

# Social Capital and Health in Indonesia

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**Summary.** — This paper empirically examines the role of community social capital in the individual's health production function. We focus on health measures relating to physical as well as mental health. In addition to exploring the relationship between social capital and health, we test for interrelationships between social and human capital in the production of health. Data come from more than 10,000 adults surveyed in the Indonesian Family Life Surveys of 1993 and 1997. We identify a robust positive empirical association between community-level social capital and good health. We find weak evidence for an interrelationship between human and social capital and mental health.  
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## 1. INTRODUCTION

In this paper we examine the empirical relationship between community-level social capital and an individual's health, focusing on Indonesia in the mid-1990s. We are especially interested in comparing, on the one hand, the relationship between social capital and health, and on the other hand, the relationship between human capital and health. In addition, we examine the empirical evidence for interrelationships between social and human capital in the production of health. We focus on measures relating both to physical and mental health.

Why might social capital be related to health and mental health? There is an extensive literature on the relationship between social capital and economic development, represented in the collection of papers in Dasgupta and Serageldin (2000) and the World Bank's social capital

web page (<http://www.worldbank.org/poverty/social/>). In the Indonesian context, Miguel, Gertler, and Levine (2005, 2006) examine the empirical relationships between industrialization and social capital. Traditionally, greater income, better education, and the products of physical, financial and human capital have been credited with leading to improvements in health (Coleman, 2000; Dasgupta & Serageldin, 2000; Rose, 2000). A growing body of literature

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points to social capital as a major factor in physical and mental health. For reviews of this literature and extensive discussion, see Berkman and Glass (2000), Kawachi and Berkman (2000), Cullen and Whiteford (2001), and the World Bank's social capital and health web page (<http://www.worldbank.org/poverty/scapital/topic/health1.htm>).

There is ongoing debate about how to think about social capital, as well as how to measure different conceptualizations of social capital (Edwards & Foley, 1998; Sobel, 2002). We do not take a strong stand on what the mechanisms are through which social capital may affect health. If we think of social capital as mattering through direct participation in organizations (Putnam, 2000) and the direct benefits accrued from this participation, then it may matter through the health-enhancing effects of these benefits. If social capital primarily means a diffuse collection of norms of reciprocity and trust (Putnam, 2000), then this may lead to direct health (especially mental health) benefits. If we think of social capital as being primarily about norms of cooperation expressed in informal networks (Fukuyama, 2000), then the benefits from this cooperation may arise through informal insurance, enabling participants to better respond to negative health shocks.

Because the study of social capital and health is still at an early stage, there is a need for work documenting what empirical relationships may exist. In this study, we construct a community-level social capital index, based on the number of categories of organizations present in a community, and use this as a proxy for social capital. While this index is only one choice of possible measures of social capital, it serves as a useful first step in exploring the relationship between social and human capital and health.

We use data on more than 10,000 adults from the Indonesian Family Life Surveys of 1993 and 1997, and examine a number of measures of mental and physical health. We are unable to closely examine the mechanisms by which community social capital might influence an individual's physical and mental health. Instead, this paper focuses on a more basic issue: is there an association between social capital and health? We ask the following questions: is the health status of individuals living in communities with high levels of social capital greater than that of individuals living in communities with low levels of social capital, after controlling for individual covariates such as age and education? Further, does the rela-

tionship between human capital and health vary according to (i.e., interact with) the level of social capital? This allows for empirical exploration of the interrelationship between human capital and social capital. While we do not interpret our estimated relationships as causal, they may help to guide thinking about the underlying causal relationships and suggest new avenues for research.

Our main finding is that community-level social capital is positively associated with an individual's good health. This is true for a range of mental and physical health measures. This relationship is robust to controlling for a wide variety of individual and community-level characteristics. For example, an increase by one standard deviation (measured at the village level) in social capital is associated with a decreased propensity to report feeling sad of 2% points, a 14% decline from the mean level. Weak evidence for a relationship between human capital and mental health is indicated by some of the measures used in this paper.

The rest of the paper proceeds as follows. Section 2 discusses our empirical specification. Section 3 presents our dataset and sample selection, and discusses the descriptive statistics of the dataset. Section 4 presents results for our mental health models, and Section 5 presents results for the physical health models. Section 6 examines the interaction between human and social capital. Section 7 explores the robustness of our results. We conclude in Section 8.

## 2. SPECIFICATION

A health production function motivates the empirical model that we use, which is a static analogue to Grossman (1972). In this setting, the health for an individual  $i$  who lives in community  $c$  is represented by  $h_{ic}$ , where  $h_{ic}$  might be an indicator for experiencing a type of mental health difficulty such as sadness, anxiety, or trouble sleeping. Alternatively,  $h_{ic}$  could represent a measure of physical health such as the number of activities of daily living (ADL) that the respondent reports being able to perform easily. Our empirical model of health can be represented by the following estimation equation:

$$h_{ic} = \alpha_0 + \alpha_1 age_{ic} + \alpha_2 ED1_{ic} + \alpha_3 ED2_{ic} \\ + \beta_1 SC_c + \beta_{21} Z_c + \varepsilon_{ic},$$

where  $h_{ic}$  is the health variable for person  $i$  in community  $c$ ;  $age_{ic}$ , age of person  $i$  in community  $c$ ;  $ED1_{ic}$ , indicator for education level less than the primary level;  $ED2_{ic}$ , indicator for education level more than the primary level;  $SC_c$ , our community-level social capital variable: the number of types of active community-level organizations (out of a possible 11);  $Z_c$ , other community-level variables.

This specification is largely paralleled in Figure 1, which shows the basic model behind the relationship between human and social capital and health, and their interactions. Figure 1 illustrates the notion that both human capital and social capital may be inputs to health. Further, our model allows for an interaction effect between the two in the production of health. Our primary specification (above) focuses on the direct relationships between human and social capital and health.

