatment and have at least one child	2.278* (1.222)
Interaction between treatment and possessing land in her name	1.112 (0.837)
Interaction between treatment and number of families living together	-0.175 (0.195)
Constant	18.87*** (1.079)
Observations	2,301
R-squared	0.088

Robust standard errors in parentheses
 *** p<0.01, ** p<0.05, * p<0.1

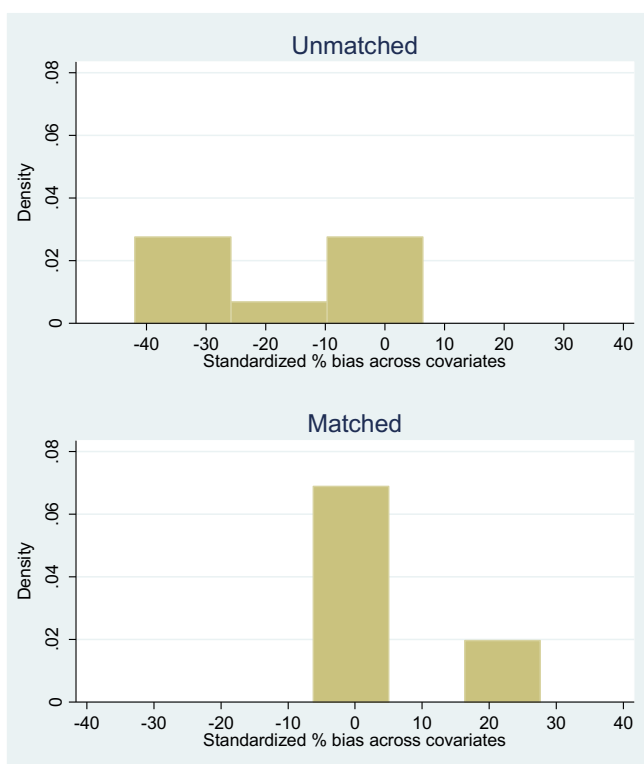
Table 13: ATT Estimation by nearest neighbor matching without replacement (60 pairs)

Variable	Sample	Treated	Controls	Difference	S.E.	T-stat
Average Mental Health Score	Unmatched	18.17091	18.08725	0.083664322	0.32185146	0.26
	ATT	18.08701	18.13671	-0.049699833	0.36888413	-0.13
	ATU	18.13671	18.01655	-0.120160167	.	.
	ATE			-0.08493	.	.

Table 14: Region of common support by nearest neighbor matching without replacement (60 pairs)

Treatment Assignment	Support		Total
	Off Support	On Support	
Untreated	6	60	66
Treated	20	60	80
Total	26	120	146

Graph 2: Balance distribution before and after matching by nearest neighbor matching without replacement (60 pairs)



Graph 3: Propensity score distribution under common support by nearest neighbor one to one matching without replacement (60 pairs)

