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Abstract

This study evaluates the health impacts of a volunteer intervention addressing health worker shortage in remote mountainous communities of Vietnam. It estimates the average treatment effect on the treated using propensity score matching methods with two stage sample data. The study found statistical evidence of improved knowledge of diarrhoeal disease prevention in the treated communities, which is an important factor of diarrhoea reduction in the long term. It did not confirm the impacts of two year volunteer intervention on the health seeking behaviour related to birth giving and hygienic behaviour in the treated households.

JEL code: I1; I18

Key words: Health Program Evaluation; Propensity Score Matching; Kernel Regression

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Outline

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1. Introduction

A volunteer approach to improving health worker supply for the remote and mountainous regions in Vietnamese context of 2002 can be viewed as an emergency intervention to lessen critical shortage of health workers in the public health system. Whiles it is recognised that improvement of the health staffing and investment for remote and poor regions calls for long term policy measures, it can not reduce the practical importance of the immediate health impacts that volunteer work has on people's health in the needed areas. From this view medical volunteer work in the remote areas can be seen as a short-term intervention to be considered systematically when policy reform of the public health system seems to take time.

This study evaluates the health impacts of a volunteer intervention using quasi-experimental design and cluster analysis. At cluster level, it selects the control group by matching the project participating (treated) communes with non-participating (control) communes across Vietnam having similar geographical, socio-economic, ethnic and health care characteristics using estimated propensity scores. Various balance tests are implemented to ensure that all important exogenous factors influencing both the project assignment and outcome are taken into consideration when constructing the control group and those selected characteristics are actually similar for both participating and non-participating communes (not just similar estimated propensity scores). At the individual level, the same questionnaire has been administered to individual beneficiaries in participating and non-participating communes to gather quantitative data on health outcome indicators. The study then estimates the average treatment effect on the treated and assesses the level of success of the intervention.

During the analysis process we faced the problem of the control group being biased by the ethnicity. To address this variable the kernel variant of propensity score matching method is applied.

We found that the local residents' knowledge of using the advocated drug for treatment of diarrhoeal diseases has been improved in the treated communities. This means that the project has done well in communication areas. The intervention, however, does not result in changing local hygienic behaviour such as using boiled water for drinking or having hygienically acceptable toilet for the household. We did not find statistically significant reduction in incidence of diarrhoea in the treated communes as the result of the two year project. Similarly, in another area of intervention – reduction of maternal risk – the indicator changes are not significant.

Cost consideration is one integral part of the evaluation. We found that the intervention has been implemented at very low costs, but partly due to the unreasonable and disincentivising payment system in the public health sector. This issue calls for reconsideration of the incentives for health staffs as a measure to improve health care supply in the poorest areas.

This paper is organised into seven parts. The next part describes the project to be evaluated. Third part presents methodology used and fourth part discusses empirical results of matching and estimation of the treatment effect on the treated. The fifth part discusses the main findings from the evaluation and the sixth part considers costs of the intervention and finally, conclusion.

2. YMV Project and selection of evaluation indicators

Young Medical Volunteers for Rural Mountain Project (YMV project for short) implemented by Vietnam Union of Students (VNUS) in the period 2002-2005 was one among the initiatives to provide primary health care to the poorest and least accessible areas where the outreach of the formal health care system was extremely poor. The project was funded by the government and technically supported by the ministry of health. The project piloted a new way to fill the health stations of the poor rural and mountainous communes with young medical graduates. At the core of the initiative there was an agreement between the central government, the provincial authorities and the VNUS on coordinated efforts: the VNUS organized teams of medical graduates who volunteered to work for two years in the selected communes as the project members; the governments of all levels provided budget to support volunteer teams and facilitated the operation of the project. As an incentive to the volunteers, the government committed to give a certain merit to those volunteers wanting to apply for a job in the public sector or continue further education after fulfilling the two year contract in the project communes. (Government of Vietnam, 2000) The organisational structure of YMV project is presented in Figure 1.

According to the end project report, during three years 2002-2005 YMV project recruited 545 volunteers and operated medical teams in 350 communes of Vietnam (on average, this means one volunteer per 2,500 local inhabitants). The project members consisted of 133 doctors and 412 graduates from medical secondary and vocational schools (having qualification of assistant to doctor or nurse). The project areas mainly concentrated in the Northern Mountain and the Central Highland regions where the outreach of the public health system was most limited and commune health centres faced acute shortage of staff.

The YMV project has broad objectives, including improving primary health care and disease prevention; building capacity of local health staff; improving social development of the commune; and advocacy for young medics to stay and work permanently in mountainous areas. Volunteers provided primary examination and treatment, referral of patients to hospitals, carried out national disease prevention programs on vaccination, malaria, tuberculosis, diarrhoea, child malnutrition, safe motherhood and family planning etc., promote hygienic life style and use of traditional medicinal herbs among local communities. They also delivered training on primary care for village health activists, run literacy classes, assisted organizing of agricultural extension courses for farmers, promoted youth clubs etc. Selection of several measurable indicators for evaluation of the project health impacts is not easy with such a broad variety of activities undertaken by the project members.

Using a project result-based management framework, we construct a logic model which links project activities with the corresponding outputs and possible health outcomes, and then select two health areas where outcomes are evaluated. These health areas are the reduction of maternal risks and incidence of diarrhoeal diseases. This logic model is summarised in Table 1.

Reduction of maternal risk

Maternal mortality rate in mountainous and midland regions was 269/100.000 live births compared to 81/100.000 in the deltas; among ethnic minorities it was as high as 316/100.000 live births. (WHO, 2005) Geographical isolation and poor transport conditions are not the only factors disadvantaging Northern and Central Highland mountainous residents in access to health services. The communal health centres in these regions are very poorly staffed and equipped. In 2002 only 28 per cent of all health staff in higher mountainous areas has medical qualification of any level, and 13 per cent of the communes have no doctor or physician at all (MoH, 2002). Incentives offered within the public health system are so low that they are often ignored. Underdevelopment of the private health services further narrows the access to health care, sometimes to practically none.

Statistics on obstetric care indicate that maternal mortality is higher in the areas where a large number of pregnancies are not monitored and where a substantial number of deliveries do not benefit from trained medical assistance (MoH and Health Partnership Group, 2008). According to the assessment by the Vietnam ministry of health, main factors contributing to maternal mortality in the country are following: delay in the decision to seek health care for various reasons contributed 46.3 per cent of fatal cases; delay in transferring the pregnant woman to the appropriate referral facility because of long distance, poor roads or lack of transportation were the

cause of 41.3 per cent; and 40 per cent are due to delay in providing essential treatment, lack of well-trained health workers, drugs or necessary equipment. (MoH, 2007).

As counter-response to reduce maternal risks, three project outcomes have been selected for evaluation, namely prenatal check-ups of pregnant women at least three times during pregnancy period, deliveries attended by trained health workers and postnatal consultation and care. Logically, the final impact of these and other efforts should be reduction in maternal mortality rate (MMR). However, measurement of MMR requires very large sample size which is not affordable within the scope of the study therefore this outcome is dropped.

Reduced incidence of diarrhoeal diseases

Among different diseases that may have been addressed by the YMV project diarrhoeal incidence is selected because of its easy-to-know symptoms and its familiarity to respondents in all regions. The study used the national health survey's definition of diarrhoea as a phenomenon of having loose bowels over three episodes per day. Cholera, dysentery and typhoid are also covered by this definition. (MoH, 2002)

Along with diarrhoeal incidence which represents the final outcome of the project efforts in the long term, three indicators are selected to assess the changes in hygienic behaviour of the local residents and improvement in their awareness and knowledge of diarrhoeal disease prevention and care. They are the use of boil water for drinking, having hygienically acceptable toilets and knowing how to use "Oresol" for treatment of diarrhoeal patient.

Overall, seven measurable outcome indicators are used for project evaluation. Definition of the selected outcome indicators is presented in Table 2.

Questionnaire

Information needed to estimate the selected outcome indicators for the health impact evaluation were collected with a structured questionnaire which also envisaged getting some information on possible reasons explaining different health seeking pattern of the surveyed households. In formulation of the questionnaire, we relied heavily on the questionnaire applied in national health survey 2002 which has been reviewed by health and statistical experts. (MoH, 2003).

The questionnaire was designed for female respondents who had children born within the project implementation period 2002-2005 and was administered to both participating and non-participating communes. Information on household demographic characteristics, use of boiled

water, hygienic toilets and diarrhoea cases is provided by just one female respondent from each household.

3. Methodology

3.1. Sample size

Cluster

The project to be evaluated was implemented at the commune level. To evaluate the health impacts at the individual level, we use cluster sampling. The number of respondents from each commune selected into a cluster may vary depending on homogeneity of the respondents, the number of clusters in the sample and the budget limitation. Considering that the households in a commune are relatively homogenous, we selected the cluster size of 30. From each household only one woman who had a child born in the project period (2002-2005) was selected as respondent.

Sample size

The sample size was selected to ensure that any change by 20 per cent in the majority of the outcome indicators will be detected at significance level of 0.05 (two-sided) and power 0.8. We use the STATA program *sampclus* to determine sample size with the data of the national health survey 2002.

The sample size of 13,500 respondents was selected from 450 clusters of which 180 were treatment and 270 controls. Each cluster is selected from one commune. The ratio of the treated clusters to control clusters is 1:1.5. This ratio is selected to reserve more possibilities for rearranging the control group in the analysis stage. With this sample size changes from 4 per cent to 20 per cent in five out of seven outcome indicators will be detected at significance level 0.05 and power of tests 0.8. The results of power analysis applied to the seven selected indicators are summarised in Table III.

3.2. Survey implementation

As mentioned earlier, YMV project areas covered 350 communes of which 213 communes are in high mountainous areas. The surveyed communes were selected from this high mountainous group to explore opportunities for improvement. However, we should note that the surveyed areas were in a disadvantaged condition as compared to the rest of the project areas. 95 per cent of the communes selected for evaluation were classified by the government as “in extremely difficult

circumstances" while for the rest of the project area this percentage was 55 per cent. Similarly, 90 per cent of them did not have a doctor compared to 69 per cent of the rest project area. Percentage of households having access to safe water and electricity was much lower than the overall project area, and so too transport conditions. Overall, the communes selected for evaluation represent the most disadvantaged part of the project area.

The survey took place from January to July 2008. It was administered so that respondents were selected randomly from at least two villages of a commune and one village was where the commune health centre was located. As the size of mountainous villages was small, a cluster often included respondents from two to four villages and the villages closer to the commune health centre had higher probability of being selected due to their better accessibility. This fact implies that the population residing further away from the commune health centre tend to be under-represented in the sample. This problem, however, does not affect the results of the evaluation since the method of this study does not require the estimator to represent the overall commune treatment effect. Except two communes omitted due to their inaccessibility (0.4% of total clusters), non-response rate was low.

Data were collected from 13,365 individual respondents grouped in 448 clusters and the household members totalled to 65,256 people. The control group consisted of 269 clusters and treated group – 179 clusters. The selected communes are spread over 33 (out of total 63) provinces of Vietnam.

The treated and control groups are highly homogeneous in demographic characteristics except for ethnicity of the respondents. The average age of the respondent was almost the same (28.5 for the treated and 28.4 for the control group). The average household size in the treated and control groups are 5.4 and 5.5 respectively.

In terms of ethnicity, the surveyed sample was greatly diversified. The respondents identified themselves belonging to over 50 nationalities and ethnic groups including all 6 language-ethnicity groups of Vietnam. The largest ethnic groups represented in the survey are Tay-Thai (27% of the respondents), Mon-Khmer (26%), H'mong-Dao (21%), and Viet-Muong (11%).

3.3. Propensity score matching

Covariates

Propensity score matching (PSM) is used twice grouping this study. In the first round, it is used to identify the control communes for sampling using secondary data. The second round of PSM was

conducted after the survey to refine the control group taking into account the additional commune data collected by the survey and to estimate the average treatment effect on the treated (ATT).

The first step of matching involves prediction of the propensity score by probit model. As Bryson et al. (2002) noted the function form depends on the nature of the program to be evaluated rather than the technical aspects of the data. Zhao (2005) shows that even when the propensity scores are poorly estimated in the misspecified models, they have little influence on the estimated treatment effects if the matching assumptions are satisfied. For this single treatment we can expect similar matching results using either probit or logit model. The probability of being selected into project can be expressed as a probit function of covariates X:

$$P_i = f(a + bX_i)$$

where P_i is the probability of being selected into the project of commune i, $P_i = 1$ for treated commune, and $P_i = 0$ for control commune. X_i is a set of characteristic variables which are exogenous to the project assignment (not contaminated by the treatment) and which have influence on both treatment assignment and the outcome of the project. (Imbens, 2007; Caliendo and Kopeinig, 2005) The control group is constructed by matching treated communes and non-treatment communes based on their propensity score.

The Rural Census conducted by the General Statistical Office of Vietnam in 2002 is used for sample selection. The Census covers all 8,934 rural communes of Vietnam and focuses on resources and infrastructural characteristics of the communes. These characteristics can be classified into 3 groups: (1) commune infrastructures (availability of safe water, electricity, road, kindergarten, school, open market, post office and so forth); (2) access to resources including agricultural and forest land and credit (3) health care service supply including availability of the health centre, number of doctors, assistants to doctor and nurses working in the health centre. Overall, the Census provides over 30 characteristics that are exogenous and may influence outcome of YMV project. All thirty covariates could have been included in the PSM model. However, as extraneous variables may increase the variance of the estimates (Lechner and Smith, 2002 cited by Bryson et all, 2002), consideration of the possible influence of each characteristic covariate on the treatment outcome is made and few covariates which have unclear relation to the outcome were excluded. Finally, 20 covariates representing 3 groups of characteristics from the Rural Census were included into the PSM model. Description of these covariates is presented in Table IV.

The Rural Census, since it focuses on infrastructural characteristics of the communes lacks social characteristics some of which, as commonly recognised, have important influences on the outcome. Omitting such important characteristics may seriously increase the bias in the resulting estimates. (Heckman et al. 1997 cited in Bryson et al. 2002) To address this shortcoming we collected additional data in the survey and then add these covariates into the probit regression. This refining activity cannot be done at the sampling stage but it becomes possible at the analysis stage. The covariates added at this stage are ethnicity and distance to commune health centre.

It should be noted that the survey collected information at individual and household level. To come up with the covariates which describe the commune characteristics we use certain assumptions which are highlighted below.

Ethnicity variables

Traditional culture and customs remain an important factor affecting health seeking behaviour of individuals and households. For example, several ethnic groups have a custom that require women to give birth to the first child alone. Such a custom, where existing, strongly affects the decision of the family on whether the woman should give birth at the health facility or at home. Therefore, it is desirable that cultural and custom factors that influence health behaviour are included as covariates into the probit regression.