For measures of human capital we use the individual's education. We include indicator variables for whether a person has more than an elementary education, or less than an elementary education (with graduation from elementary education being the omitted category). For measures of social capital, we construct a measure of the number of categories of community organizations that have an active group. Measures of health outcomes, as discussed above, are used as dependent variables.

In this specification, the coefficients on education and community organizations are inter-

preted as health returns on human and social capital. This parallels a typical wage regression, where education is included as a right hand side variable, and the estimated coefficient is interpreted as the wage return to human capital. In a similar fashion, this paper interprets the coefficient on education as a health return to human capital. Similarly, the coefficient on the social capital proxy variable is interpreted to be the health return to social capital.

It is important to note that several biases may be present in this analysis. The ability to interpret the estimated coefficients as unbiased estimates of the return to human and social capital depends on the assumption that the error term  $\varepsilon_{ic}$  is uncorrelated with the right hand side variables. This assumption may be violated if there are unobserved factors which influence (or are correlated with) health, and which are also correlated with our right hand side variables. If there are such unobserved factors, the estimated coefficients will be biased. We take steps to address this problem by including a wide range of control variables in our specifications.

The specification listed above does not allow for the interactions presented in Figure 1. In addition to estimating that equation, we also estimate a specification that allows for such interactions, which can in turn be tested for their significance. To do this we estimate the following equation:

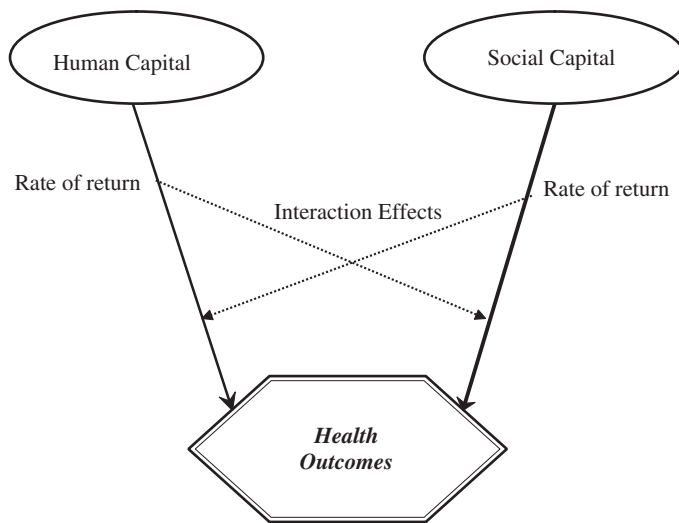


Figure 1. The interrelationships among human and social capital and health.

$$\begin{aligned}
 h_{ic} = & \alpha_0 + \alpha_1 age_{ic} + \alpha_2 ED1_{ic} + \alpha_3 ED2_{ic} \\
 & + \beta_1 SC_c + \delta_1 ED1_{ic} * SC_c \\
 & + \delta_2 ED2_{ic} * SC_c + \beta_{21} Z_c + \varepsilon_{ic}.
 \end{aligned}$$

In this way we test for the importance of the interaction effects by examining the sign and statistical significance of the coefficients  $\delta_1$  and  $\delta_2$ .

### 3. DATA SOURCE, SAMPLE SELECTION, AND VARIABLE MEASUREMENT

The data we use come from the first two waves of the Indonesian Family Life Survey (IFLS1 and IFLS2), from the years 1993 (IFLS1) and 1997 (IFLS2) (Frankenberg & Karoly, 1995; Frankenberg & Thomas, n.d.). This survey, conducted by RAND, is a large longitudinal household-level survey representative of 13 of Indonesia's 27 provinces, covering 83% of its population. The IFLS collects information about demographics, education, and health, as well as community-level information.

Our individual-level data come from the 1993 (IFLS1) wave. The IFLS1 survey has responses to mental health related questions for 12,985 individuals, about 90% of adults surveyed. This information is about self-reported levels of sadness, anxiety, and insomnia, fatigue or exhaustion, short-temper or hypersensitivity, and bodily pains during the previous four weeks. In addition, we have information on the individual's overall self-reported health status (SRHS), as well as their ability to perform a number of basic ADL.

The 1997 (IFLS2) wave contains several questions that can provide measures of social capital. These questions relate to the density of local civic organizations. The dataset has a list of programs, and information is collected on whether or not each program exists in the community. These programs include: Save and Borrow group; Cooperative; "Pharmacy" garden; Family planning acceptors' group; Child development group; Adolescents' group; Senior citizens' group; Youth group; Health fund; "MCH health group;" and "10 HH program." For a discussion of Family planning groups in Indonesia, see Shiffman (2002).

We merge information from the two waves to make one cross-section for analysis. First we take the community organization information from the IFLS2 wave and create several community-level variables. We then match these

communities to the individuals in the IFLS1 wave, and assign the community-level characteristics to them. While we would prefer to use contemporaneous individual- and community-level information, we are unable to do so, as there are no mental health questions in IFLS2 and no social capital questions in IFLS1. Merging data from the two different data collection waves result in a temporal mismatch. For instance, if the existence of community organizations is determined by the average health in a community, then we may be putting a dependent variable on the right hand side of our regressions. We assume that the primary determinant of community organization density is not the health of the community's members, and so we do not think that this is a great concern in our analysis. However, we note that our results are conditional on the assumption that the community organization density variable is exogenous. Two of our health measures (SRHS and ADL) are also asked of respondents in the IFLS2. Using data from only the IFLS2, we have re-estimated our main models (corresponding to the first two columns of Table 1), with results very similar to those we report below. As such we have some confidence that our results are not being driven by the temporal mismatch of the data.