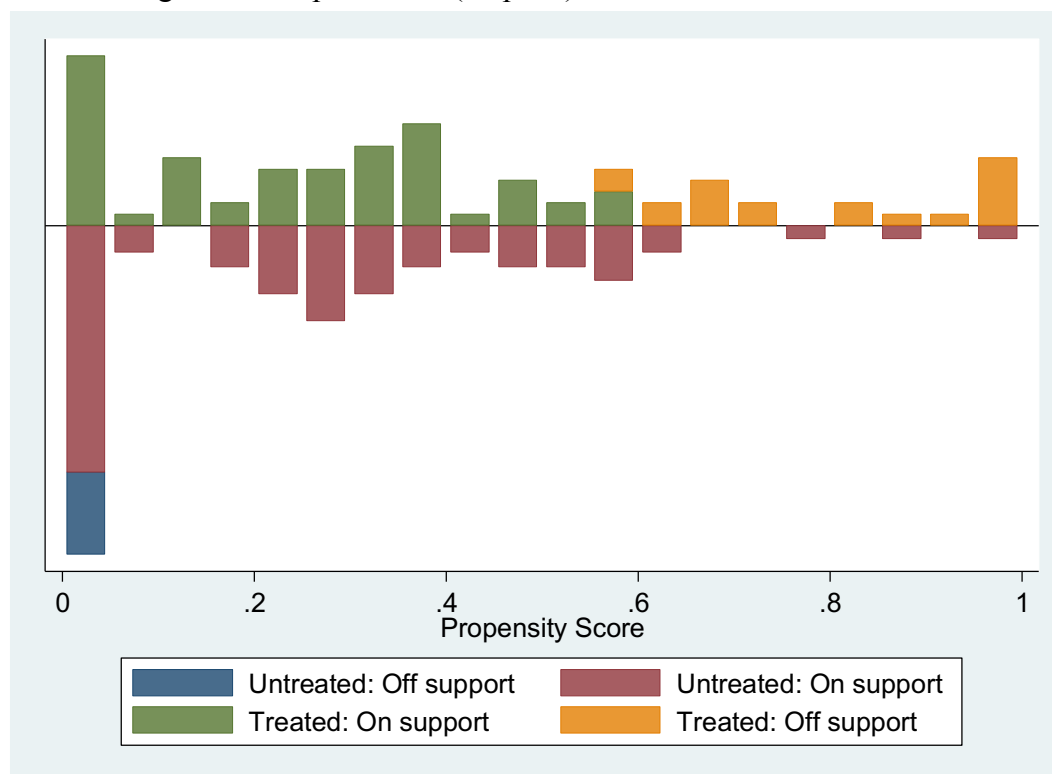


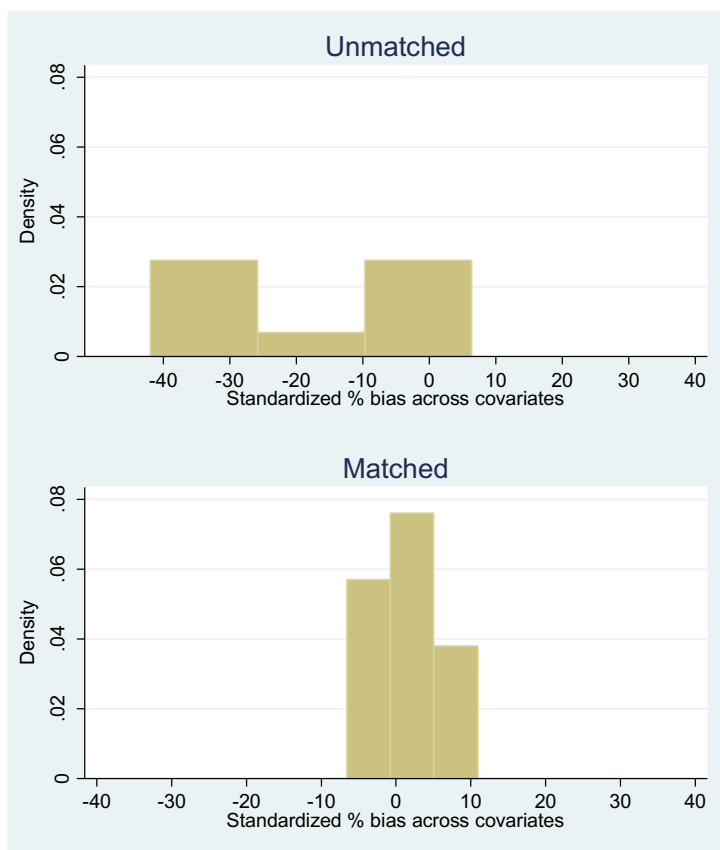
Table 15: ATT estimation by nearest neighbor matching with replacement (5 neighbors)

Variable	Sample	Treated	Controls	Difference	S.E.	T-stat
Average mental health score	Unmatched	18.17091	18.0872453	0.083664322	0.321851462	0.26
	ATT	18.10975	18.2612939	-0.151546494	0.365568958	-0.41
	ATU	18.13671	17.9332156	-0.203494867	.	.
	ATE		-	0.174297606	.	.

Table 16: Region of common support by nearest neighbor matching with replacement (5 neighbors)

Treatment Assignment	Off support	On support	Total
Untreated	6	60	66
Treated	3	77	80
Total	9	137	146

Graph 4: Balance distribution before and after matching by nearest neighbor matching with replacement (5 neighbors)



Graph 5: Propensity score distribution under common support by nearest neighbor matching with replacement (5 neighbors)

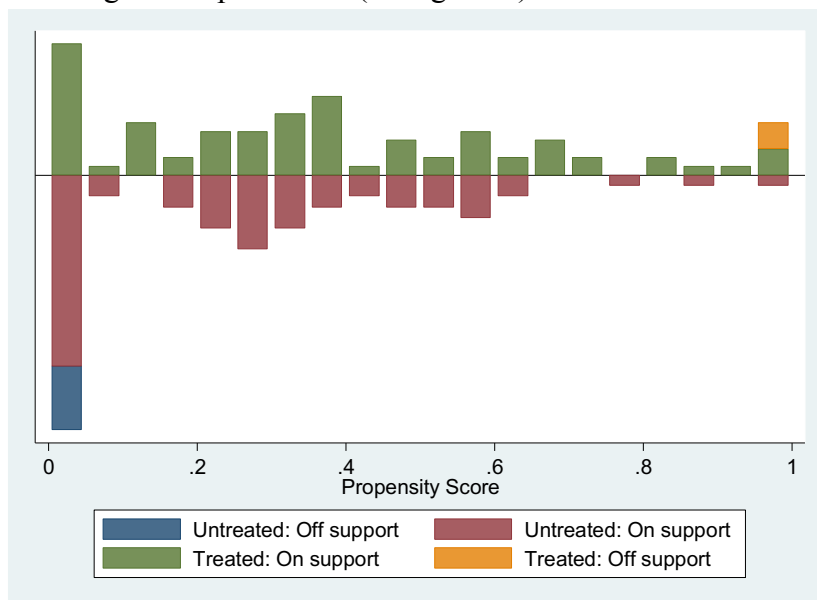


Table 17: Propensity score distribution under common support (stratification method)