The survey data consists of information on ethnicity of the respondent and all her household members. It allows identifying the ethnic composition of each cluster surveyed which is then used as the ethnic characteristic of the treated and control communes in the PSM model (roughly assuming that the ethnic composition of the commune is similar to that of the group of respondents randomly selected to the cluster).

The fact that we have over 50 ethnic groups in the sample necessitates grouping of ethnicities with relatively similar level of health services utilisation in order to include them into the probit model. In the most recent analysis of the socio-economic situation of the different ethnic groups in Vietnam using data of three national household living standard surveys 1993, 1998 and 2004 conducted by the Institute of Development Studies and Economic Faculty of the Sussex University in cooperation with Vietnam Academy of Social Sciences, all 54 nationalities and ethnicities residing in the country have been grouped into 7 groups: (1) majority Kinh; (2) Hoa (or Chinese); (3) Khmer and Cham; (4) Tay, Thai, Muong, Nung; (5) Northern mountain minorities; (6) Central Highland minorities; and "other minorities". Such a grouping is considered reasonable by consulted ethnologists and NGO members. (CAF and IDS, 2008) This study makes

use of this classification with some simplification. Since the number of respondents who are Chinese, Khmer and "other minorities" is very small, all respondents are classified into 4 groups: (1) Kinh-Chinese; (2) Tay, Thai, Muong, Nung; (3) Northern minorities; and (4) Central minorities including the Central Highland minorities and few Khmer and Cham residing in the Southern Central region. The ethnicity characteristic of the commune by this way is defined as the proportion of respondents belonging to certain ethnic groups in the total number of respondents.

Distance to commune health centre

It is commonly recognised that poor transport conditions strongly influence household access to health services. (MoH, 2006). Thus, the distance of the respondent's residence to the health facility is assumed to have important influence on the participation prediction and treatment outcome and hence need to be included in the analysis.

There are different options for inclusion of the distance covariate into analysis. One option is using the distance to commune health centre as a weight in estimation of the treatment effect. We however do not have any prior information on the extent to which distance to a health facility may affect the project participation and health outcome and how different distances work on this. (For example, is one kilometre different from two kilometres in influencing the health seeking behaviour?) In this situation using the distance as a weight may result in meaningless estimation.

The alternate option to use the distance variable as a commune characteristic and include it into the participation model is logical because distance is an exogenous variable and satisfies matching assumptions. The problem is in constructing the commune characteristic variable for PSM model based on the data on distance at individual level. The distribution of the respondents by distance to the commune health centre is relatively similar for the treated and control groups. About 67 per cent of the respondents in the treated group reside at a distance of two kilometres or less to the commune health centre, 23 per cent at a distance from three to five kilometres, and 10 per cent live further from the commune health centre. The corresponding figures for the control group are 63, 24 and 13 per cent. The maximum distance of a surveyed household to the commune health centre is 30 kilometres. Thus, we select the median of distance of respondents to the commune health centre as a reasonable characteristic covariate for the PSM model. Here, the mean distance of the respondents to commune health centre is less meaningful than median because it seemingly attaches an equal weight to the distance while we do not know the relative importance of the different distance range for the participation.

Finally, in total the probit regression model used for estimation of propensity score and matching has 24 characteristic covariates. Definitions of these covariates are presented in Table V.

Ethnicity bias problem and selection of the matching algorithm

As described earlier, at the sampling stage we used the data on commune infrastructures from the Rural Census for propensity score matching and identification of the control group. The data on ethnic characteristics of the control communes was lacking. Whiles the Vietnamese ethnic groups differed remarkably by their welfare including consumption of services such as health and education, the survey result showed that distribution of the control group by ethnicities is biased towards "better welfare" ethnicities. As the national household living standard surveys consistently showed, the Viet-Chinese group ranked top by welfare, followed by Tay-Thai-Muong-Nung, Northern minorities and Central minorities. (CAF and IDS, 2008). Compared to distribution of the treated group by ethnicity, the control group consisted of significantly higher proportion of the "better welfare" Tay-Thai-Muong-Nung and Northern minorities, while the "lower welfare" Central minorities were significantly underrepresented. (See Table IX for details) This sampling unbalance threatened to invalidate the evaluation results and needed to be adequately addressed.

Our strategy to address the ethnicity bias is reconstructing the control groups using the kernel variant of propensity score matching. An advantage of this variant is that it allows reweighting the data to take into account differences in the distributions of propensity scores between the treated and untreated observations (Galdo, Smith and Black, 2007). By narrowing the bandwidth (or distance around the treated unit) we can drop those treated units which have no matches and by this way improve similarity of treated and control distributions. By doing so, however the variance of the estimated treated mean increases.

The main issue to be dealt with is selection of the optimal bandwidth which balances between the bias reduction and estimated treated variance increase. The literature provides a principle to select the optimal bandwidth – the level at which the sum of squared pointwise bias and variance of the matched treated (the mean integrated squared error, or MSE) is minimized (Galdo, Smith and Black, 2007). This method involves a considerable computational burden since optimal bandwidth is required for each outcome indicator.

3.4. Quality of matching

While objective in matching is the similarity of covariates between the treatment and control groups, the matched control communes identified by this approach may have similar propensity scores as the treated communes but need not necessarily be similar in covariates. To examine this problem, after estimation of propensity score and matching we assessed the quality of the control group by testing whether the distribution of characteristics covariates is similar between the control and treatment groups given the predicted propensity score. Two types of tests were implemented:

First, we tested for the mean equality of each covariate between the treatment and control groups (pstest). If a good control group is constructed, the hypothesis of mean equality cannot be rejected for the majority of covariates and the biases are small.

The second is the balance test, or test for the mean equality of covariates within strata. (Rosenbaum and Rubin, 1983 cited in Bryson, 2002; Dehejia and Wahba, 2002 cited in WB, 2004) To carry out this test, we sorted the treated communes in ascending order of the predicted propensity score and divided into 10 strata and distributed the identified control communes into 10 strata corresponding to their matched treated communes. After that the t-test was performed within each stratum to examine whether there is a statistically significant difference in mean of covariates between the treated and control sub-groups. Ideally all characteristic covariates should be balanced for all strata. If there are several covariates not balanced in many strata, the control group should be reconstructed by modifying the participation model. Variables that are considered less important in predicting the participation and influencing outcomes can be dropped from the model. As noted by Bryson (2002), the balancing test is a useful diagnostic on participation model specification though it does not help to solve variable selection problem.

4. Empirical results

4.1. Matching

In this study we estimated the propensity score and conduct matching at the cluster level and then estimated the ATT at individual level. In the first step, we conducted series of matching using Kernel variant with the bandwidth narrowing from 0.2 to 0.01 and the distance between the bandwidths set at 0.01. For each matching MSE was computed and tabulated so that the optimal bandwidth corresponding to the least MSE was identified.

In this round of matching the number of covariates reduced from initial 24 to 21. As mentioned, this study used the rural census data for sampling and after the sampling round of matching two covariates became identical for both the treated and non-treated groups and hence were dropped. These covariates are "commune in difficult circumstances" and "commune having a health centre". Actually, all treated and non-treated communes are in difficult circumstances and have a health centre. The third covariate - "belonging to the Kinh-Chinese ethnic group" – was dropped due to its colinearity with the three other ethnic groups.

The study envisages evaluating seven outcomes which have differing missing values. Putting all outcomes together in a probit regression would result in approximately 20 per cent of clusters dropped due to missing values when the program calculates matching weights. To avoid this we ran the matching and tabulated MSE separately for each of the outcomes. In the results, the number of treated observations on the common support reduced just by 5 per cent when the bandwidth was narrowed. The first step was a straightforward computational exercise which gave the optimal matching bandwidth corresponding to each of the outcomes.

The second step involved application of pstest and balance test to examine the quality of the matching with selected optimal bandwidths after matching. In the pstest, all covariates pass the t-test for equality of mean in the treated and non-treated groups on common support. The standardised bias after matching is low. In the total 147 t-tests performed 76 per cent of the tests have standardised bias after matching below 5 per cent and 91 per cent of the tests have standardised bias after matching below 7 per cent. The maximum bias – belonging to the covariate Northern mountain ethnic group - is 13.3 per cent. Overall, the pstest results indicate the balance of the characteristic variables after matching. The difference of the sample means in the treated and control groups is very small in most of covariates.

The results of the balance test after matching bring out some problems. Since the bandwidths were selected based on minimised MSE (but not minimised matching bias), we found a notable number of blocks with unbalanced covariates between the matched treated and control groups. Two outcomes - prenatal checkups and having acceptable toilet - with the matching bandwidths 0.13 and 0.14 respectively, have the best results of the balance test. The proportion of unbalanced blocks in the balance test for these outcomes is approximately 9 per cent of the total number of blocks. Specifically, out of 210 t-tests in each balance test for these outcomes there were 19 and 18 rejections of the mean equality hypothesis respectively. In each balance test there was one stratum with five (out of 21) covariates unbalanced between the matched treated and control

groups. In the matching for the outcome prenatal checkups we found the covariate doctor unbalanced in three blocks. This is the maximum number of unbalanced blocks on one covariate.

It seems that the matching addressed the issue of data biased by ethnicity variables adequately. The covariate Tay-Thai-Muong-Nung ethnic group is completely balanced over strata. Two other ethnic group covariates (Northern and Central Mountain) contain one and two unbalanced blocks respectively.

Overall, we found that the matching for the two outcomes prenatal checkups and having acceptable toilet has relatively low proportion of unbalanced blocks and these unbalanced blocks distribute evenly over the strata. We accepted these matching results as satisfactory.

The balance tests for the other five outcomes have from 11 to 14.3 per cent of blocks with unbalanced covariates. The maximum number of unbalanced covariates in one stratum in several matching is as high as six (out of 21 covariates). Two covariates distance to health centre and doctor show most imbalances between the treated and control groups on common support. The first is unbalanced in five (out of ten) strata in the matching with the outcome know to use Oresol. The second is unbalanced in four strata in the matching with the outcome incidence of diarrhoea. These problems need to be addressed.

In order to find out a matching option with better balance over strata, we ran two additional matching for each of the outcomes with the bandwidths given by the next two least MSE and examine the quality of the matching using pstest and balance test.

The additional matching results show better performance in the pstest. We found no rejection of the mean equality hypothesis between the matched treated and control groups. In the total 210 t-tests performed 81 per cent of the tests have standardised bias after matching below 5 per cent and 93 per cent of the tests have standardised bias after matching below 7 per cent. The maximum bias is 13.3 per cent (belonging to above mentioned covariate Northern mountain ethnic group).

The balance test results for the outcome incidence of diarrhoea become worse when we moved to the second bandwidth and the initial balance returned when the third bandwidth was employed. The proportion of unbalanced blocks in the matching with optimal bandwidth is 11 per cent, and there are two strata with five unbalanced covariates. For this outcome we selected the initial matching with optimal bandwidth of 0.04.

Two outcomes delivery attended and use of boiled water have similar MSE minimizing bandwidths of 0.01, 0.02 and 0.03. They show few changes in the balance of the covariates when moving from the optimal bandwidth to the next two bandwidths. In the best cases, the proportion

of unbalanced blocks reduced slightly from 13 to 12 per cent and distribution of the unbalanced blocks over strata smoothened a little in the sense that the maximum number of unbalanced covariates in one stratum reduced from 6 to 5. Two other outcomes, postnatal consultation and know to use Oresol, experience more improvement in the quality of matching when the bandwidths change from 0.02 to 0.13 for the first and 0.01 to 0.08 for the second. The first outcome has the proportion of t-test rejections of mean equality hypothesis reduced from 13 to 9 per cent of the total number of t-tests performed and the similar figure for the second is from 14.3 to 10.5 per cent. Maximum number of unbalanced covariates in a stratum reduced to five for the first outcome and four for the second.

Having examined the quality of the matching using the balance test, we selected the matching options which have the least number of unbalanced blocks and more event distribution of the covariates over strata. Finally, we have three control groups constructed with 9 per cent of unbalanced blocks, two other control groups with 11 and two - with 12 per cent of unbalanced blocks. The results of pstests and balance tests for different matching options are tabulated in Table VII-VIII.

4.2. Average treatment effect on the treated (ATT)

The third step is estimation of the ATT for each of the outcomes. In this estimation we combined the matching weight and the sampling weight which are the reciprocal of the ratio between the number of responses and the cluster size. The ATT estimation results are tabulated in Table VI.

Outcome 1: Prenatal checkups

The mean rate of mothers having three prenatal checkups during pregnancy period is 0.314 in the control group and 0.326 in the treated group. Estimated ATT is 0.012, meaning a difference of 3.8 per cent in the mean of the treated group compared to the control group. The ATT, however, is not statistically significant at significance level of 0.05 (two sided).

Outcome 2: Delivery attended by trained health worker

The mean rate of mothers giving birth with attendance of trained health workers is 0.497 in the control group and 0.445 in the treated group. This implies that the performance of the treated group is lower than the control group by 10.4 per cent, equivalent to the ATT value -0.041. However, t-statistic on the ATT is 1.51, indicating that this difference is not statistically significant at significance level of 0.05.

Outcome 3: Postnatal examination

The mean rate of mothers having postnatal examination is 0.256 in the control group and 0.272 in the treated group. The estimated ATT is 0.011, equivalent to 6.1 per cent difference in the treated mean compared to the control mean. T-statistic on the ATT is 0.59 indicating that we can not reject the hypothesis that ATT is zero at significance level of 0.05.

Outcome 4: Use of boil water for drinking

The estimated ATT for the indicator use of boiled water has negative sign and minimal value of 0.014. It corresponds to the control mean of 0.365 and treated mean of 0.351. As percentage of the control mean, the ATT equals 3.9 per cent. The ATT is not statistically significant, as indicated by its t-statistic.

Outcome 5: Having hygienically acceptable toilet

The rate of households having hygienically acceptable toilet in the mountainous areas is low in general. The mean rate is 0.083 in the control group and 0.089 in the treated group, meaning an increase of 7.7 per cent in performance of the treated group compared to the control group. The estimated ATT is 0.006. This difference, however, is not statistically significant at 0.05 levels.

Outcome 6: Know how to use drug for diarrhoea

The mean rate of residents knowing how to use simple drug Oresol for diarrhoea is 0.387 in the control group and 0.459 in the treated group. The estimated ATT is 0.072, meaning an increase of 18.7 per cent in the mean of the treated group compared to the control group. The t-statistic on the ATT is 2.13 indicating that the ATT is statistically significant at the significance level of 0.05 (two sided). In this case we found positive treatment impacts on the rate of residents knowing how to use drug Oresol for diarrhoeal patients.