Our analysis is focused on a cross section of individuals aged 26 and older. The sample is restricted to those individuals with non-missing data on the demographic, socioeconomic status (SES), and health variables, and who can be matched to a community for the purpose of looking at community-level correlates. This yields a sample of 10,971 individuals in 306 communities.

Table B.1 presents summary statistics of the health variables. Four questions are related to the measurement of overall health, or to physical health. The first asks whether a person has experienced fatigue within the past four weeks. Twenty-seven percentage of respondents answered "yes" to this question. One out of five individuals reported experiencing bodily pain within the past four weeks. Individuals are asked to report their overall health, with allowable responses being "very healthy," "somewhat healthy," "somewhat unhealthy," and "very unhealthy." We code these responses from 1 (very healthy) to 4 (very unhealthy). The mean response to the SRHS question is 1.96 corresponding to a response of "somewhat healthy." Indeed, this is the modal response to this question. The final variable is the number

Table 1. *General health variables*

	Outcome variable			
	SRHS	# of ADL "difficult or impossible" to perform	Fatigue	Bodily pain
Mean of LHS variable	1.96	0.46	0.265	0.199
<i>Individual variables</i>				
Age	0.00716 (6.73)	0.01859 (7.00)	0.00034 (0.33)	0.00179 (2.22)
Age* (Age $\geq$ 50)	0.00016 (0.39)	-0.00070 (0.69)	-0.00049 (1.41)	0.00011 (0.34)
Age* (Age $\geq$ 60)	0.00118 (3.18)	0.00784 (8.84)	0.00101 (3.36)	0.00047 (1.94)
Female*	-0.01325 (0.76)	0.13245 (4.43)	0.01328 (1.06)	0.01579 (1.47)
Less than elementary education <sup>a</sup>	-0.04027 (1.73)	0.06450 (1.48)	-0.01026 (0.62)	-0.01429 (1.00)
Post-elementary education <sup>a</sup>	-0.00256 (0.14)	0.06039 (1.96)	0.00192 (0.13)	-0.02178 (1.62)
Employed*	-0.09112 (5.61)	-0.34856 (8.92)	-0.00125 (0.09)	-0.04494 (4.01)
Log(per capita expenditure)	-0.00289 (0.30)	-0.03860 (1.48)	0.01942 (2.51)	0.00959 (1.37)
<i>Community variables</i>				
Number of groups in community	-0.01949 (3.45)	-0.01979 (2.22)	-0.01322 (2.65)	-0.00857 (2.62)
Mean ln(exp)	-0.01151 (0.34)	-0.01408 (0.25)	0.03619 (1.13)	0.04522 (1.84)
Received "Underdeveloped" village funds <sup>a</sup>	0.01499 (0.38)	-0.06678 (1.19)	0.02882 (0.98)	0.00755 (0.41)
Ln(community population)	-0.01851 (1.32)	-0.03706 (1.41)	-0.03433 (2.29)	0.00055 (0.07)
Urban <sup>a</sup>	0.04110 (1.28)	0.12302 (2.53)	0.07009 (2.45)	0.02107 (1.14)
Observations	10,971	10,971	10,971	10,971
(Pseudo) <i>R</i> -squared	0.064	0.133	0.013	0.019

Notes: SRHS is self-reported-health-status on a 1–4 scale, with 1 being best health and 4 being worst health. # ADL easy is the number (out of 13) of ADL that the individual can easily do. Errors are computed to allow for clustering within community. Columns 1 and 2 are estimated with OLS. Columns 3 and 4 are estimated as Probits, and coefficients are presented as probability derivatives for continuous variables, and change in probability for binary variables. Employed refers to both formal and informal sectors. (*T* statistics in parentheses.)

<sup>a</sup> Binary RHS variables.

of ADL that the respondent reports being able to do "easily." The categories for the activities are: to carry a heavy load (like a pail of water) for 20 meters; to sweep the house floor or yard; to walk for five kilometers; to draw a pail of water from a well; to bow, squat, keel; to dress without help; to stand up from a sitting position in a chair without help; to go to the bathroom without help; and to stand up from

sitting on the floor without help. The mean value is 8.55 (out of 9).

The next four variables in Table B.1 are the variables that are related to mental health. They are each indicators for whether an individual has experienced a "symptom" within the four weeks prior to the interview. The four symptoms are sadness, anxiety, insomnia, and short temper. These questions are loosely

modeled after the mental health component of the RAND SF-36, a survey instrument that has been shown to be useful in screening for mental disorders in the United States (Ware & Gandek, 1998, p. 907). The mental health questions asked in the IFLS (and the answers allowed for) are more limited than those in the SF-36.

Those who report feeling sadness make up 14% of the population. Six percent of respondents report feeling anxiety. Twenty-one percent report having trouble sleeping, and 14% report having a short temper. Outside sources to corroborate these numbers have been searched for extensively and none have been found with comparable questions. As such, these results may be the first such data on these types of self-reported experiences (sadness, anxiety, etc.) for Indonesia.

Table B.2 presents summary statistics of the demographic and socioeconomic variables. The mean age for individuals in our sample is 45, and a little more than one-third are older than 50, with about one-sixth older than age 60. Slightly more than half of the members of the sample are women. Approximately one-quarter has not finished elementary school, and 20% have completed more than elementary school. The remaining 54% have finished elementary education, but not beyond. Approximately two-thirds of the sample is working, either in the formal or informal sector. The per-capita monthly expenditure in the average household is about US\$33/month, based on an exchange rate of 2105 Rupiah/US\$.