Estimated propensity score				
	Percentiles	Smallest		
1%	0.2742055	0.273156		
5%	0.3722674	0.2742055		
10%	0.4162979	0.34803	Obs	140
25%	0.5153195	0.3563657	Sum of Wgt.	140
50%	0.5746097		Mean	0.565369
		Largest	Std. Dev.	0.098869
75%	0.6284508	0.7511283		
90%	0.6717675	0.7612177	Variance	0.009775
95%	0.7287329	0.7648246	Skewness	-0.50734
99%	0.7648246	0.7939201	Kurtosis	3.442948

Table 18: Blocks for the propensity score under common support (stratification method)

Blockid	TREATMENT		Total
	0	1	
2	5	6	11
3	38	44	82
4	17	30	47
Total	60	80	140

Note: The propensity score distribution was balanced for each of 9 variables used for matching for all stratified 4 blocks under common support

Table 19: Inferior of block of propensity score under common support (stratification method)

Inferior	Treatment		Total
	0	1	
0.2	5	6	11
0.4	38	44	82
0.6	17	30	47
Total	60	80	140

Table 20: ATT under stratification of propensity score with bootstrapping of errors (100 times)

n.treat	n. contr.	ATT	Std. Err.	t
80	60	0.026	0.393	0.066

Graph 6: Balance checking under stratification of propensity score method

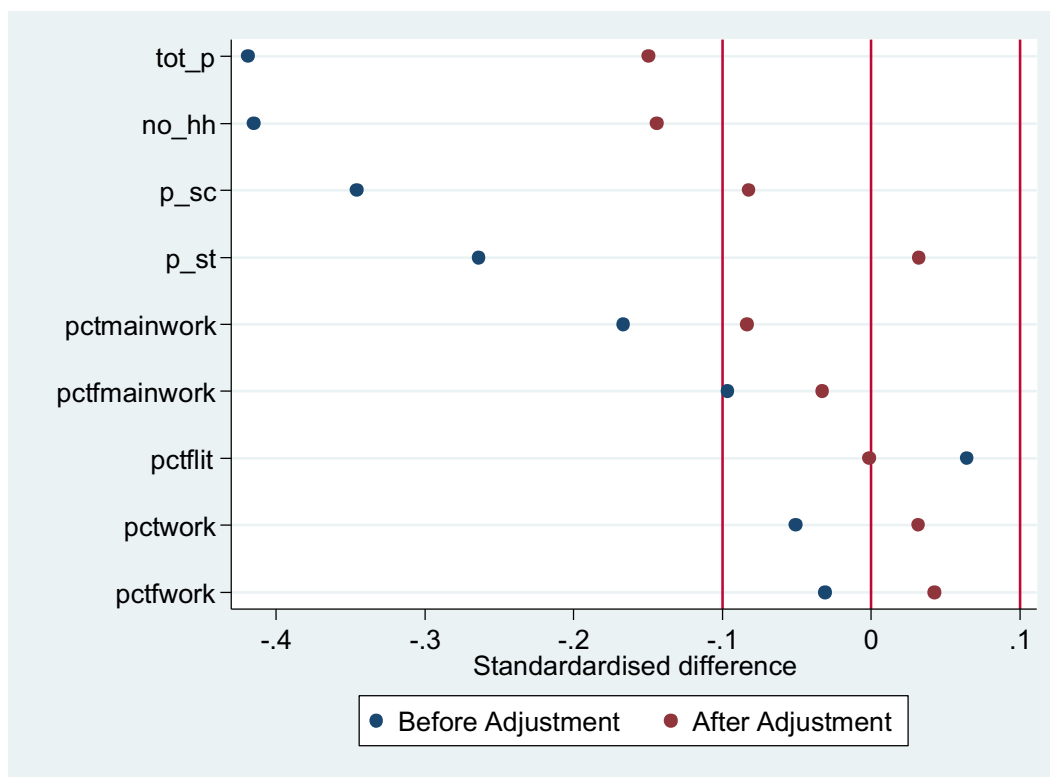


Table 21: ATT under doubly robust estimate weighted by inverse probability treatment weight (IPTWT) method

	Coef.	Std. Err.	z	P>z	[95% Conf. Interval]
Average Mental Health Score	0.065467	0.326195	0.2	0.841	-0.57386 0.704797

Graph 7: Balance check under doubly robust estimate weighted by inverse probability treatment weight (IPTWT) method