Outcome 7: Incidence of diarrhoea

The mean incidence of diarrhoea in both the treated and control group are close to 0.014. The estimated ATT has very small value of 0.0005, which equals 3.8 per cent of the mean control. T-statistic of the ATT is 0.33 indicating that we can not reject the hypothesis that ATT is zero.

For sensitivity analysis we also estimated the ATT using other matching options which have been examined for the quality of the matching. The results have showed that the bandwidth adjustment applied in the matching process does not change the sign and statistical significance of the ATT whiles the selected matching options which have better balance between the treated and control group give more precise results of the test.

5. Impacts

Reduction of maternal risks

Reduction of maternal risk is one of the two key areas selected for evaluation of the YMV impacts on the health outcomes of the beneficiaries. Three outcomes selected cover the key services to be provided to mothers in order to reduce risks related to giving birth – prenatal checkups as required during pregnancy period, giving birth with support of the trained health worker and postnatal care. The YMV project report documented a significant workload done by volunteer health workers in this area. These services, as one should note, are a part of the comprehensive service packages provided by the commune health centres where the volunteer medics served as a unit of the whole system.

The impact evaluation results show that an incremental modest increase of the health workforce provided by the volunteer project did not result in improvement of the health outcomes in maternal areas. Statistical difference has not been found between the treated and control groups in terms of the rates of mothers having due prenatal checkups during their pregnancy period, giving birth with attendance of the trained health workers or having postnatal examination by health workers. It appears that improvement in health outcomes related to birth requires more systematic changes in the health service delivery system.

Reduction of diarrhoeal diseases

As the second focus area of the impact evaluation, reduction of diarrhoeal diseases is covered by four outcomes: household's use of boiled water for drinking and use of hygienically acceptable toilet; knowledge of using advocated drug for diarrhoeal patients; and incidence of diarrhoeal diseases. Actually, the power analysis has showed that detecting any statistical change in the incidence of diarrhoeal diseases is very difficult as it requires exceptionally large ATT in the short term. So it is not surprising that we could not confirm whether there are differences in the mean incidence of diarrhoeal diseases between the treated and control groups.

The evaluation results confirm that the volunteer project has improved the knowledge of diarrhoeal prevention in the treated communities compared to the control group. The mean rate of mothers who can describe how to use the advocated drug for diarrhoeal patients in the treated group is by 19 per cent higher than that of the control group and this difference is statistically significant. Obviously, the volunteer project is successful in communication for prevention of disease. Better preparedness of the treated communities for diarrhoeal diseases will be contributing in reduction of the disease incidence in the long term.

The study did not find the treatment effect on the household's hygienic behaviour such as use of boiled water for drinking and use of hygienically acceptable toilet.

6. Costs of intervention

Data was collected to inform policy makers about the public expenditure costs of the YMV intervention and how might investment in primary health care be better targeted to improve health MDGs in poor and disadvantaged areas.

The costs of YMV project mainly consist of labour costs. Almost 80 per cent the central and provincial funding is the subsistence allowance for the volunteers. Another 10 per cent are transport and housing support which are again field expenses by nature. The project management costs, together with the costs of advocacy workshops and training totalled to only 7 per cent of the budget. The remaining 4 per cent of the budget was spent on supporting the project members with two months subsistence allowance after the project end. The details of costs are summarized in Table X.

In total, the central budget provided about US$540,000 for project implementation in two years (24 months). The volunteers were paid the minimum salary that public health workers at commune health centres may receive, plus some petty cash to cover transport expenses from their place of living to the work place and to support their finding a place to live. Usually, the volunteers stayed at the commune health centre and where such centre did not exist, they homestayed in villages. In total, the subsistence allowance and field support may add up to US$30-35 per month, depending on qualification of the volunteer. The central budget also covered volunteer's social insurance and health insurance which totalled to 17 per cent of the salary.

Since the government salary is very low, advocacy was made to call for contributions from the provincial authorities. Reports show that most of the provinces provided money incentives, however, the incentive level varied. Based on the fact that a majority of provinces paid salaries equal to the ordinary salary for a health worker at a commune, we estimated the contribution from the provincial budget to about US$290,000 in two years.

Overall, YMV project costs US$830,000. Divided by the total population of 350 beneficiary communes (1.4 million people), we get that a beneficiary's primary health care per year costs US$0.30. This figure shows that the resources spent on improvement of primary health care in the project areas in fact was very limited.

As mentioned earlier, the Vietnamese salary payment for the health staffs at local levels in general is unreasonable. The current "fee for service" financing system provides very weak incentives, if any, in poor areas where the overwhelming part of population has poor livelihood and cannot afford to pay any additional fees for health services. Health workers in such areas do not receive the part of income supposed to be paid from the fees collected.

The very low cost level in a labour extensive sector such as health care is not necessarily promising since inadequately low costs may mean low quality of services. Nevertheless, low cost is an advantage of the volunteer approach in general and worth consideration as a development alternative.

7. Conclusion

YMV project has broad objectives including provision of primary care, capacity building for the commune health system, rural development and advocacy for new graduates to work in rural mountainous areas. With one project member serving 2,500 mountainous residents on average, the project input should be assessed no more than an incremental increase of the health service supply in communes to meet a range of ambitious targets. Operating within the "fee for service" financing system which provides no incentives for the health staffs in poor area YMV project based mainly on enthusiasm of the young graduates. This situation created important constraints on the project efforts.

YMV project has been successful in certain extent in improving beneficiaries' preparedness for communicable disease reduction. Though the actual reduction in incidence of disease has not been found after two years, the level of awareness and knowledge developed by the project will be an important asset for the community to fight the disease in the long term future.

Regardless the levels of efforts, YMV project did not achieve improvement in maternal health outcomes and changing hygienic behaviour of the households. Obviously, achievement of such changes requires more commitment, focused and systematic actions.

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8. Tables and Figures:

Table I Logic model of health impact evaluation

1. Target: Reducing maternal risks

Result-Based Project Management Sequence				
Inputs →	**Activities** →	**Outputs** →	**Outcomes** →	**Impacts**
• Young doctors, assistants to doctors and nurses • CHC budget • Support from National Target Program for Reproductive Health • Instruction and monitoring of the Provincial Department of Health (DOH) • Participation of other stakeholders in community	Disseminate on safe motherhood and family planning to community, youth in particular	• Communication campaigns • Education and communication materials	Change in the rate of mothers receiving full package of safe motherhood care: Measurable indicators: 1. Mothers having 3 pregnancy checkups 2. Deliveries attended by health workers 3. Mothers receiving postnatal consultation and care	Change in maternal mortality rate. Indicator to be used: • Death during pregnancy, delivery and 42 days after delivery, per live birth
	Provide pregnancy check-up and care to mothers	• Pregnancy checkups performed • Tetanus injections done		
	Perform delivery	• Safe deliveries performed		
	Diagnose and timely transfer cases with complications to hospital	• Transferred cases		
	Provide consultations and care to mothers after delivery	• Postnatal examinations and consultations		

2. Target: Reducing incidence of diarrhoeal diseases

<table>
<tr><th colspan="5">Result-Based Project Management Sequence</th></tr>
<tr><th>Inputs</th><th>Activities</th><th>Outputs</th><th>Outcomes</th><th>Impacts</th></tr>
<tr>
<td rowspan="3">• Young doctors, assistants to doctors and nurses
• CHC budget
• Support from National Target Programs for Malaria Control and Control of Diarrhoeal diseases
• Instruction and monitoring of the Provincial Department of Health (DOH)
• Participation of other stakeholders in community</td>
<td>Disseminate on personal and environmental hygiene for prevention of diarrhoeal diseases</td>
<td rowspan="2">• Education & communication materials delivered
• Coverage (community groups)</td>
<td rowspan="3">Change in hygienic behaviour.
Measurable indicators:
1. Percentage use of boiled water for drinking
2. Percentage use of hygienically acceptable toilet
Change in awareness and knowledge of diarrhoeal disease prevention and care.
Measurable indicators:
1. Percentage knowing how to use simple drug for diarrhoea (Oresol)
2. Percentage being aware of diarrhoeal symptoms</td>
<td rowspan="3">Change in incidence of diarrhoeal diseases.
Indicator to be use:
• Rate of household members infected with diarrhoeal diseases in total members of households surveyed</td>
</tr>
<tr>
<td>Disseminate on primary care of patients with diarrhoea</td>
</tr>
<tr>
<td>Carry out frequent village/home visit, provide friendly primary care.</td>
<td>• Home visits
• Outpatient visits at CHC
• Treated cases</td>
</tr>
</table>

Table II Definition of selected outcome indicators

Index	INDICATOR	DEFINITION
1	Mothers having at least three pregnancy checkups	Number of mothers who received at least three check-ups in their last pregnancy divided by the number of mothers surveyed
2	Delivery attended by health workers	Number of deliveries attended by professionally trained medical staff divided by the number of mothers surveyed
3	Mothers receiving postnatal consultation	Number of mothers who received postnatal consultation in their last birth divided by the number of mothers surveyed
4	Use of boiled water for drinking	Number of households which always boil water for drinking, divided by number of households surveyed
5	Use of acceptable toilet	Number of households which use flushed toilets with sewage/septic tank, double vault compose latrine and suilabh, pour flush toilet, divided by number of households surveyed
6	Mothers knowing how to use simple drug for diarrhoea	Number of mothers who know how to use drug "Oresol" for diarrhoea, divided by the number of mothers surveyed
7	Incidence of diarrhoea	The number of diarrhoea cases in a surveyed household divided by the number of household members
NOTE: Mothers surveyed are mothers who have children born in 2002-2005 period		

Table III Power analysis

Sample size: **Number of clusters in treated group: 180** **Number of clusters in control groups: 270** **Cluster size n = 30**						
Indicators		"Communes in difficult circumstances" (NHS, 2002)		**Detectable change $(\mu_1 - \mu_2)$ as percentage of μ_1**		
				Significance Levels (alpha)		
	Calculated for power 0.80	**Mean**	**S.d**	**0.01**	**0.05**	**0.1**
1	Incidence of diarrhoeal diseases	0.036	0.111	31%	26%	24%
2	Mothers receiving postnatal consultation	0.064	0.244	27%	22%	20%
3	Use of acceptable toilet	0.083	0.276	25%	20%	18%
4	Know how to use drug for diarrhoea	0.246	0.431	11%	9%	8%
5	Mothers having three prenatal checkups	0.262	0.440	11%	9%	8%
6	Delivery attended by health workers	0.397	0.489	7%	6%	5%
7	Use of boiled water for drinking	0.624	0.484	4%	4%	3%
	Calculated for power 0.90					
1	Incidence of diarrhoeal diseases	0.036	0.111	35%	29%	26%
2	Mothers receiving postnatal consultation	0.064	0.244	30%	25%	23%
3	Use of acceptable toilet	0.083	0.276	29%	24%	21%
4	Know how to use drug for diarrhoea	0.246	0.431	13%	11%	10%
5	Mothers having three prenatal checkups	0.262	0.440	12%	10%	9%
6	Delivery attended by health workers	0.397	0.489	8%	7%	6%
7	Use of boiled water for drinking	0.624	0.484	5%	4%	4%
	Denote: μ_1 is mean of the control group, here is the mean of "communes in difficult circumstances" group μ_2 is mean of the treated group					

Table IV Explanatory variables in probit regression

Name	Type	Description
1. Difficult commune	Binary	Commune in difficult circumstances by the government classification
2. Ethnic group 1	Continuous	Proportion of Kinh respondents in total number of respondents in a commune
3. Ethnic group 2	Continuous	Proportion of Tay, Thai, Muong and Nung respondents in total number of respondents in a commune
4. Ethnic group 3	Continuous	Proportion of the Northern ethnic minority respondents (who are not Tay, Thai, Muong and Nung) in total number of respondents in a commune
5. Ethnic group 4	Continuous	Proportion of the Central ethnic minority respondents (who are not Tay, Thai, Muong and Nung) in total number of respondents in a commune
6. Health centre	Binary	Having a commune health centre
7. Doctor	Continuous	Number of doctors per thousand residents
8. Assistant to doctor	Continuous	Number of assistants to doctor per thousand residents
9. Nurse	Continuous	Number of nurses per thousand residents
10. Safe water	Continuous	Ratio of households using safe water in commune
11. Electiricy	Continuous	Ratio of households using electricity in commune
12. Poor	Continuous	Ratio of poor households in commune
13. Credit	Continuous	Ratio of households receiving credit from programs and projects in commune
14. Distance	Continuous	Distance from the respondent residence to the commune health centre calculated as median of the commune
15. Agricultural land	Continuous	Number of square metres of agricultural land per capita
16. Irrigated land	Continuous	Number of square metres of irrigated land per capita
17. Forest land	Continuous	Number of square metres of forest land per capita
18. Long-term forest land	Continuous	Number of square metres of forest land allocated to household on long-term basic per capita
19. Noland	Continuous	Ratio of households having no agricultural land in commune
20. Kindergarten for age 3 to 5	Discrete	Number of kindergartens for ages from 3 to 5 per thousand residents
21. Primary school	Discrete	Number of primary schools (grade 1-5) per thousand residents
22. Lower secondary school	Discrete	Number of lower secondary (grade 6-9) schools per thousand residents
23. Open market	Discrete	Number of open markets in commune territory
24. Post office	Binary	Having a post office

Table V Kernel Propensity Score Matching: Optimal Bandwidth for each Outcome Indicator

Outcome Variable	Bandwidth	After matching bias	S.E of estimated matched mean treated	MSE (Min $\sum[(bias)^2+(SE)^2]$)	Number of control	Number of treated
Mothers having three prenatal checkups	0.13	0.029	0.012	0.00098	269	177
	0.12	0.029	0.012	0.00099	269	177
	0.09	0.029	0.013	0.00101	269	175
Delivery attended by health workers	0.01	0.036	- 0.041	0.00297	269	172
	0.02	0.035	- 0.051	0.00383	269	172
	0.03	0.034	- 0.052	0.00386	269	174
Mothers receiving postnatal consultation	0.02	0.028	0.011	0.00089	269	172
	0.01	0.029	0.010	0.00093	269	172
	0.13	0.027	0.016	0.00096	269	177
Use of boiled water for drinking	0.02	0.037	- 0.008	0.00147	269	172
	0.01	0.039	- 0.003	0.00152	269	172
	0.03	0.037	- 0.014	0.00155	269	174
Use of acceptable toilet	0.14	0.019	0.006	0.00040	269	178
	0.15	0.019	0.007	0.00042	269	178
	0.16	0.019	0.008	0.00042	269	178
Know how to use drug for diarrhoea	0.01	0.035	0.064	0.00537	263	170
	0.07	0.032	0.072	0.00620	263	172
	0.08	0.032	0.072	0.00624	263	172
Incidence of diarrhoeal diseases	0.04	0.001	0.001	0.00000227	269	174
	0.03	0.001	0.000	0.00000228	269	174
	0.05	0.001	0.001	0.00000244	269	174