Table B.3 reports means of the community-level variables. These are simple averages over the 303 communities, without weighting by the community size. We note that the community-level variables (with the exception of expenditures) come from the IFLS 2 survey and, as such, represent values as of 1997. Expenditure data come from community-level averages over the 1993 samples. Slightly more than half of the communities in the IFLS are urban. The mean population is 11,361 residents. About one in five have received "underdeveloped village" funds from the central government. The average village level of household per-capita expenditure is US\$39/month. Of the 11 possible types of community organizations, the average community has 5.32 active organizations. The number of community organizations is correlated with education levels. However, conditional on the other community level controls, educational attainment and so-

cial capital are not strongly correlated. The average community has 36 IFLS respondents, with 90% of the communities having between 19 and 54 respondents.

#### 4. EMPIRICAL ANALYSIS OF GENERAL HEALTH AND SOCIAL CAPITAL

Four empirical models were estimated using different general health measures as the dependent variables. Results are presented in Table 1. For each of the specifications, the same explanatory variables are used. We include the social capital variable as well as several other control variables at the individual and community-level. Individual-level controls include age (allowing the slope to change at ages 50 and 60), sex, education, employment status, and household-level per capita expenditure. The education controls are indicator variables for less than elementary education and greater than elementary education (with exactly elementary education as the omitted group).

Community-level controls include social capital, community-level per capita expenditure, community receipt of underdeveloped village funds, community population, and urban status. The community-level per capita expenditure variable is calculated for each household as the mean (1993) expenditure over all other households in the community. This is done to avoid spurious correlations between own household expenditure and mean household expenditure. If own household expenditure were included in the computation of the community mean, there could be a mechanical relationship between the two. An indicator is included for whether the village has received (by 1997) "underdeveloped village" funds from the central government. These two variables serve to proxy for the general degree of wealth in a community. In addition to controlling for wealth, population and urban/rural status are also controlled for, as it stands to reason that larger communities may be more likely to have more groups. Similarly, the patterns of community group formation may be different across urban and rural settings.

For all models, standard errors are computed by allowing for community-level clustering as well as general heteroscedasticity. *T*-statistics are presented in parentheses.

The first dependent variable is SRHS. This variable is included as is and an OLS regression

is run. This specification places equal weight on each transition from one health state to another, which is an arbitrary assumption. There is a marked age pattern with SRHS, with older people more likely to report poor status, and this accelerates with age beyond 60. Individuals who are employed are more likely to report better health status. People who live in communities with strong social capital are also significantly more likely to report better health status. The other community-level variables are not significantly different from zero. We have also estimated an ordered logit specification for SRHS. Results from this specification (not shown) indicate similar patterns in sign and statistical significance to those of the OLS specification.

The second dependent variable considered is the number of ADL. Again, there is a strong age pattern, with elderly having a higher score. Women also report fewer "easy" ADLs, as do those with a post-elementary education. Employed persons report significantly more "easy" ADLs. Those who live in communities with strong social capital score better on this variable, as do those who live in rural communities. As with SRHS, we have also estimated an ordered logit specification for the ADLs, again resulting in similar patterns of sign and significance for the variables of interest.

The next variable considered in Table 1 is an indicator for whether a person has felt fatigue. This model (as well as that for bodily pain) is estimated with a probit model. Reports of fatigue are found to increase with age only for those over 60, and increased household expenditure is positively associated with fatigue. People in more populated communities report less fatigue, and those in urban areas report more fatigue. The social capital variable is strongly negatively correlated with fatigue.

The final dependent variable is an indicator for the experience of bodily pain. Older people are much more likely to report bodily pain, and those who are employed are much less likely to do so. Again, social capital is strongly negatively related to bodily pain. No other community-level variables are significantly correlated with this condition.

## 5. EMPIRICAL ANALYSIS OF MENTAL HEALTH AND SOCIAL CAPITAL

Probit models were estimated for the four mental health dependent variables: sadness,

anxiety, insomnia, and short temper. The results, presented in Table 2, are transformed to probability derivatives. In the case of binary exogenous variables, the change is presented in probability associated with a change from 0 to 1 of the exogenous variable.

Results from column 1 show the model used for reported sadness. They indicate that there is no strong age pattern in reported sadness – each of the age variables is small and insignificantly different from zero. Women are significantly more likely than men to report feeling sad – on average 4% points more likely. There is no significant difference between those with less than elementary education and those with elementary education. Individuals with greater than elementary education are 2% points less likely to report feeling sad. Employment status is not correlated with sadness, and household per capita expenditure is weakly positively (significant at the 10% level) correlated with sadness. Being in an urban area is associated with greater reported sadness. Larger communities are associated with reduced sadness. Social capital is also associated with reduced sadness. The magnitude on the social capital variable indicates that a one standard deviation increase (measured at the village level) in social capital is associated with a decreased propensity to report feeling sad of 2% points, a 14% decline from the mean level.

The second column reports results for anxiety. Results indicate that there is no strong age gradient in reported anxiety. Women are much more likely to report being anxious (2.4% points, with a mean prevalence of 6%), and individuals with greater than a high school degree are also more likely to report feeling anxious. The community-level socioeconomic and population variables are not significantly correlated with anxiety, while individuals living in urban areas are much more likely to report feeling anxiety. The social capital variable is highly negatively associated with reports of anxiety.

The third column reports results for trouble sleeping. As with the previous two measures, there are no strong age patterns, and women are significantly more likely than men to report sleeping troubles. Education and total expenditure are not strongly correlated with insomnia, although those who are working are much less likely to report sleeping difficulties. Again, the measure of social capital is strongly negatively associated with insomnia, while none of the other community-level variables are significantly correlated with this outcome.

Table 2. *Mental health conditions*

	Dependent variable			
	Sad	Anxious	Insomnia	Short temper
Mean of LHS variable	0.141	0.06	0.212	0.142
<i>Individual variables</i>				
Age	0.00110 (1.60)	0.00020 (0.40)	0.00145 (1.59)	-0.00022 (0.29)
Age* (Age $\geq$ 50)	-0.00041 (1.46)	-0.00027 (1.31)	-0.00015 (0.43)	0.00059 (2.08)
Age* (Age $\geq$ 60)	0.00024 (0.95)	0.00005 (0.30)	0.00027 (1.08)	0.00012 (0.59)
Female*	0.04072 (4.75)	0.02435 (4.28)	0.03387 (3.12)	0.05728 (6.25)
Less than elementary education <sup>a</sup>	-0.00937 (0.78)	-0.00283 (0.31)	-0.02036 (1.36)	-0.01658 (1.38)
Post-elementary education <sup>a</sup>	-0.02202 (1.86)	0.01929 (2.58)	-0.01465 (1.16)	0.01123 (0.92)
Employed <sup>a</sup>	-0.00471 (0.57)	-0.01011 (1.76)	-0.04378 (4.33)	0.00798 (0.93)
Log(per capita expenditure)	0.00946 (1.56)	0.00136 (0.32)	0.00874 (1.24)	0.01006 (1.82)
<i>Community variables</i>				
Number of groups in community	-0.00773 (2.32)	-0.00487 (2.42)	-0.01168 (3.41)	-0.01119 (3.38)
Mean ln(exp)	0.00946 (0.57)	0.00778 (0.43)	0.03799 (1.44)	0.03536 (1.47)
Received "Underdeveloped" village funds <sup>a</sup>	0.02046 (1.13)	0.01019 (0.93)	0.00802 (0.40)	-0.01437 (0.80)
Ln(community population)	-0.02269 (2.91)	-0.00994 (1.79)	-0.01644 (1.76)	-0.01768 (2.23)
Urban <sup>a</sup>	0.05165 (2.86)	0.03408 (2.79)	0.02750 (1.44)	0.06444 (3.45)
Observations	10,971	10,971	10,971	10,971
Pseudo R-squared	0.016	0.027	0.015	0.031

Notes: Dependent variable equals 1 if respondent reports feeling sadness in the past week. Probit estimates. Errors are computed to allow for clustering within community. Coefficients are presented as probability derivatives for continuous variables, and change in probability for binary variables. Employed refers to both formal and informal sectors. (*T* statistics in parentheses.)

<sup>a</sup> Binary RHS variables.

The last column in Table 2 presents results for self-reports of experiencing a short temper. For individuals aged less than 50 there is no strong age pattern, but for those older than 50, age is associated with increasing short-temperedness. Women are almost 6% points more likely to report being short tempered. This condition is not significantly correlated with any of the individual-level SES variables. It is also negatively correlated with the community population. As with the other three conditions, this is strongly negatively associated with social

capital. None of the other community-level variables are significantly correlated with this condition.

At this point it should be noted that one universal finding across all measures is that women are more likely to report poor outcomes for these questions. This is consistent with the one source of external data for the region, in which the World Bank reports that the number of disability adjusted life years (DALYs) lost to women due to unipolar major depression in Other (non-China, non-India) Asia Countries

and Islands are twice those lost by men (World Bank, <http://devdata.worldbank.org/hnpstats/DALselection.asp>).

To summarize the results from Tables 1 and 2, for a wide variety of mental and physical health conditions, living in a community with a greater number of active community-level organizations is strongly related with better health. This variable, indeed, is the only variable among those considered that is found to be statistically significantly protective for every condition that we measured. This is the case after controlling for a variety of individual-level and community-level covariates.

We have tried several variations on our preferred specification. For each of the dependent variables, we have modeled the influence of age on health in several different functional forms. These have included polynomials up to third order, splines with knots (allowing for slope changes) every 10 years, and several specifications based on indicator variables. In no specification is strong evidence of nonlinearities not captured in the results found.

In addition to testing for difference in age specification, we examined several other specifications. Many subsets of the control variables were left out and the results for social capital were not highly sensitive to this. The point estimates change somewhat depending on the other control variables, but they were always large and significant. We tested for nonlinearities in the impact of community population and found no significant evidence for this. An interaction between urban status and community population was also allowed for but no significant interaction was found. The models were also estimated excluding the population term and also excluding the urban term. The main results were not affected by these changes. Potential nonlinearities in the impact of the social capital variable were also searched for and not found. We conclude that the main finding, that of a strong correlation between the number of community organizations and good health, is a fairly robust finding.

## 6. INTERACTIONS BETWEEN SOCIAL AND HUMAN CAPITAL

We next consider the interactions between human capital and social capital in the following way: human capital is modeled with indicators for education level, and social capital is modeled with the variable for the number of

organizations active in the community. The interaction between these two variables is tested for by including the interactions in the specifications:

$$h_{ic} = \alpha_0 + \alpha_1 age_{ic} + \alpha_2 ED1_{ic} + \alpha_3 ED2_{ic} \\ + \beta_1 SC_c + \delta_1 ED1_{ic} * SC_c \\ + \delta_2 ED2_{ic} * SC_c + \beta_{21} Z_c + \varepsilon_{ic}.$$

This specification is estimated on four dependent variables: reported sadness, reported anxiety, SRHS, and number of "difficult or impossible" ADLs. Results are presented in Table 3. In general, there is weak and mixed support for the interaction between human and social capital. With regard to the mental health questions, there is evidence of interactions for anxiety, but not for sadness. With regard to the physical health questions, there is evidence for interactions with the ADL specification, but not for the SRHS specification.