Table VI Estimated Average Treatment Effect on the Treated (ATT)

Outcome Variables	Kernel Matching Bandwidth	Mean Treated	Mean Control	ATT	ATT as percentage of mean control	T > |t|
1. Mothers having three prenatal checkups	0.13	0.326	0.314	0.012	3.8	0.684
2. Delivery attended by health worker	0.02	0.446	0.497	-0.051	-10.3	0.130
3. Mothers receiving postnatal consultation	0.13	0.272	0.256	0.016	6.1	0.555
4. Use of boil water for drinking	0.03	0.351	0.365	-0.014	-3.9	0.701
5. Having hygienically acceptable toilet	0.14	0.089	0.083	0.006	7.7	0.760
6. Know how to use drug for diarrhoea	0.08	0.459	0.387	0.072	18.7	0.034
7. Incidence of diarrhoea	0.04	0.014	0.014	0.001	3.8	0.743

Table VII Pstest

Outcome: Mothers having three prenatal checkups
Kernel matching with bandwidth 0.13

Variable	Sample	Mean		Percentage bias	Percentage reduction of bias	p>|t|
		Treated	Control			
Ethnic group 2	Unmatched	0.227	0.316	-22.2		0.024
	Matched	0.229	0.232	-0.7	96.9	0.946
Ethnic group 3	Unmatched	0.277	0.398	-27.7		0.005
	Matched	0.281	0.303	-5.1	81.6	0.621
Ethnic group 4	Unmatched	0.403	0.218	41.8		0.000
	Matched	0.397	0.368	6.6	84.2	0.560
Doctor	Unmatched	0.049	0.054	-2.6		0.784
	Matched	0.049	0.046	1.5	43.3	0.887
Associate doctor	Unmatched	0.971	0.900	8.9		0.360
	Matched	0.968	0.934	4.2	52.1	0.701
Nurse	Unmatched	1.010	1.188	-14.4		0.152
	Matched	1.005	1.046	-3.4	76.5	0.753
Water	Unmatched	0.355	0.345	2.9		0.764
	Matched	0.357	0.347	2.8	2.7	0.795
Electricity	Unmatched	0.345	0.324	6.5		0.500
	Matched	0.344	0.329	4.7	27.8	0.667
Poor	Unmatched	0.520	0.462	31.7		0.001
	Matched	0.521	0.516	2.9	90.9	0.787
Credit	Unmatched	0.314	0.356	-15.9		0.101
	Matched	0.312	0.316	-1.7	89.2	0.868
Distance	Unmatched	2.162	2.551	-16.4		0.100
	Matched	2.182	2.190	-0.4	97.8	0.970
Agricultural land	Unmatched	2,267.300	2,049.400	13.5		0.149
	Matched	2,233.100	2,202.800	1.9	86.1	0.864
Irrigated land	Unmatched	160.360	165.310	-2.3		0.806
	Matched	161.510	154.420	3.4	-43.3	0.757
Forest land	Unmatched	20,628.000	13,703.000	13		0.139
	Matched	15,684.000	15,357.000	0.6	95.3	0.914
Long-term forest land	Unmatched	2,333.300	4,056.800	-25.1		0.015
	Matched	2,359.600	2,258.400	1.5	94.1	0.834
No land	Unmatched	0.018	0.007	16.9		0.059
	Matched	0.013	0.010	3.5	79	0.640
Kindergarten for age 3-5	Unmatched	0.832	0.940	-9		0.357
	Matched	0.839	0.793	3.9	57.2	0.704
Primary school	Unmatched	0.630	0.589	10.4		0.285
	Matched	0.628	0.607	5.5	47.3	0.619
Lower secondary school	Unmatched	0.187	0.198	-3.8		0.691
	Matched	0.187	0.185	0.5	87.7	0.963
Open market	Unmatched	0.128	0.097	10.1		0.291
	Matched	0.130	0.135	-1.5	85.2	0.896
Post office	Unmatched	0.279	0.305	-5.6		0.563
	Matched	0.277	0.286	-2	64.7	0.851

Outcome: Delivery attended by health worker
Kernel matching with bandwidth 0.01

Variable	Sample	Mean		Percentage bias	Percentage reduction of bias	p>|t|
		Treated	Control			
Ethnic group 2	Unmatched	0.227	0.316	-22.2		0.024
	Matched	0.234	0.218	3.9	82.5	0.704
Ethnic group 3	Unmatched	0.277	0.398	-27.7		0.005
	Matched	0.285	0.343	-13.3	52	0.217
Ethnic group 4	Unmatched	0.403	0.218	41.8		0.000
	Matched	0.387	0.361	5.8	86.1	0.614
Doctor	Unmatched	0.049	0.054	-2.6		0.784
	Matched	0.051	0.042	4.6	-78.6	0.658
Associate doctor	Unmatched	0.971	0.900	8.9		0.360
	Matched	0.956	0.943	1.7	81.3	0.878
Nurse	Unmatched	1.010	1.188	-14.4		0.152
	Matched	1.005	1.085	-6.4	55.4	0.585
Water	Unmatched	0.355	0.345	2.9		0.764
	Matched	0.351	0.317	10.1	-252.1	0.349
Electricity	Unmatched	0.345	0.324	6.5		0.500
	Matched	0.345	0.319	7.9	-21.7	0.470
Poor	Unmatched	0.520	0.462	31.7		0.001
	Matched	0.520	0.517	1.8	94.2	0.866
Credit	Unmatched	0.314	0.356	-15.9		0.101
	Matched	0.317	0.301	6	62.4	0.571
Distance	Unmatched	2.162	2.551	-16.4		0.100
	Matched	2.182	2.093	3.7	77.3	0.690
Agricultural land	Unmatched	2,267.300	2,049.400	13.5		0.149
	Matched	2,221.700	2,263.100	-2.6	81	0.818
Irrigated land	Unmatched	160.360	165.310	-2.3		0.806
	Matched	161.160	148.270	6.1	-160.7	0.577
Forest land	Unmatched	20,628.000	13,703.000	13		0.139
	Matched	13,653.000	16,086.000	-4.6	64.9	0.340
Long-term forest land	Unmatched	2,333.300	4,056.800	-25.1		0.015
	Matched	2,389.600	1,975.700	6	76	0.363
No land	Unmatched	0.018	0.007	16.9		0.059
	Matched	0.008	0.011	-4.6	72.6	0.530
Kindergarten for age 3-5	Unmatched	0.832	0.940	-9		0.357
	Matched	0.854	0.808	3.8	57.7	0.729
Primary school	Unmatched	0.630	0.589	10.4		0.285
	Matched	0.619	0.633	-3.4	67.4	0.767
Lower secondary school	Unmatched	0.187	0.198	-3.8		0.691
	Matched	0.183	0.181	0.7	80.5	0.941
Open market	Unmatched	0.128	0.097	10.1		0.291
	Matched	0.128	0.115	4	60.7	0.723
Post office	Unmatched	0.279	0.305	-5.6		0.563
	Matched	0.285	0.267	3.8	31.6	0.718

Outcome: Delivery attended by health worker
Kernel matching with bandwidth 0.02

Variable	Sample	Mean		Percentage bias	Percentage reduction of bias	p>|t|
		Treated	Control			
Ethnic group 2	Unmatched	0.227	0.316	-22.20		0.024
	Matched	0.234	0.220	3.50	84.40	0.735
Ethnic group 3	Unmatched	0.277	0.398	-27.70		0.005
	Matched	0.285	0.324	-9.00	67.60	0.399
Ethnic group 4	Unmatched	0.403	0.218	41.80		0.000
	Matched	0.387	0.374	2.90	93.00	0.800
Doctor	Unmatched	0.049	0.054	-2.60		0.784
	Matched	0.051	0.049	1.00	62.10	0.927
Associate doctor	Unmatched	0.971	0.900	8.90		0.360
	Matched	0.956	0.942	1.70	80.60	0.874
Nurse	Unmatched	1.010	1.188	-14.40		0.152
	Matched	1.005	1.056	-4.10	71.50	0.721
Water	Unmatched	0.355	0.345	2.90		0.764
	Matched	0.351	0.325	7.60	-165.60	0.480
Electricity	Unmatched	0.345	0.324	6.50		0.500
	Matched	0.345	0.322	6.90	-6.50	0.529
Poor	Unmatched	0.520	0.462	31.70		0.001
	Matched	0.520	0.521	-0.60	98.20	0.957
Credit	Unmatched	0.314	0.356	-15.90		0.101
	Matched	0.317	0.311	2.40	85.20	0.824
Distance	Unmatched	2.162	2.551	-16.40		0.100
	Matched	2.182	2.157	1.00	93.80	0.916
Agricultural land	Unmatched	2267.300	2049.400	13.50		0.149
	Matched	2221.700	2211.000	0.70	95.10	0.953
Irrigated land	Unmatched	160.360	165.310	-2.30		0.806
	Matched	161.160	142.620	8.80	-274.80	0.412
Forest land	Unmatched	20628.000	13703.000	13.00		0.139
	Matched	13653.000	15443.000	-3.40	74.20	0.463
Long-term forest land	Unmatched	2333.300	4056.800	-25.10		0.015
	Matched	2389.600	2137.400	3.70	85.40	0.601
No land	Unmatched	0.018	0.007	16.90		0.059
	Matched	0.008	0.012	-4.90	71.10	0.494
Kindergarten for age 3-5	Unmatched	0.832	0.940	-9.00		0.357
	Matched	0.854	0.804	4.10	54.30	0.699
Primary school	Unmatched	0.630	0.589	10.40		0.285
	Matched	0.619	0.626	-1.70	83.60	0.881
Lower secondary school	Unmatched	0.187	0.198	-3.80		0.691
	Matched	0.183	0.189	-2.00	46.90	0.843
Open market	Unmatched	0.128	0.097	10.10		0.291
	Matched	0.128	0.117	3.60	64.40	0.750
Post office	Unmatched	0.279	0.305	-5.60		0.563
	Matched	0.285	0.268	3.80	32.00	0.720

Outcome: Delivery attended by health worker
Kernel matching with bandwidth 0.03

Variable	Sample	Mean		Percentage bias	Percentage reduction of bias	p>|t|
		Treated	Control			
Ethnic group 2	Unmatched	0.227	0.316	-22.20		0.024
	Matched	0.233	0.216	4.10	81.40	0.683
Ethnic group 3	Unmatched	0.277	0.398	-27.70		0.005
	Matched	0.285	0.318	-7.40	73.20	0.480
Ethnic group 4	Unmatched	0.403	0.218	41.80		0.000
	Matched	0.388	0.375	3.10	92.70	0.790
Doctor	Unmatched	0.049	0.054	-2.60		0.784
	Matched	0.050	0.049	0.60	76.20	0.954
Associate doctor	Unmatched	0.971	0.900	8.90		0.360
	Matched	0.947	0.957	-1.30	85.50	0.908
Nurse	Unmatched	1.010	1.188	-14.40		0.152
	Matched	0.998	1.033	-2.80	80.20	0.799
Water	Unmatched	0.355	0.345	2.90		0.764
	Matched	0.351	0.330	6.30	-119.60	0.558
Electricity	Unmatched	0.345	0.324	6.50		0.500
	Matched	0.343	0.321	6.70	-4.10	0.533
Poor	Unmatched	0.520	0.462	31.70		0.001
	Matched	0.523	0.524	-0.90	97.20	0.934
Credit	Unmatched	0.314	0.356	-15.90		0.101
	Matched	0.313	0.308	1.80	88.40	0.860
Distance	Unmatched	2.162	2.551	-16.40		0.100
	Matched	2.173	2.185	-0.50	96.90	0.957
Agricultural land	Unmatched	2267.300	2049.400	13.50		0.149
	Matched	2225.600	2210.200	1.00	92.90	0.931
Irrigated land	Unmatched	160.360	165.310	-2.30		0.806
	Matched	161.200	144.840	7.70	-230.60	0.466
Forest land	Unmatched	20628.000	13703.000	13.00		0.139
	Matched	13578.000	15100.000	-2.90	78.00	0.518
Long-term forest land	Unmatched	2333.300	4056.800	-25.10		0.015
	Matched	2400.300	2159.700	3.50	86.00	0.619
No land	Unmatched	0.018	0.007	16.90		0.059
	Matched	0.009	0.011	-3.10	81.70	0.654
Kindergarten for age 3-5	Unmatched	0.832	0.940	-9.00		0.357
	Matched	0.844	0.786	4.80	46.40	0.642
Primary school	Unmatched	0.630	0.589	10.40		0.285
	Matched	0.619	0.623	-1.10	89.70	0.925
Lower secondary school	Unmatched	0.187	0.198	-3.80		0.691
	Matched	0.183	0.185	-0.70	80.70	0.942
Open market	Unmatched	0.128	0.097	10.10		0.291
	Matched	0.132	0.126	2.00	79.80	0.859
Post office	Unmatched	0.279	0.305	-5.60		0.563
	Matched	0.282	0.272	2.10	62.10	0.841

Outcome: Mothers having postnatal consultation
Kernel matching with bandwidth 0.02