When the mental health outcomes are examined, one regression with significant interactions is the anxiety specification. Here the base coefficient on social capital indicates that being in a community with higher numbers of active groups is associated with a lower likelihood of reporting anxiety. Evaluated at three groups (the 25th percentile) active in the community, the results indicate that those with post-elementary education are almost 4% points more likely to report being anxious than their counterparts with elementary education. Evaluated at seven groups (the 75th percentile), this gap increases to 6.8% points. In this instance, it seems that social capital interacts with human capital in a way that exacerbates the health differences across education groups.

In the ADL regression, the base coefficient on the number of groups in the community is negative, indicating that individuals living in communities with greater levels of social capital are healthier. Note that the interactions between post-elementary education and social capital have the opposite sign to their main effects. The estimated coefficients imply that for individuals with post-elementary education, the relationship with respect to social capital is approximately zero. In other words, social capital is protective for those with low and middle education, but is not correlated with ADLs for those with high education.

We have tried a variation on the specifications in Table 3 where we allow for a set of community indicator variables. In this variation, we are unable to estimate the coefficients

Table 3. *Interactions between social and human capital*

	Outcome variable			
	Sad	Anxious	SRHS	# of ADL “difficult or impossible” to perform
Mean of LHS variable	0.141	0.06	1.96	0.46
<i>Individual variables</i>				
Age	0.00107 (1.56)	0.00017 (0.34)	0.00716 (6.74)	0.01851 (6.97)
Age* (Age ≥ 50)	-0.00040 (1.43)	-0.00025 (1.23)	0.00018 (0.43)	-0.00068 (0.66)
Age* (Age ≥ 60)	0.00025 (0.99)	0.00007 (0.38)	0.00120 (3.24)	0.00788 (8.87)
Female <sup>a</sup>	0.04067 (4.72)	0.02386 (4.25)	-0.01262 (0.72)	0.13243 (4.43)
Less than elementary education <sup>a</sup>	-0.01331 (0.54)	0.00882 (0.44)	0.01576 (0.38)	0.07082 (0.74)
Post-elementary education <sup>a</sup>	-0.05883 (2.51)	0.01861 (1.46)	-0.02735 (0.73)	-0.07498 (1.15)
Employed <sup>a</sup>	-0.00500 (0.60)	0.00995 (1.73)	-0.09034 (5.55)	-0.34909 (8.95)
Log(per capita expenditure)	0.00937 (1.54)	0.00116 (0.27)	-0.00337 (0.34)	-0.03883 (1.49)
<i>Community variables</i>				
Number of groups in community	-0.00970 (2.48)	-0.00614 (2.81)	-0.01762 (2.93)	-0.02542 (2.39)
Number of groups* (education less than elementary)	0.00082 (0.16)	-0.00286 (0.64)	-0.01221 (1.47)	-0.00170 (0.09)
Number of groups* (education greater than elementary)	0.00791 (1.83)	0.00704 (2.75)	0.00430 (0.70)	0.02500 (2.22)
Mean ln(exp)	0.01233 (0.55)	0.00779 (0.47)	-0.01160 (0.35)	-0.01628 (0.29)
Received “Underdeveloped” village funds <sup>a</sup>	0.01990 (1.10)	0.00871 (0.82)	0.01323 (0.33)	0.06439 (1.14)
Ln(community population)	-0.02303 (2.94)	-0.01032 (1.86)	-0.01887 (1.34)	-0.03805 (1.46)
Urban <sup>a</sup>	0.05206 (2.91)	0.03357 (2.89)	0.03967 (1.24)	0.12317 (2.55)
Observations	10,971	10,971	10,971	10,971
(Pseudo) R-squared	0.017	0.030	0.065	0.133

Notes: SRHS is self-reported-health-status on a 1–4 scale, with 1 being best health and 4 being worst health. # ADL easy is the number (out of 13) of activities of daily living that the individual can easily do. Errors are computed to allow for clustering within community. In columns 1 and 2, coefficients are presented as probability derivatives for continuous variables, and change in probability for binary variables. Columns 3 and 4 are estimated with OLS. Employed refers to both formal and informal sectors. (*T* statistics in parentheses.)

<sup>a</sup> Binary RHS variables.

on the number of community groups (or other community-level variables), but we can look at the interaction effects. In all cases the interaction effects are very similar in magnitude to those reported in Table 3, and they are also generally the same in terms of statistical significance. In one case (sadness) the interaction be-

tween post-elementary education and social capital increases in significance, but even here the point estimate (.0086) is similar to that of Table 3 (.0079). Separately, we have also examined whether there are interactions between sex and social capital, and age and social capital, using a strategy analogous to the one employed

above. In all cases, we find no significant interactions.

## 7. EXTENSIONS TO THE EMPIRICAL ANALYSIS AND DISCUSSION

### (a) *Types of community groups in the social capital measure*

Our social capital variable is a summation of the number of categories of community groups that are active per community. Of interest is whether certain types of community organizations are particularly associated with improved health outcomes. Our canonical measure of social capital is a variable ranging from 0 to 11, depending on how many types of community groups are active. This aggregate index is the sum of 11 separate indicator variables, each having a value of one or zero depending on the presence or absence of a particular type of community group.

In order to explore which types of community groups matter, we disaggregate the social capital variable into its 11 components, and include each component separately as a dummy variable. This specification has 11 separate variables, each one an indicator for the presence of a particular category of community group. Results from this model are presented in Table 4, estimated for each of our eight dependent variables. Only the coefficients for the 11 community groups are shown, but the full set of controls is included in the regression. We also present *p*-values for a test of the joint significance of the 11 indicator variables.