Variable	Sample	Mean		Percentage bias	Percentage reduction of bias	p>|t|
		Treated	Control			
Ethnic group 2	Unmatched	0.227	0.316	-22.2		0.024
	Matched	0.229	0.232	-0.7	96.9	0.946
Ethnic group 3	Unmatched	0.277	0.398	-27.7		0.005
	Matched	0.281	0.303	-5.1	81.6	0.621
Ethnic group 4	Unmatched	0.403	0.218	41.8		0.000
	Matched	0.397	0.368	6.6	84.2	0.560
Doctor	Unmatched	0.049	0.054	-2.6		0.784
	Matched	0.049	0.046	1.5	43.3	0.887
Associate doctor	Unmatched	0.971	0.900	8.9		0.360
	Matched	0.968	0.934	4.2	52.1	0.701
Nurse	Unmatched	1.010	1.188	-14.4		0.152
	Matched	1.005	1.046	-3.4	76.5	0.753
Water	Unmatched	0.355	0.345	2.9		0.764
	Matched	0.357	0.347	2.8	2.7	0.795
Electricity	Unmatched	0.345	0.324	6.5		0.500
	Matched	0.344	0.329	4.7	27.8	0.667
Poor	Unmatched	0.520	0.462	31.7		0.001
	Matched	0.521	0.516	2.9	90.9	0.787
Credit	Unmatched	0.314	0.356	-15.9		0.101
	Matched	0.312	0.316	-1.7	89.2	0.868
Distance	Unmatched	2.162	2.551	-16.4		0.100
	Matched	2.182	2.190	-0.4	97.8	0.970
Agricultural land	Unmatched	2,267.300	2,049.400	13.5		0.149
	Matched	2,233.100	2,202.800	1.9	86.1	0.864
Irrigated land	Unmatched	160.360	165.310	-2.3		0.806
	Matched	161.510	154.420	3.4	-43.3	0.757
Forest land	Unmatched	20,628.000	13,703.000	13		0.139
	Matched	15,684.000	15,357.000	0.6	95.3	0.914
Long-term forest land	Unmatched	2,333.300	4,056.800	-25.1		0.015
	Matched	2,359.600	2,258.400	1.5	94.1	0.834
No land	Unmatched	0.018	0.007	16.9		0.059
	Matched	0.013	0.010	3.5	79	0.640
Kindergarten for age 3-5	Unmatched	0.832	0.940	-9		0.357
	Matched	0.839	0.793	3.9	57.2	0.704
Primary school	Unmatched	0.630	0.589	10.4		0.285
	Matched	0.628	0.607	5.5	47.3	0.619
Lower secondary school	Unmatched	0.187	0.198	-3.8		0.691
	Matched	0.187	0.185	0.5	87.7	0.963
Open market	Unmatched	0.128	0.097	10.1		0.291
	Matched	0.130	0.135	-1.5	85.2	0.896
Post office	Unmatched	0.279	0.305	-5.6		0.563
	Matched	0.277	0.286	-2	64.7	0.851

Outcome: Mothers having postnatal consultation
Kernel matching with bandwidth 0.01

Variable	Sample	Mean		Percentage bias	Percentage reduction of bias	p>|t|
		Treated	Control			
Ethnic group 2	Unmatched	0.227	0.316	-22.20		0.024
	Matched	0.234	0.218	3.90	82.50	0.704
Ethnic group 3	Unmatched	0.277	0.398	-27.70		0.005
	Matched	0.285	0.343	-13.30	52.00	0.217
Ethnic group 4	Unmatched	0.403	0.218	41.80		0.000
	Matched	0.387	0.361	5.80	86.10	0.614
Doctor	Unmatched	0.049	0.054	-2.60		0.784
	Matched	0.051	0.042	4.60	-78.60	0.658
Associate doctor	Unmatched	0.971	0.900	8.90		0.360
	Matched	0.956	0.943	1.70	81.30	0.878
Nurse	Unmatched	1.010	1.188	-14.40		0.152
	Matched	1.005	1.085	-6.40	55.40	0.585
Water	Unmatched	0.355	0.345	2.90		0.764
	Matched	0.351	0.317	10.10	-252.10	0.349
Electricity	Unmatched	0.345	0.324	6.50		0.500
	Matched	0.345	0.319	7.90	-21.70	0.470
Poor	Unmatched	0.520	0.462	31.70		0.001
	Matched	0.520	0.517	1.80	94.20	0.866
Credit	Unmatched	0.314	0.356	-15.90		0.101
	Matched	0.317	0.301	6.00	62.40	0.571
Distance	Unmatched	2.162	2.551	-16.40		0.100
	Matched	2.182	2.093	3.70	77.30	0.690
Agricultural land	Unmatched	2267.300	2049.400	13.50		0.149
	Matched	2221.700	2263.100	-2.60	81.00	0.818
Irrigated land	Unmatched	160.360	165.310	-2.30		0.806
	Matched	161.160	148.270	6.10	-160.70	0.577
Forest land	Unmatched	20628.000	13703.000	13.00		0.139
	Matched	13653.000	16086.000	-4.60	64.90	0.340
Long-term forest land	Unmatched	2333.300	4056.800	-25.10		0.015
	Matched	2389.600	1975.700	6.00	76.00	0.363
No land	Unmatched	0.018	0.007	16.90		0.059
	Matched	0.008	0.011	-4.60	72.60	0.530
Kindergarten for age 3-5	Unmatched	0.832	0.940	-9.00		0.357
	Matched	0.854	0.808	3.80	57.70	0.729
Primary school	Unmatched	0.630	0.589	10.40		0.285
	Matched	0.619	0.633	-3.40	67.40	0.767
Lower secondary school	Unmatched	0.187	0.198	-3.80		0.691
	Matched	0.183	0.181	0.70	80.50	0.941
Open market	Unmatched	0.128	0.097	10.10		0.291
	Matched	0.128	0.115	4.00	60.70	0.723
Post office	Unmatched	0.279	0.305	-5.60		0.563
	Matched	0.285	0.267	3.80	31.60	0.718

Outcome: Mothers having postnatal consultation
Kernel matching with bandwidth 0.13

Variable	Sample	Mean		Percentage bias	Percentage reduction of bias	p>|t|
		Treated	Control			
Ethnic group 2	Unmatched	0.227	0.316	-22.20		0.024
	Matched	0.229	0.232	-0.70	96.90	0.946
Ethnic group 3	Unmatched	0.277	0.398	-27.70		0.005
	Matched	0.281	0.303	-5.10	81.60	0.621
Ethnic group 4	Unmatched	0.403	0.218	41.80		0.000
	Matched	0.397	0.368	6.60	84.20	0.560
Doctor	Unmatched	0.049	0.054	-2.60		0.784
	Matched	0.049	0.046	1.50	43.30	0.887
Associate doctor	Unmatched	0.971	0.900	8.90		0.360
	Matched	0.968	0.934	4.20	52.10	0.701
Nurse	Unmatched	1.010	1.188	-14.40		0.152
	Matched	1.005	1.046	-3.40	76.50	0.753
Water	Unmatched	0.355	0.345	2.90		0.764
	Matched	0.357	0.347	2.80	2.70	0.795
Electricity	Unmatched	0.345	0.324	6.50		0.500
	Matched	0.344	0.329	4.70	27.80	0.667
Poor	Unmatched	0.520	0.462	31.70		0.001
	Matched	0.521	0.516	2.90	90.90	0.787
Credit	Unmatched	0.314	0.356	-15.90		0.101
	Matched	0.312	0.316	-1.70	89.20	0.868
Distance	Unmatched	2.162	2.551	-16.40		0.100
	Matched	2.182	2.190	-0.40	97.80	0.970
Agricultural land	Unmatched	2267.300	2049.400	13.50		0.149
	Matched	2233.100	2202.800	1.90	86.10	0.864
Irrigated land	Unmatched	160.360	165.310	-2.30		0.806
	Matched	161.510	154.420	3.40	-43.30	0.757
Forest land	Unmatched	20628.000	13703.000	13.00		0.139
	Matched	15684.000	15357.000	0.60	95.30	0.914
Long-term forest land	Unmatched	2333.300	4056.800	-25.10		0.015
	Matched	2359.600	2258.400	1.50	94.10	0.834
No land	Unmatched	0.018	0.007	16.90		0.059
	Matched	0.013	0.010	3.50	79.00	0.640
Kindergarten for age 3-5	Unmatched	0.832	0.940	-9.00		0.357
	Matched	0.839	0.793	3.90	57.20	0.704
Primary school	Unmatched	0.630	0.589	10.40		0.285
	Matched	0.628	0.607	5.50	47.30	0.619
Lower secondary school	Unmatched	0.187	0.198	-3.80		0.691
	Matched	0.187	0.185	0.50	87.70	0.963
Open market	Unmatched	0.128	0.097	10.10		0.291
	Matched	0.130	0.135	-1.50	85.20	0.896
Post office	Unmatched	0.279	0.305	-5.60		0.563
	Matched	0.277	0.286	-2.00	64.70	0.851

Outcome: Use of boiled water for drinking
Kernel matching with bandwidth 0.02

Variable	Sample	Mean		Percentage bias	Percentage reduction of bias	p>|t|
		Treated	Control			
Ethnic group 2	Unmatched	0.227	0.316	-22.2		0.024
	Matched	0.234	0.220	3.5	84.4	0.735
Ethnic group 3	Unmatched	0.277	0.398	-27.7		0.005
	Matched	0.285	0.324	-9	67.6	0.399
Ethnic group 4	Unmatched	0.403	0.218	41.8		0.000
	Matched	0.387	0.374	2.9	93	0.800
Doctor	Unmatched	0.049	0.054	-2.6		0.784
	Matched	0.051	0.049	1	62.1	0.927
Associate doctor	Unmatched	0.971	0.900	8.9		0.360
	Matched	0.956	0.942	1.7	80.6	0.874
Nurse	Unmatched	1.010	1.188	-14.4		0.152
	Matched	1.005	1.056	-4.1	71.5	0.721
Water	Unmatched	0.355	0.345	2.9		0.764
	Matched	0.351	0.325	7.6	-165.6	0.480
Electricity	Unmatched	0.345	0.324	6.5		0.500
	Matched	0.345	0.322	6.9	-6.5	0.529
Poor	Unmatched	0.520	0.462	31.7		0.001
	Matched	0.520	0.521	-0.6	98.2	0.957
Credit	Unmatched	0.314	0.356	-15.9		0.101
	Matched	0.317	0.311	2.4	85.2	0.824
Distance	Unmatched	2.162	2.551	-16.4		0.100
	Matched	2.182	2.157	1	93.8	0.916
Agricultural land	Unmatched	2,267.300	2,049.400	13.5		0.149
	Matched	2,221.700	2,211.000	0.7	95.1	0.953
Irrigated land	Unmatched	160.360	165.310	-2.3		0.806
	Matched	161.160	142.620	8.8	-274.8	0.412
Forest land	Unmatched	20,628.000	13,703.000	13		0.139
	Matched	13,653.000	15,443.000	-3.4	74.2	0.463
Long-term forest land	Unmatched	2,333.300	4,056.800	-25.1		0.015
	Matched	2,389.600	2,137.400	3.7	85.4	0.601
No land	Unmatched	0.018	0.007	16.9		0.059
	Matched	0.008	0.012	-4.9	71.1	0.494
Kindergarten for age 3-5	Unmatched	0.832	0.940	-9		0.357
	Matched	0.854	0.804	4.1	54.3	0.699
Primary school	Unmatched	0.630	0.589	10.4		0.285
	Matched	0.619	0.626	-1.7	83.6	0.881
Lower secondary school	Unmatched	0.187	0.198	-3.8		0.691
	Matched	0.183	0.189	-2	46.9	0.843
Open market	Unmatched	0.128	0.097	10.1		0.291
	Matched	0.128	0.117	3.6	64.4	0.750
Post office	Unmatched	0.279	0.305	-5.6		0.563
	Matched	0.285	0.268	3.8	32	0.720

Outcome: Use of boiled water for drinking
Kernel matching with bandwidth 0.01

Variable	Sample	Mean		Percentage bias	Percentage reduction of bias	p>|t|
		Treated	Control			
Ethnic group 2	Unmatched	0.227	0.316	-22.20		0.024
	Matched	0.234	0.218	3.90	82.50	0.704
Ethnic group 3	Unmatched	0.277	0.398	-27.70		0.005
	Matched	0.285	0.343	-13.30	52.00	0.217
Ethnic group 4	Unmatched	0.403	0.218	41.80		0.000
	Matched	0.387	0.361	5.80	86.10	0.614
Doctor	Unmatched	0.049	0.054	-2.60		0.784
	Matched	0.051	0.042	4.60	-78.60	0.658
Associate doctor	Unmatched	0.971	0.900	8.90		0.360
	Matched	0.956	0.943	1.70	81.30	0.878
Nurse	Unmatched	1.010	1.188	-14.40		0.152
	Matched	1.005	1.085	-6.40	55.40	0.585
Water	Unmatched	0.355	0.345	2.90		0.764
	Matched	0.351	0.317	10.10	-252.10	0.349
Electricity	Unmatched	0.345	0.324	6.50		0.500
	Matched	0.345	0.319	7.90	-21.70	0.470
Poor	Unmatched	0.520	0.462	31.70		0.001
	Matched	0.520	0.517	1.80	94.20	0.866
Credit	Unmatched	0.314	0.356	-15.90		0.101
	Matched	0.317	0.301	6.00	62.40	0.571
Distance	Unmatched	2.162	2.551	-16.40		0.100
	Matched	2.182	2.093	3.70	77.30	0.690
Agricultural land	Unmatched	2267.300	2049.400	13.50		0.149
	Matched	2221.700	2263.100	-2.60	81.00	0.818
Irrigated land	Unmatched	160.360	165.310	-2.30		0.806
	Matched	161.160	148.270	6.10	-160.70	0.577
Forest land	Unmatched	20628.000	13703.000	13.00		0.139
	Matched	13653.000	16086.000	-4.60	64.90	0.340
Long-term forest land	Unmatched	2333.300	4056.800	-25.10		0.015
	Matched	2389.600	1975.700	6.00	76.00	0.363
No land	Unmatched	0.018	0.007	16.90		0.059
	Matched	0.008	0.011	-4.60	72.60	0.530
Kindergarten for age 3-5	Unmatched	0.832	0.940	-9.00		0.357
	Matched	0.854	0.808	3.80	57.70	0.729
Primary school	Unmatched	0.630	0.589	10.40		0.285
	Matched	0.619	0.633	-3.40	67.40	0.767
Lower secondary school	Unmatched	0.187	0.198	-3.80		0.691
	Matched	0.183	0.181	0.70	80.50	0.941
Open market	Unmatched	0.128	0.097	10.10		0.291
	Matched	0.128	0.115	4.00	60.70	0.723
Post office	Unmatched	0.279	0.305	-5.60		0.563
	Matched	0.285	0.267	3.80	31.60	0.718

Outcome: Use of boiled water for drinking
Kernel matching with bandwidth 0.03

Variable	Sample	Mean		Percentage bias	Percentage reduction of bias	p>|t|
		Treated	Control			
Ethnic group 2	Unmatched	0.227	0.316	-22.20		0.024
	Matched	0.233	0.216	4.10	81.40	0.683
Ethnic group 3	Unmatched	0.277	0.398	-27.70		0.005
	Matched	0.285	0.318	-7.40	73.20	0.480
Ethnic group 4	Unmatched	0.403	0.218	41.80		0.000
	Matched	0.388	0.375	3.10	92.70	0.790
Doctor	Unmatched	0.049	0.054	-2.60		0.784
	Matched	0.050	0.049	0.60	76.20	0.954
Associate doctor	Unmatched	0.971	0.900	8.90		0.360
	Matched	0.947	0.957	-1.30	85.50	0.908
Nurse	Unmatched	1.010	1.188	-14.40		0.152
	Matched	0.998	1.033	-2.80	80.20	0.799
Water	Unmatched	0.355	0.345	2.90		0.764
	Matched	0.351	0.330	6.30	-119.60	0.558
Electricity	Unmatched	0.345	0.324	6.50		0.500
	Matched	0.343	0.321	6.70	-4.10	0.533
Poor	Unmatched	0.520	0.462	31.70		0.001
	Matched	0.523	0.524	-0.90	97.20	0.934
Credit	Unmatched	0.314	0.356	-15.90		0.101
	Matched	0.313	0.308	1.80	88.40	0.860
Distance	Unmatched	2.162	2.551	-16.40		0.100
	Matched	2.173	2.185	-0.50	96.90	0.957
Agricultural land	Unmatched	2267.300	2049.400	13.50		0.149
	Matched	2225.600	2210.200	1.00	92.90	0.931
Irrigated land	Unmatched	160.360	165.310	-2.30		0.806
	Matched	161.200	144.840	7.70	-230.60	0.466
Forest land	Unmatched	20628.000	13703.000	13.00		0.139
	Matched	13578.000	15100.000	-2.90	78.00	0.518
Long-term forest land	Unmatched	2333.300	4056.800	-25.10		0.015
	Matched	2400.300	2159.700	3.50	86.00	0.619
No land	Unmatched	0.018	0.007	16.90		0.059
	Matched	0.009	0.011	-3.10	81.70	0.654
Kindergarten for age 3-5	Unmatched	0.832	0.940	-9.00		0.357
	Matched	0.844	0.786	4.80	46.40	0.642
Primary school	Unmatched	0.630	0.589	10.40		0.285
	Matched	0.619	0.623	-1.10	89.70	0.925
Lower secondary school	Unmatched	0.187	0.198	-3.80		0.691
	Matched	0.183	0.185	-0.70	80.70	0.942
Open market	Unmatched	0.128	0.097	10.10		0.291
	Matched	0.132	0.126	2.00	79.80	0.859
Post office	Unmatched	0.279	0.305	-5.60		0.563
	Matched	0.282	0.272	2.10	62.10	0.841

Outcome: Having hygienically acceptable toilet
Kernel matching with bandwidth 0.14

Variable	Sample	Mean		Percentage bias	Percentage reduction of bias	p>|t|
		Treated	Control			
Ethnic group 2	Unmatched	0.227	0.316	-22.2		0.024
	Matched	0.228	0.232	-0.9	95.8	0.927
Ethnic group 3	Unmatched	0.277	0.398	-27.7		0.005
	Matched	0.279	0.303	-5.5	80.2	0.594
Ethnic group 4	Unmatched	0.403	0.218	41.8		0.000
	Matched	0.400	0.367	7.6	81.9	0.506
Doctor	Unmatched	0.049	0.054	-2.6		0.784
	Matched	0.049	0.046	1.4	47.7	0.895
Associate doctor	Unmatched	0.971	0.900	8.9		0.360
	Matched	0.968	0.938	3.9	56.5	0.728
Nurse	Unmatched	1.010	1.188	-14.4		0.152
	Matched	1.011	1.046	-2.8	80.2	0.791
Water	Unmatched	0.355	0.345	2.9		0.764
	Matched	0.356	0.348	2.5	11.9	0.814
Electricity	Unmatched	0.345	0.324	6.5		0.500
	Matched	0.347	0.329	5.7	11.7	0.598
Poor	Unmatched	0.520	0.462	31.7		0.001
	Matched	0.521	0.516	2.4	92.3	0.818
Credit	Unmatched	0.314	0.356	-15.9		0.101
	Matched	0.315	0.317	-0.5	96.6	0.959
Distance	Unmatched	2.162	2.551	-16.4		0.100
	Matched	2.171	2.191	-0.8	94.8	0.928
Agricultural land	Unmatched	2,267.300	2,09.400	13.5		0.149
	Matched	2,264.100	2,201.100	3.9	71.1	0.724
Irrigated land	Unmatched	160.360	165.310	-2.3		0.806
	Matched	161.260	154.510	3.2	-36.4	0.768
Forest land	Unmatched	20,628.000	13,703.000	13		0.139
	Matched	20,580.000	15,347.000	9.8	24.4	0.363
Long-term forest land	Unmatched	2,333.300	4,056.800	-25.1		0.015
	Matched	2,346.400	2,258.000	1.3	94.9	0.854
No land	Unmatched	0.018	0.007	16.9		0.059
	Matched	0.013	0.010	3.4	79.6	0.648
Kindergarten for age 3-5	Unmatched	0.832	0.940	-9		0.357
	Matched	0.834	0.793	3.5	61.4	0.731
Primary school	Unmatched	0.630	0.589	10.4		0.285
	Matched	0.631	0.607	6	42.8	0.589
Lower secondary school	Unmatched	0.187	0.198	-3.8		0.691
	Matched	0.186	0.185	0.3	92.7	0.978
Open market	Unmatched	0.128	0.097	10.1		0.291
	Matched	0.129	0.136	-2.1	79.3	0.855
Post office	Unmatched	0.279	0.305	-5.6		0.563
	Matched	0.275	0.285	-2.2	61.3	0.837

Outcome: Know how to use drug for diarrhoea
Kernel matching with bandwidth 0.01

Variable	Sample	Mean		Percentage bias	Percentage reduction of bias	p>|t|
		Treated	Control			
Ethnic group 2	Unmatched	0.220	0.305	-21.3		0.031
	Matched	0.227	0.211	3.9	81.8	0.705
Ethnic group 3	Unmatched	0.279	0.403	-28.4		0.004
	Matched	0.287	0.305	-4.2	85.3	0.694
Ethnic group 4	Unmatched	0.408	0.223	41.5		0.000
	Matched	0.392	0.419	-6.3	84.9	0.591
Doctor	Unmatched	0.047	0.055	-3.9		0.683
	Matched	0.049	0.050	-0.2	94.9	0.985
Associate doctor	Unmatched	0.971	0.906	8.2		0.401
	Matched	0.956	0.975	-2.3	71.5	0.829
Nurse	Unmatched	1.008	1.146	-11.4		0.257
	Matched	1.003	0.995	0.7	94.1	0.943
Water	Unmatched	0.352	0.340	3.4		0.725
	Matched	0.348	0.305	12.4	-268.2	0.245
Electricity	Unmatched	0.345	0.317	8.5		0.379
	Matched	0.344	0.313	9.4	-11.3	0.383
Poor	Unmatched	0.518	0.459	31.9		0.001
	Matched	0.518	0.522	-2.4	92.5	0.826
Credit	Unmatched	0.316	0.356	-15.1		0.122
	Matched	0.319	0.302	6.2	58.9	0.545
Distance	Unmatched	2.096	2.493	-17.2		0.086
	Matched	2.113	2.162	-2.1	87.7	0.830
Agricultural land	Unmatched	2,292.500	2,080.400	13.2		0.162
	Matched	2,247.500	2,235.300	0.8	94.3	0.947
Irrigated land	Unmatched	162.170	166.110	-1.9		0.847
	Matched	163.060	151.630	5.4	-190.3	0.622
Forest land	Unmatched	20,686.000	13,664.000	13.1		0.140
	Matched	13,632.000	14,685.000	-2	85	0.602
Long-term forest land	Unmatched	2,359.600	4,136.700	-25.7		0.013
	Matched	2,417.700	1,976.300	6.4	75.2	0.340
No land	Unmatched	0.018	0.007	16.9		0.062
	Matched	0.008	0.005	4.4	73.8	0.292
Kindergarten for age 3-5	Unmatched	0.819	0.913	-7.8		0.427
	Matched	0.840	0.760	6.7	14.1	0.526
Primary school	Unmatched	0.630	0.592	9.7		0.325
	Matched	0.619	0.608	2.9	70.2	0.776
Lower secondary school	Unmatched	0.186	0.196	-3.4		0.728
	Matched	0.182	0.198	-5.7	-69.6	0.584
Open market	Unmatched	0.130	0.099	9.8		0.311
	Matched	0.129	0.113	5	48.5	0.653
Post office	Unmatched	0.282	0.300	-3.9		0.687
	Matched	0.288	0.268	4.5	-15	0.673

Outcome: Know how to use drug for diarrhoea
Kernel matching with bandwidth 0.07

Variable	Sample	Mean		Percentage bias	Percentage reduction of bias	p>|t|
		Treated	Control			
Ethnic group 2	Unmatched	0.220	0.305	-21.30		0.031
	Matched	0.226	0.222	1.00	95.50	0.926
Ethnic group 3	Unmatched	0.279	0.403	-28.40		0.004
	Matched	0.287	0.308	-4.90	82.60	0.639
Ethnic group 4	Unmatched	0.408	0.223	41.50		0.000
	Matched	0.393	0.377	3.50	91.60	0.761
Doctor	Unmatched	0.047	0.055	-3.90		0.683
	Matched	0.049	0.046	1.30	66.70	0.901
Associate doctor	Unmatched	0.971	0.906	8.20		0.401
	Matched	0.947	0.928	2.40	70.80	0.827
Nurse	Unmatched	1.008	1.146	-11.40		0.257
	Matched	0.996	1.034	-3.20	72.20	0.773
Water	Unmatched	0.352	0.340	3.40		0.725
	Matched	0.348	0.336	3.50	-3.40	0.747
Electricity	Unmatched	0.345	0.317	8.50		0.379
	Matched	0.342	0.327	4.60	46.30	0.678
Poor	Unmatched	0.518	0.459	31.90		0.001
	Matched	0.521	0.518	1.60	95.10	0.886
Credit	Unmatched	0.316	0.356	-15.10		0.122
	Matched	0.315	0.314	0.40	97.50	0.971
Distance	Unmatched	2.096	2.493	-17.20		0.086
	Matched	2.105	2.140	-1.50	91.30	0.875
Agricultural land	Unmatched	2292.500	2080.400	13.20		0.162
	Matched	2251.100	2223.900	1.70	87.20	0.879
Irrigated land	Unmatched	162.170	166.110	-1.90		0.847
	Matched	163.070	151.980	5.20	-181.60	0.632
Forest land	Unmatched	20686.000	13664.000	13.10		0.140
	Matched	13556.000	15104.000	-2.90	78.00	0.501
Long-term forest land	Unmatched	2359.600	4136.700	-25.70		0.013
	Matched	2428.200	2177.600	3.60	85.90	0.600
No land	Unmatched	0.018	0.007	16.90		0.062
	Matched	0.009	0.010	-1.80	89.50	0.783
Kindergarten for age 3-5	Unmatched	0.819	0.913	-7.80		0.427
	Matched	0.831	0.779	4.30	44.90	0.679
Primary school	Unmatched	0.630	0.592	9.70		0.325
	Matched	0.619	0.606	3.10	67.80	0.774
Lower secondary school	Unmatched	0.186	0.196	-3.40		0.728
	Matched	0.182	0.185	-1.20	64.20	0.905
Open market	Unmatched	0.130	0.099	9.80		0.311
	Matched	0.134	0.132	0.60	93.40	0.955
Post office	Unmatched	0.282	0.300	-3.90		0.687
	Matched	0.285	0.284	0.20	95.70	0.988

Outcome: Know how to use drug for diarrhoea
Kernel matching with bandwidth 0.08

Variable	Sample	Mean		Percentage bias	Percentage reduction of bias	p>|t|
		Treated	Control			
Ethnic group 2	Unmatched	0.220	0.305	-21.30		0.031
	Matched	0.226	0.224	0.60	97.40	0.956
Ethnic group 3	Unmatched	0.279	0.403	-28.40		0.004
	Matched	0.287	0.308	-4.90	82.70	0.641
Ethnic group 4	Unmatched	0.408	0.223	41.50		0.000
	Matched	0.393	0.375	4.00	90.30	0.725
Doctor	Unmatched	0.047	0.055	-3.90		0.683
	Matched	0.049	0.046	1.40	65.40	0.897
Associate doctor	Unmatched	0.971	0.906	8.20		0.401
	Matched	0.947	0.926	2.70	67.30	0.806
Nurse	Unmatched	1.008	1.146	-11.40		0.257
	Matched	0.996	1.040	-3.60	68.00	0.742
Water	Unmatched	0.352	0.340	3.40		0.725
	Matched	0.348	0.337	3.30	3.20	0.762
Electricity	Unmatched	0.345	0.317	8.50		0.379
	Matched	0.342	0.327	4.70	45.00	0.670
Poor	Unmatched	0.518	0.459	31.90		0.001
	Matched	0.521	0.517	2.00	93.70	0.853
Credit	Unmatched	0.316	0.356	-15.10		0.122
	Matched	0.315	0.315	-0.10	99.50	0.995
Distance	Unmatched	2.096	2.493	-17.20		0.086
	Matched	2.105	2.135	-1.30	92.70	0.894
Agricultural land	Unmatched	2292.500	2080.400	13.20		0.162
	Matched	2251.100	2227.600	1.50	88.90	0.896
Irrigated land	Unmatched	162.170	166.110	-1.90		0.847
	Matched	163.070	153.210	4.70	-150.50	0.671
Forest land	Unmatched	20686.000	13664.000	13.10		0.140
	Matched	13556.000	15178.000	-3.00	76.90	0.482
Long-term forest land	Unmatched	2359.600	4136.700	-25.70		0.013
	Matched	2428.200	2211.200	3.10	87.80	0.650
No land	Unmatched	0.018	0.007	16.90		0.062
	Matched	0.009	0.010	-2.00	88.30	0.761
Kindergarten for age 3-5	Unmatched	0.819	0.913	-7.80		0.427
	Matched	0.831	0.781	4.20	47.00	0.689
Primary school	Unmatched	0.630	0.592	9.70		0.325
	Matched	0.619	0.606	3.10	67.60	0.773
Lower secondary school	Unmatched	0.186	0.196	-3.40		0.728
	Matched	0.182	0.185	-1.20	63.20	0.903
Open market	Unmatched	0.130	0.099	9.80		0.311
	Matched	0.134	0.132	0.50	94.80	0.965
Post office	Unmatched	0.282	0.300	-3.90		0.687
	Matched	0.285	0.286	-0.20	96.00	0.988