It does not appear that each category of group contributes in an equal fashion to mental and physical health. For sadness, the two strongest correlates of improved health are the existence of a pharmacy garden (with a large but statistically insignificant coefficient), the existence of a family planning group (estimated to be very large and statistically significant), and the existence of the 10 HH program (also large but insignificant). The other groups do not appear to be strongly correlated with sadness. The same results hold true for anxiety – the same three groups are associated with reduced anxiety. For insomnia, again the pharmacy garden and family planning group are significantly associated with better health. For short temper, the pharmacy garden is strongly and significantly associated with better outcomes. For these four outcomes, the community group

variables are jointly significant at the 10% level for sadness, at the 5% level for anxiety, and at the 1% level for insomnia and short temper.

When the physical health conditions are considered, the patterns are somewhat less clear. For SRHS, the presence of savings and borrowing groups is associated with better health. For the ADL measure, the only significant correlate of improved health is the family planning group. For the presence of body pain and fatigue, the pharmacy garden is protective, and the 10 household program is also protective for bodily pain. For these four outcomes, the community group variables are jointly significant at the 1% level for SRHS and ADLs, and at the 5% level for bodily pain and fatigue.

To conclude, this table focuses attention on evidence that several of the groups are more protective than the others. In particular, it appears that the existence of a pharmacy garden and family planning acceptors' groups, as well as the 10 HH program, is associated with better mental and physical health.

### (b) *Discussion*

If we accept the interpretation of our results as identifying an impact of community-level social capital on health, we are then led to the question of why this is so, and through what mechanisms? We can think of several possibilities. First, participation in community organizations may provide direct material benefits, or may help to target material resources most efficiently within a community. Second, participation may provide access to social networks and connections. These may be either directly beneficial, and in addition they may help an individual's informal insurance opportunities. Third, the presence of these community organizations may offer health-promoting externalities to the community. Finally, there may be some other facet of community level social capital that is responsible for the improved health, and a high number of community organizations may be reflecting this social capital.

In general, we believe that our results are consistent with each of these possibilities. We do not think that our data are able to bring further strong empirical evidence to the question of mechanisms, leaving this for future work. We note that the first two mechanisms above link the benefits of social capital directly to participation in the organizations we measure, while the second two allow for more dispersed

Table 4. *Specification checks*

	Outcome variable							
	Sad	Anxious	Insomnia	Short temper	SRHS	# of ADL "difficult or impossible" to perform	Bodily pain	Fatigue
Save and Borrow group <sup>a</sup>	-0.02938 (0.36)	-0.10700 (1.20)	-0.08219 (1.22)	-0.05324 (0.69)	-0.05938 (2.27)	0.03048 (0.62)	-0.04073 (0.62)	-0.01210 (0.15)
Cooperative <sup>a</sup>	0.00760 (0.11)	-0.00550 (0.06)	0.05327 (0.83)	-0.06651 (0.92)	-0.02991 (1.04)	0.00256 (0.05)	0.06795 (1.13)	-0.06526 (0.69)
"Pharmacy" garden <sup>a</sup>	-0.11092 (1.69)	-0.15220 (2.09)	-0.16017 (2.74)	-0.20931 (3.13)	-0.09294 (2.71)	-0.03065 (0.72)	-0.15262 (2.46)	-0.15638 (2.13)
Family planning acceptors' group <sup>a</sup>	-0.14298 (2.31)	-0.15319 (2.19)	-0.10780 (1.99)	-0.11956 (1.89)	-0.00515 (0.16)	-0.17321 (4.26)	-0.00290 (0.05)	-0.13718 (1.79)
Child development group <sup>a</sup>	0.05631 (0.76)	0.09565 (1.25)	-0.00452 (0.07)	0.03282 (0.44)	-0.02161 (0.61)	-0.01572 (0.32)	-0.02738 (0.42)	0.07179 (0.90)
Adolescents' group <sup>a</sup>	0.04545 (0.75)	0.15227 (2.04)	0.01890 (0.32)	-0.01692 (0.21)	0.07666 (2.55)	0.03782 (0.68)	0.07068 (1.18)	-0.03401 (0.39)
Senior citizens' group <sup>a</sup>	-0.00271 (0.03)	0.01151 (0.13)	-0.04561 (0.71)	-0.00233 (0.03)	-0.01588 (0.46)	-0.00488 (0.09)	-0.00443 (0.08)	-0.07523 (0.85)
Youth group <sup>a</sup>	-0.09373 (1.17)	-0.11510 (1.19)	-0.06546 (0.95)	-0.00585 (0.07)	-0.04695 (1.48)	-0.10951 (2.03)	-0.01035 (0.15)	-0.10388 (1.08)
Health fund <sup>a</sup>	0.05370 (0.71)	0.03885 (0.50)	0.02374 (0.37)	0.07913 (1.09)	-0.02926 (0.76)	0.02333 (0.48)	0.00915 (0.13)	-0.00515 (0.06)
MCH health group <sup>a</sup>	-0.01227 (0.14)	-0.03205 (0.34)	0.00768 (0.11)	-0.07143 (0.96)	-0.00044 (0.02)	-0.00059 (0.01)	-0.00127 (0.02)	-0.02300 (0.25)
10 HH program <sup>a</sup>	-0.12005 (1.50)	-0.15375 (1.94)	-0.02282 (0.34)	-0.11094 (1.36)	0.03609 (1.05)	0.03302 (0.67)	-0.13344 (2.09)	0.03694 (0.46)
<i>P</i> -value for test of joint significance of group indicator variables	0.097	0.029	0.007	0.004	0.006	0.001	0.064	0.063
Observations	10,971	10,971	10,971	10,971	10,956	10,971	10,971	10,971
(Pseudo) <i>R</i> -squared	0.021	0.037	0.019	0.037	0.074	0.137	0.024	0.017

Probit estimates in columns 1–4, 7, and 8. OLS estimates in columns 5 and 6. Errors are computed to allow for clustering within community. For probits, coefficients are presented as probability derivatives for continuous variables, and change in probability for binary variables. Employed refers to both formal and informal sectors. Other RHS variables included are age, sex, expenditure, education, community population, urban status, mean expenditure, and if received underdeveloped village funds. (*T* statistics in parentheses.)