Outcome: Incidence of diarrhoeal diseases
Kernel matching with bandwidth 0.04

Variable	Sample	Mean		Percentage bias	Percentage reduction of bias	p>|t|
		Treated	Control			
Ethnic group 2	Unmatched	0.227	0.316	-22.2		0.024
	Matched	0.233	0.219	3.6	83.8	0.723
Ethnic group 3	Unmatched	0.277	0.398	-27.7		0.005
	Matched	0.285	0.313	-6.3	77.4	0.550
Ethnic group 4	Unmatched	0.403	0.218	41.8		0.000
	Matched	0.388	0.376	2.7	93.6	0.815
Doctor	Unmatched	0.049	0.054	-2.6		0.784
	Matched	0.050	0.049	0.6	75.4	0.952
Associate doctor	Unmatched	0.971	0.900	8.9		0.360
	Matched	0.947	0.952	-0.5	93.9	0.961
Nurse	Unmatched	1.010	1.188	-14.4		0.152
	Matched	0.998	1.035	-3	79.1	0.787
Water	Unmatched	0.355	0.345	2.9		0.764
	Matched	0.351	0.333	5.3	-85.2	0.621
Electricity	Unmatched	0.345	0.324	6.5		0.500
	Matched	0.343	0.323	6.1	6.1	0.575
Poor	Unmatched	0.520	0.462	31.7		0.001
	Matched	0.523	0.523	-0.1	99.5	0.989
Credit	Unmatched	0.314	0.356	-15.9		0.101
	Matched	0.313	0.309	1.6	89.7	0.875
Distance	Unmatched	2.162	2.551	-16.4		0.100
	Matched	2.173	2.196	-1	94	0.919
Agricultural land	Unmatched	2,267.300	2,049.400	13.5		0.149
	Matched	2,225.600	2,210.800	0.9	93.2	0.934
Irrigated land	Unmatched	160.360	165.310	-2.3		0.806
	Matched	161.200	146.650	6.9	-194.1	0.518
Forest land	Unmatched	20,628.000	13,703.000	13		0.139
	Matched	13,578.000	15,068.000	-2.8	78.5	0.524
Long-term forest land	Unmatched	2,333.300	4,056.800	-25.1		0.015
	Matched	2,400.300	2,166.600	3.4	86.4	0.629
No land	Unmatched	0.018	0.007	16.9		0.059
	Matched	0.009	0.011	-3	82.3	0.661
Kindergarten for age 3-5	Unmatched	0.832	0.940	-9		0.357
	Matched	0.844	0.786	4.8	46.6	0.642
Primary school	Unmatched	0.630	0.589	10.4		0.285
	Matched	0.619	0.619	-0.2	98.3	0.987
Lower secondary school	Unmatched	0.187	0.198	-3.8		0.691
	Matched	0.183	0.185	-0.7	82.2	0.947
Open market	Unmatched	0.128	0.097	10.1		0.291
	Matched	0.132	0.127	1.7	83.3	0.883
Post office	Unmatched	0.279	0.305	-5.6		0.563
	Matched	0.282	0.276	1.2	78.3	0.909

Outcome: Incidence of diarrhoeal diseases
Kernel matching with bandwidth 0.03

Variable	Sample	Mean		Percentage bias	Percentage reduction of bias	p>|t|
		Treated	Control			
Ethnic group 2	Unmatched	0.227	0.316	-22.2		0.024
	Matched	0.233	0.216	4.1	81.4	0.683
Ethnic group 3	Unmatched	0.277	0.398	-27.7		0.005
	Matched	0.285	0.318	-7.4	73.2	0.480
Ethnic group 4	Unmatched	0.403	0.218	41.8		0.000
	Matched	0.388	0.375	3.1	92.7	0.790
Doctor	Unmatched	0.049	0.054	-2.6		0.784
	Matched	0.050	0.049	0.6	76.2	0.954
Associate doctor	Unmatched	0.971	0.900	8.9		0.360
	Matched	0.947	0.957	-1.3	85.5	0.908
Nurse	Unmatched	1.010	1.188	-14.4		0.152
	Matched	0.998	1.033	-2.8	80.2	0.799
Water	Unmatched	0.355	0.345	2.9		0.764
	Matched	0.351	0.330	6.3	-119.6	0.558
Electricity	Unmatched	0.345	0.324	6.5		0.500
	Matched	0.343	0.321	6.7	-4.1	0.533
Poor	Unmatched	0.520	0.462	31.7		0.001
	Matched	0.523	0.524	-0.9	97.2	0.934
Credit	Unmatched	0.314	0.356	-15.9		0.101
	Matched	0.313	0.308	1.8	88.4	0.860
Distance	Unmatched	2.162	2.551	-16.4		0.100
	Matched	2.173	2.185	-0.5	96.9	0.957
Agricultural land	Unmatched	2,267.300	2,049.400	13.5		0.149
	Matched	2,225.600	2,210.200	1	92.9	0.931
Irrigated land	Unmatched	160.360	165.310	-2.3		0.806
	Matched	161.200	144.840	7.7	-230.6	0.466
Forest land	Unmatched	20,628.000	13,703.000	13		0.139
	Matched	13,578.000	15,100.000	-2.9	78	0.518
Long-term forest land	Unmatched	2,333.300	4,056.800	-25.1		0.015
	Matched	2,400.300	2,159.700	3.5	86	0.619
No land	Unmatched	0.018	0.007	16.9		0.059
	Matched	0.009	0.011	-3.1	81.7	0.654
Kindergarten for age 3-5	Unmatched	0.832	0.940	-9		0.357
	Matched	0.844	0.786	4.8	46.4	0.642
Primary school	Unmatched	0.630	0.589	10.4		0.285
	Matched	0.619	0.623	-1.1	89.7	0.925
Lower secondary school	Unmatched	0.187	0.198	-3.8		0.691
	Matched	0.183	0.185	-0.7	80.7	0.942
Open market	Unmatched	0.128	0.097	10.1		0.291
	Matched	0.132	0.126	2	79.8	0.859
Post office	Unmatched	0.279	0.305	-5.6		0.563
	Matched	0.282	0.272	2.1	62.1	0.841

Outcome: Incidence of diarrhoeal diseases
Kernel matching with bandwidth 0.05

Variable	Sample	Mean		Percentage bias	Percentage reduction of bias	p>|t|
		Treated	Control			
Ethnic group 2	Unmatched	0.227	0.316	-22.2		0.024
	Matched	0.233	0.222	2.8	87.5	0.785
Ethnic group 3	Unmatched	0.277	0.398	-27.7		0.005
	Matched	0.285	0.309	-5.5	80.2	0.601
Ethnic group 4	Unmatched	0.403	0.218	41.8		0.000
	Matched	0.388	0.376	2.8	93.3	0.809
Doctor	Unmatched	0.049	0.054	-2.6		0.784
	Matched	0.050	0.048	1	62.7	0.927
Associate doctor	Unmatched	0.971	0.900	8.9		0.360
	Matched	0.947	0.946	0.2	98.2	0.988
Nurse	Unmatched	1.010	1.188	-14.4		0.152
	Matched	0.998	1.034	-2.9	79.9	0.794
Water	Unmatched	0.355	0.345	2.9		0.764
	Matched	0.351	0.336	4.4	-53	0.684
Electricity	Unmatched	0.345	0.324	6.5		0.500
	Matched	0.343	0.325	5.3	17.5	0.623
Poor	Unmatched	0.520	0.462	31.7		0.001
	Matched	0.523	0.521	0.9	97.1	0.933
Credit	Unmatched	0.314	0.356	-15.9		0.101
	Matched	0.313	0.309	1.7	89.4	0.871
Distance	Unmatched	2.162	2.551	-16.4		0.100
	Matched	2.173	2.195	-0.9	94.3	0.922
Agricultural land	Unmatched	2,267.300	2,049.400	13.5		0.149
	Matched	2,225.600	2,213.300	0.8	94.4	0.945
Irrigated land	Unmatched	160.360	165.310	-2.3		0.806
	Matched	161.200	148.560	6	-155.3	0.578
Forest land	Unmatched	20,628.000	13,703.000	13		0.139
	Matched	13,578.000	15,090.000	-2.8	78.2	0.514
Long-term forest land	Unmatched	2,333.300	4,056.800	-25.1		0.015
	Matched	2,400.300	2,180.400	3.2	87.2	0.650
No land	Unmatched	0.018	0.007	16.9		0.059
	Matched	0.009	0.011	-2.7	84.2	0.688
Kindergarten for age 3-5	Unmatched	0.832	0.940	-9		0.357
	Matched	0.844	0.789	4.6	49.2	0.659
Primary school	Unmatched	0.630	0.589	10.4		0.285
	Matched	0.619	0.615	0.8	92.5	0.944
Lower secondary school	Unmatched	0.187	0.198	-3.8		0.691
	Matched	0.183	0.184	-0.5	87.9	0.964
Open market	Unmatched	0.128	0.097	10.1		0.291
	Matched	0.132	0.127	1.7	83	0.881
Post office	Unmatched	0.279	0.305	-5.6		0.563
	Matched	0.282	0.278	0.8	85.1	0.937

Table VIII Balance test

Outcome: Mothers having three prenatal checkups
Kernel matching
Bandwidth 0.13

Mapping rejection of mean-equality hypothesis at significance level 0.05, by stratum

	COVARIATE	Strata by ascending propensity scores										Number of unbalanced blocks by covariates
		1	2	3	4	5	6	7	8	9	10	
1	Ethnic group 2											0
2	Ethnic group 3							1				1
3	Ethnic group 4	1						1				2
4	Doctor				1			1		1		3
5	Assistant to doctor											0
6	Nurse			1						1		2
7	Safe water											0
8	Electricity		1				1					2
9	Poor											0
10	Credit											0
11	Distance										1	1
12	Agricultural land			1						1		2
13	Irrigated land											0
14	Forest land											0
15	Long-term forest land											0
16	No land			1						1		2
17	Kindergarten for age 3-5											0
18	Primary school						1				1	2
19	Lower secondary school							1				1
20	Open market							1				1
21	Post office											0
Total number of unbalanced blocks		1	1	3	1	0	2	5	0	4	2	19
Proportion of unbalanced blocks												**9%**

Outcome: Delivery attended by health workers

Kernel matching
Bandwidth 0.01

Mapping rejection of mean-equality hypothesis at significance level 0.05, by stratum

	COVARIATE	Strata by ascending propensity scores										Number of unbalanced blocks by covariates
		1	2	3	4	5	6	7	8	9	10	
1	Ethnic group 2											0
2	Ethnic group 3				1				1			2
3	Ethnic group 4											0
4	Doctor				1			1		1		3
5	Assistant to doctor				1	1						2
6	Nurse											0
7	Safe water											0
8	Electricity						1					1
9	Poor											0
10	Credit										1	1
11	Distance				1					1	1	3
12	Agricultural land			1						1		2
13	Irrigated land											0
14	Forest land					1						1
15	Long-term forest land											0
16	No land			1								1
17	Kindergarten for age 3-5					1		1			1	3
18	Primary school				1	1					1	3
19	Lower secondary school							1		1		2
20	Open market							1				1
21	Post office									1		1
Total number of unbalanced blocks		0	0	2	5	4	1	4	1	5	4	26
Proportion of unbalanced blocks												**12.4%**

Outcome: Delivery attended by health workers

Kernel matching
Bandwidth 0.02

Mapping rejection of mean-equality hypothesis at significance level 0.05, by stratum

	COVARIATE	Strata by ascending propensity scores										Number of unbalanced blocks by covariates
		1	2	3	4	5	6	7	8	9	10	
1	Ethnic group 2											0
2	Ethnic group 3				1							1
3	Ethnic group 4											0
4	Doctor				1	1		1		1		4
5	Assistant to doctor				1	1						2
6	Nurse									1		1
7	Safe water											0
8	Electricity						1					1
9	Poor											0
10	Credit											0
11	Distance				1						1	2
12	Agricultural land									1		1
13	Irrigated land											0
14	Forest land					1						1
15	Long-term forest land											0
16	No land			1					1	1		3
17	Kindergarten for age 3-5					1					1	2
18	Primary school				1	1					1	3
19	Lower secondary school							1		1	1	3
20	Open market							1				1
21	Post office											0
Total number of unbalanced blocks		0	0	1	5	5	1	3	1	5	4	25
Proportion of unbalanced blocks												**11.9%**

Outcome: Delivery attended by health workers

Kernel matching
Bandwidth 0.03

Mapping rejection of mean-equality hypothesis at significance level 0.05, by stratum

	COVARIATE	Strata by ascending propensity scores										Number of unbalanced blocks by covariates
		1	2	3	4	5	6	7	8	9	10	
1	Ethnic group 2											0
2	Ethnic group 3				1				1			2
3	Ethnic group 4											0
4	Doctor				1			1		1		3
5	Assistant to doctor				1	1						2
6	Nurse									1		1
7	Safe water											0
8	Electricity						1					1
9	Poor											0
10	Credit									1	1	2
11	Distance				1						1	2
12	Agricultural land			1						1		2
13	Irrigated land					1						1
14	Forest land											0
15	Long-term forest land											0
16	No land			1						1		2
17	Kindergarten for age 3-5					1					1	2
18	Primary school				1	1					1	3
19	Lower secondary school							1		1	1	3
20	Open market							1				1
21	Post office											0
Total number of unbalanced blocks		0	0	2	5	4	1	3	1	6	5	27
Proportion of unbalanced blocks												**12.9%**

Outcome: Mothers receiving postnatal consultation

Kernel matching
Bandwidth 0.02

Mapping rejection of mean-equality hypothesis at significance level 0.05, by stratum

	COVARIATE	Strata by ascending propensity scores										Number of unbalanced blocks by covariates
		1	2	3	4	5	6	7	8	9	10	
1	Ethnic group 2											0
2	Ethnic group 3				1				1			2
3	Ethnic group 4											0
4	Doctor				1			1		1		3
5	Assistant to doctor				1	1						2
6	Nurse									1		1
7	Safe water											0
8	Electricity						1					1
9	Poor											0
10	Credit									1	1	2
11	Distance				1						1	2
12	Agricultural land			1						1		2
13	Irrigated land											0
14	Forest land					1						1
15	Long-term forest land											0
16	No land			1						1		2
17	Kindergarten for age 3-5					1					1	2
18	Primary school				1	1					1	3
19	Lower secondary school							1		1	1	3
20	Open market							1				1
21	Post office											0
Total number of unbalanced blocks		0	0	2	5	4	1	3	1	6	5	27
Proportion of unbalanced blocks												**12.9%**

Outcome: Mothers receiving postnatal consultation

Kernel matching
Bandwidth 0.01

Mapping rejection of mean-equality hypothesis at significance level 0.05, by stratum

	COVARIATE	Strata by ascending propensity scores										Number of unbalanced blocks by covariates
		1	2	3	4	5	6	7	8	9	10	
1	Ethnic group 2											0
2	Ethnic group 3				1				1			2
3	Ethnic group 4											0
4	Doctor				1			1		1		3
5	Assistant to doctor				1	1						2
6	Nurse											0
7	Safe water											0
8	Electricity						1					1
9	Poor											0
10	Credit										1	1
11	Distance				1					1	1	3
12	Agricultural land			1						1		2
13	Irrigated land											0
14	Forest land					1						1
15	Long-term forest land											0
16	No land			1								1
17	Kindergarten for age 3-5					1		1			1	3
18	Primary school				1	1					1	3
19	Lower secondary school							1		1	1	3
20	Open market							1				1
21	Post office									1		1
Total number of unbalanced blocks		0	0	2	5	4	1	4	1	5	5	27
Proportion of unbalanced blocks												**12.9%**

Outcome: Mothers receiving postnatal consultation

Kernel matching
Bandwidth 0.13

Mapping rejection of mean-equality hypothesis at significance level 0.05, by stratum

	COVARIATE	Strata by ascending propensity scores										Number of unbalanced blocks by covariates
		1	2	3	4	5	6	7	8	9	10	
1	Ethnic group 2											0
2	Ethnic group 3							1				1
3	Ethnic group 4	1						1				2
4	Doctor				1			1		1		3
5	Assistant to doctor											0
6	Nurse			1						1		2
7	Safe water											0
8	Electricity		1				1					2
9	Poor											0
10	Credit											0
11	Distance										1	1
12	Agricultural land			1						1		2
13	Irrigated land											0
14	Forest land											0
15	Long-term forest land											0
16	No land			1						1		2
17	Kindergarten for age 3-5											0
18	Primary school						1				1	2
19	Lower secondary school							1				1
20	Open market							1				1
21	Post office											0
Total number of unbalanced blocks		1	1	3	1	0	2	5	0	4	2	19
Proportion of unbalanced blocks												**9%**

Outcome: Use of boiled water for drinking

Kernel matching
Bandwidth 0.02

Mapping rejection of mean-equality hypothesis at significance level 0.05, by stratum

	COVARIATE	Strata by ascending propensity scores										Number of unbalanced blocks by covariates
		1	2	3	4	5	6	7	8	9	10	
1	Ethnic group 2											0
2	Ethnic group 3				1				1			2
3	Ethnic group 4											0
4	Doctor				1			1		1		3
5	Assistant to doctor				1	1						2
6	Nurse									1		1
7	Safe water											0
8	Electricity						1					1
9	Poor											0
10	Credit									1	1	2
11	Distance				1						1	2
12	Agricultural land			1						1		2
13	Irrigated land											0
14	Forest land					1						1
15	Long-term forest land											0
16	No land			1						1		2
17	Kindergarten for age 3-5					1					1	2
18	Primary school				1	1					1	3
19	Lower secondary school							1		1	1	3
20	Open market							1				1
21	Post office											0
Total number of unbalanced blocks		0	0	2	5	4	1	3	1	6	5	27
Proportion of unbalanced blocks												**12.9%**

Outcome: Use of boiled water for drinking

Kernel matching
Bandwidth 0.01

Mapping rejection of mean-equality hypothesis at significance level 0.05, by stratum

	COVARIATE	Strata by ascending propensity scores										Number of unbalanced blocks by covariates
		1	2	3	4	5	6	7	8	9	10	
1	Ethnic group 2											0
2	Ethnic group 3				1				1			2
3	Ethnic group 4											0
4	Doctor				1			1		1		3
5	Assistant to doctor				1	1						2
6	Nurse											0
7	Safe water											0
8	Electricity						1					1
9	Poor											0
10	Credit										1	1
11	Distance				1					1	1	3
12	Agricultural land			1						1		2
13	Irrigated land											0
14	Forest land					1						1
15	Long-term forest land											0
16	No land			1								1
17	Kindergarten for age 3-5					1		1			1	3
18	Primary school				1	1					1	3
19	Lower secondary school							1		1	1	3
20	Open market							1				1
21	Post office									1		1
Total number of unbalanced blocks		0	0	2	5	4	1	4	1	5	5	27
Proportion of unbalanced blocks												**12.9%**

Outcome: Use of boiled water for drinking

Kernel matching
Bandwidth 0.03

Mapping rejection of mean-equality hypothesis at significance level 0.05, by stratum

	COVARIATE	Strata by ascending propensity scores										Number of unbalanced blocks by covariates
		1	2	3	4	5	6	7	8	9	10	
1	Ethnic group 2											0
2	Ethnic group 3				1							1
3	Ethnic group 4											0
4	Doctor				1	1		1		1		4
5	Assistant to doctor				1	1						2
6	Nurse									1		1
7	Safe water											0
8	Electricity						1					1
9	Poor											0
10	Credit											0
11	Distance				1						1	2
12	Agricultural land									1		1
13	Irrigated land											0
14	Forest land					1						1
15	Long-term forest land											0
16	No land			1					1	1		3
17	Kindergarten for age 3-5					1					1	2
18	Primary school				1	1					1	3
19	Lower secondary school							1		1	1	3
20	Open market							1				1
21	Post office											0
Total number of unbalanced blocks		0	0	1	5	5	1	3	1	5	4	25
Proportion of unbalanced blocks												**11.9%**

Outcome: Having hygienically acceptable toilet

Kernel matching
Bandwidth 0.14

Mapping rejection of mean-equality hypothesis at significance level 0.05, by stratum

	COVARIATE	Strata by ascending propensity scores										Number of unbalanced blocks by covariates
		1	2	3	4	5	6	7	8	9	10	
1	Ethnic group 2											0
2	Ethnic group 3							1				1
3	Ethnic group 4	1						1				2
4	Doctor							1		1		2
5	Assistant to doctor											0
6	Nurse			1						1		2
7	Safe water											0
8	Electricity		1				1					2
9	Poor											0
10	Credit											0
11	Distance										1	1
12	Agricultural land			1						1		2
13	Irrigated land											0
14	Forest land											0
15	Long-term forest land											0
16	No land			1						1		2
17	Kindergarten for age 3-5											0
18	Primary school						1				1	2
19	Lower secondary school							1				1
20	Open market							1				1
21	Post office											0
Total number of unbalanced blocks		1	1	3	0	0	2	5	0	4	2	18
Proportion of unbalanced blocks												**8.6%**

Outcome: Know how to use drug for diarrhoea

Kernel matching
Bandwidth 0.01

Mapping rejection of mean-equality hypothesis at significance level 0.05, by stratum

	COVARIATE	Strata by ascending propensity scores										Number of unbalanced blocks by covariates
		1	2	3	4	5	6	7	8	9	10	
1	Ethnic group 2				1			1				2
2	Ethnic group 3								1			1
3	Ethnic group 4				1							1
4	Doctor					1		1				2
5	Assistant to doctor				1	1						2
6	Nurse											0
7	Safe water			1	1				1			3
8	Electricity						1					1
9	Poor								1			1
10	Credit								1			1
11	Distance				1	1			1	1	1	5
12	Agricultural land						1			1		2
13	Irrigated land											0
14	Forest land					1						1
15	Long-term forest land											0
16	No land			1					1			2
17	Kindergarten for age 3-5			1		1					1	3
18	Primary school				1							1
19	Lower secondary school							1				1
20	Open market							1				1
21	Post office											0
Total number of unbalanced blocks		0	0	3	6	5	2	4	6	2	2	30
Proportion of unbalanced blocks												**14.3%**

Outcome: Know how to use drug for diarrhoea

Kernel matching
Bandwidth 0.07

Mapping rejection of mean-equality hypothesis at significance level 0.05, by stratum

	COVARIATE	Strata by ascending propensity scores										Number of unbalanced blocks by covariates
		1	2	3	4	5	6	7	8	9	10	
1	Ethnic group 2							1				1
2	Ethnic group 3				1							1
3	Ethnic group 4	1										1
4	Doctor				1	1				1		3
5	Assistant to doctor				1							1
6	Nurse									1		1
7	Safe water			1								1
8	Electricity						1					1
9	Poor											0
10	Credit											0
11	Distance				1	1			1		1	4
12	Agricultural land									1		1
13	Irrigated land											0
14	Forest land										1	1
15	Long-term forest land											0
16	No land			1						1		2
17	Kindergarten for age 3-5			1		1			1			3
18	Primary school				1							1
19	Lower secondary school											0
20	Open market							1				1
21	Post office											0
Total number of unbalanced blocks		1	0	3	5	3	1	2	2	4	2	23
Proportion of unbalanced blocks												**11%**

Outcome: Know how to use drug for diarrhoea

Kernel matching
Bandwidth 0.08

Mapping rejection of mean-equality hypothesis at significance level 0.05, by stratum

	COVARIATE	Strata by ascending propensity scores										Number of unbalanced blocks by covariates
		1	2	3	4	5	6	7	8	9	10	
1	Ethnic group 2							1				1
2	Ethnic group 3				1							1
3	Ethnic group 4	1										1
4	Doctor				1	1				1		3
5	Assistant to doctor				1							1
6	Nurse									1		1
7	Safe water			1								1
8	Electricity						1					1
9	Poor											0
10	Credit											0
11	Distance					1			1		1	3
12	Agricultural land									1		1
13	Irrigated land											0
14	Forest land										1	1
15	Long-term forest land											0
16	No land			1						1		2
17	Kindergarten for age 3-5			1		1			1			3
18	Primary school				1							1
19	Lower secondary school											0
20	Open market							1				1
21	Post office											0
Total number of unbalanced blocks		1	0	3	4	3	1	2	2	4	2	22
Proportion of unbalanced blocks												**10.5%**

Outcome: Incidence of diarrhoeal diseases

Kernel matching
Bandwidth 0.04

Mapping rejection of mean-equality hypothesis at significance level 0.05, by stratum

	COVARIATE	Strata by ascending propensity scores										Number of unbalanced blocks by covariates
		1	2	3	4	5	6	7	8	9	10	
1	Ethnic group 2											0
2	Ethnic group 3				1							1
3	Ethnic group 4											0
4	Doctor				1	1		1		1		4
5	Assistant to doctor				1	1						2
6	Nurse									1		1
7	Safe water											0
8	Electricity						1					1
9	Poor											0
10	Credit											0
11	Distance				1						1	2
12	Agricultural land									1		1
13	Irrigated land											0
14	Forest land											0
15	Long-term forest land											0
16	No land			1					1	1		3
17	Kindergarten for age 3-5			1		1						2
18	Primary school				1						1	2
19	Lower secondary school							1		1	1	3
20	Open market							1				1
21	Post office											0
Total number of unbalanced blocks		0	0	2	5	3	1	3	1	5	3	23
Proportion of unbalanced blocks												**11%**

Outcome: Incidence of diarrhoeal diseases

Kernel matching
Bandwidth 0.03

Mapping rejection of mean-equality hypothesis at significance level 0.05, by stratum

	COVARIATE	Strata by ascending propensity scores										Number of unbalanced blocks by covariates
		1	2	3	4	5	6	7	8	9	10	
1	Ethnic group 2											0
2	Ethnic group 3				1							1
3	Ethnic group 4											0
4	Doctor				1	1		1		1		4
5	Assistant to doctor				1	1						2
6	Nurse									1		1
7	Safe water											0
8	Electricity						1					1
9	Poor											0
10	Credit											0
11	Distance				1						1	2
12	Agricultural land									1		1
13	Irrigated land											0
14	Forest land					1						1
15	Long-term forest land											0
16	No land			1					1	1		3
17	Kindergarten for age 3-5					1					1	2
18	Primary school				1	1					1	3
19	Lower secondary school							1		1	1	3
20	Open market							1				1
21	Post office											0
Total number of unbalanced blocks		0	0	1	5	5	1	3	1	5	4	25
Proportion of unbalanced blocks												**11.9%**

Outcome: Incidence of diarrhoeal diseases

Kernel matching
Bandwidth 0.05

Mapping rejection of mean-equality hypothesis at significance level 0.05, by stratum

	COVARIATE	Strata by ascending propensity scores										Number of unbalanced blocks by covariates
		1	2	3	4	5	6	7	8	9	10	
1	Ethnic group 2											0
2	Ethnic group 3				1							1
3	Ethnic group 4											0
4	Doctor				1	1		1		1		4
5	Assistant to doctor				1	1						2
6	Nurse			1						1		2
7	Safe water											0
8	Electricity						1					1
9	Poor											0
10	Credit											0
11	Distance				1						1	2
12	Agricultural land									1		1
13	Irrigated land											0
14	Forest land											0
15	Long-term forest land											0
16	No land			1					1	1		3
17	Kindergarten for age 3-5			1		1						2
18	Primary school				1						1	2
19	Lower secondary school							1		1		2
20	Open market							1				1
21	Post office											0
Total number of unbalanced blocks		0	0	3	5	3	1	3	1	5	2	23
Proportion of unbalanced blocks												**11%**

Table IX Distribution of respondents by ethnicity

	Proportion of each ethnic group in total number of respondents of the control and treated groups, in per cent			
	Viet-Chinese	Tay-Thai-Muong-Nung	Northern minorities	Central minorities
Control	5	30	43	22
Treated	8	23	31	38

Table X YMV Project costs

Average exchange rate for three years 2002-04: 1 US dollar = 15,602 Vietnamese dong

	Item	Number of volunteers	Monthly cost norm (VND)	Support from local authority (VND)	Total project costs for 24 months (VND)	Total project costs for 24 months (USD)
	Fix items					
1	Training, advocacy workshops and project management				900,000,000	57,685
	Variable costs					
2	Salary and allowances					
	2.1 Subsistence allowance and insurance					
	Higher education graduates					
	Subsistence allowance (1.92 x minimum salary)	133	403,200	403,200	2,574,028,800	164,981
	Social insurance (15% of salary)	133	60,480		193,052,160	12,374
	Health insurance payment (2% of salary)	133	8,064		25,740,288	1,650
	Intermediate graduates					
	Subsistence allowance (1.57 x minimum salary)	412	329,700	329,700	6,520,147,200	417,905
	Social insurance (15% of salary)	412	49,455		489,011,040	31,343
	Health insurance payment (2% of salary)	412	6,594		65,201,472	4,179
	2.2 Regional allowance	545	30,000		392,400,000	25,151
3	Other expenses					
	3.1 Uniform	545	15,000		196,200,000	12,575
	3.2 Housing support	545	0,000		392,400,000	25,151
	3.3 Transport expenses	545	50,000		654,000,000	41,918
4	Post project support				521,150,000	33,403
	Total project costs				12,923,330,960	828,312
	Total days of service (260 days per year)				283,400	283,400
	Cost per day of service, VND				45,601	2.92
	Total beneficiary population in 350 communes				1,373,750	1,373,750
	Cost per beneficiary's primary care per year				**4,704**	**0.30**

Figure 1 YMV project organisation chart