<sup>a</sup> Binary RHS variables.

correlations. One limitation of our paper is that we are unable to directly delineate the impacts from an individual's participation from greater external benefits from the organization. However, we can address this issue indirectly. We do this by identifying groups of individuals that are more or less likely to have participated in certain groups.

We identify groups that are targeted demographically, and to see whether they are particularly associated with improved health for their targeted groups, and less so for non-targeted groups. We have done so for five groups: family planning acceptor's and MCH health groups (targeted at women); adolescents' and youth groups (targeted at younger people); and senior citizens' group (targeted at older people). For each of these, we have re-estimated our models on split samples based on the targeting. Somewhat surprisingly, we found that the organizations were roughly equally protective for both targeted and non-targeted demographic groups. This evidence suggests that the mechanism that the social capital is working through either the third or fourth mechanism listed above: either community organizations are contributing to social capital in ways that involve community-wide spillovers; or they are reflective measures of community-level social capital.

Why are some organization types more strongly associated with health than others? We speculate that the organizations that are most strongly associated with health (pharmacy garden, family planning acceptors' group) are

those that best foster social interactions within the community at large. Given the limitations of our data we are unable to test this hypothesis directly, and leave further exploration of this matter for future work.

## 8. CONCLUSION

This paper looks at the relationship between health and several individual- and community-level variables. We focus our attention on human capital (education) and social capital (number of community organizations). Across a variety of physical and mental health measures, social capital is positively associated with good health. This relationship is robust to a number of specification checks. We find evidence for a relationship between human capital and mental health for some, but not all, of the health measures used. There is mixed evidence for the existence of interactions between social and human capital. The various components of the social capital measure, when examined, show that a few groups in particular are associated with improved health. These components are the existence of a pharmacy garden and family planner's acceptance groups. This may not be surprising, given that both group activities/forms of social capital are health-related. While one cannot interpret our estimates as the causal impact of social capital on health, our findings are suggestive that a research design able to delineate the causal relationships would be worthwhile.

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*Cooperative*: There are many types of cooperatives, including village cooperatives, farmers’ cooperatives, and saving/borrowing cooperatives. They engage in credit related activities, as well as sometimes running local shops.

*“Pharmacy” garden*: This is a community garden, where members will have their own plot, usually for cultivating traditional medicine.

*Family planning acceptors’ group*: This group’s activities include education related to maternal and infant health, and reproductive health.

*Child development group*: This group’s focus is child health and child development. It is targeted toward mothers with children under five years of age.

*Adolescents’ group*: This group is focused on families with adolescents.

*Senior citizens’ group*: This group is focused on health care for elderly people.

*Youth group*: This group is focused on youth skills, ranging from handicrafts to sports to youth employment.

*Health fund*: This is a community-level informal health insurance group.

*MCH health group*: This group is focused on Maternal and Children’s health.

*10 HH program*: This group is usually comprised of seven to ten households. The activities usually include rotating savings associations, and sharing of information on contraception, health, etc.

APPENDIX A. DESCRIPTION OF THE COMMUNITY ORGANIZATIONS

Below we outline a brief description of the 11 types of community organizations. We are grateful to Vivi Alatas and Yulia Herawati, for their assistance in obtaining the descriptions:

*Save and Borrow group*: This is a community group with a fund for saving and borrowing by its members.

APPENDIX B. SUMMARY STATISTICS

Table B.1. *Summary statistics – individuals*

Health and mental health variables	Mean	Standard deviation	Number of observations
<i>General health variables</i>			
Fatigue	0.264	0.441	10,971
Bodily pain	0.193	0.399	10,971
SRHS	1.96	0.55	10,956
Number of ADLs “Easy”	8.55	1.31	10,971
<i>Mental health variables</i>			
Sadness	0.142	0.349	10,971
Anxious	0.06	0.237	10,971
Trouble sleeping	0.211	0.408	10,971
Short temper	0.142	0.35	10,971

Note: SRHS from 1 (best) to 4 (worst). This table reports the arithmetic mean of individuals’ SRHS. Data are from the 1993 and 1997 waves of the IFLS.

Table B.2. *Summary statistics – individuals*

	Mean	Standard deviation	Number of observations
<i>Demographic variables</i>			
Age	45	13.3	10,971
Fraction age $\geq$ 50	0.37	0.48	10,971
Fraction age $\geq$ 60	0.17	0.38	10,971
Female	0.54	0.49	10,971
<i>Socioeconomic variables</i>			
Less than elementary education	0.26	0.44	10,971
Post-elementary education	0.2	0.4	10,971
Employed	0.65	0.48	10,971
Log(per capita monthly expenditure)	10.8	0.81	10,971
Per capita expenditure, US\$	33	50	10,971

*Note:* Conversion to US\$ is based on 2105 Rupiah/US\$. Data are from the 1993 and 1997 waves of the IFLS.

Table B.3. *Summary statistics – communities*

	Mean	Standard deviation	Number of observations
<i>General variables</i>			
Urban	0.574	0.495	303
Community population	11,361	20,473	303
<i>Socioeconomic variables</i>			
Ever received “underdeveloped village” funds	0.211	0.409	303
Mean HH (per capita expenditure)	39.2	21.3	303
<i>Social capital variable</i>			
Number (out of 11) of active community organizations	5.34	2.64	303

*Note:* Unit of observation is the community, as identified in the IFLS. Means are unweighted. Per capita expenditure is in US\$/month. Data are from the 1993 and 1997 waves of the IFLS.

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