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Social capital and healthy ageing in Indonesia

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Abstract

Background: A large international literature has found a positive association between social capital and measures of physical and mental health. However, there is a paucity of research on the links between social capital and healthy ageing in a developing country environment, where universal social security coverage is absent and health infrastructure is poor.

Method: In this paper, we develop and empirically test a model of the linkages between social capital and the health outcomes for older adults in Indonesia, using data from the *Indonesian Family Life Survey-East (IFLS-East)*, conducted in 2012. Using multivariate regression analysis, we examine whether social capital plays a role in mitigating poor health among older individuals aged 50 years and above in Indonesia's most vulnerable provinces. We test the robustness of these social capital variables across different health measures (self-assessed health, Activities of Daily Living (ADL), measures of chronic illness and mental health measures), as well as across different demographic groups, after controlling for an array of socio-economic, demographic and geographic characteristics.

Results: Our findings show that access to better social capital (using measures of neighbourhood trust and community participation) is associated with a higher degree of physical mobility, independence, and mental well-being among older individuals but has no influence on chronic illnesses. These results are consistent when we estimate samples disaggregated by gender, rural/urban residence, and by age categories.

Conclusion: From a policy perspective these results point to the importance of social capital measures in moderating the influence of poor health, particularly in the Activities of Daily Living.

Keywords: Social capital, Self-assessed health, Mental health, Indonesia

Background

Social capital is described by Putnam as a collection of norms, networks and trust that can improve the efficiency of society [1]. It refers to the institutions, relationships and norms that shape the quality and frequency of social interactions. Although social capital is seen as a multidimensional concept, the two most commonly used indicators of social capital in the empirical literature are membership of voluntary associations and generalized social trust.

A large international literature has found a positive association between social capital and measures of physical and mental health [2–7]. Another strand of literature has found social capital to be positively associated with

the utilization of health services [8], engagement in physical activities, reduction in alcohol abuse and the use of complementary and alternative medicine by older Americans [9]. The mechanism by which social capital influences health is complex, but it is generally believed that social capital provides informal insurance against health risks through norms of cooperation expressed via informal networks [10]. Several studies have found that social capital enables better responses to negative health shocks through a reduction in informational costs and a spread of health norms [1, 3]. The idea is that social capital, through increased interaction with others, creates and develops social norms, neighbourhood reciprocity and social trust, which in turn fosters communication and cooperation among members of a community. The focus of this literature has predominantly been on Western developed countries, where elements of social

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capital variables may be better defined, and some measures of social capital such as membership of organisations may be more organised.

It is also important to consider that different measures of social capital may have different impacts depending on the health measure used (self-assessed, mental health, physical or cognitive), or the ways in which social capital is defined and whether accessibility to social capital is easy. Social capital may be associated with better health particularly for older populations, given their greater vulnerability and their greater reliance on social networks. There is however limited evidence of the positive links between social capital and health of older individuals in a developing country context. Indeed much of the recent research linking social capital to the health of older individuals has come from China, where social capital measures are shown to have differential impacts depending on the social capital measure and the health measure used, emphasising the need to take specific contexts into account [11–13]. For example, using data on individuals aged 16–80 years from rural Shandong province, Yip et al. find that the social capital measure ‘trust’ is positively associated with all three measures of health (self-reported general health, psychological and subjective well-being) [12]. However, the social capital measure ‘membership of social organisations’ is found to be statistically insignificant. Norstrand and Xu on the other hand, find no statistically significant associations between social capital measures and the health of older rural residents’ health, but the health of older urban Chinese residents is associated with bonding social capital (measured using close ties with family) [11]. Shen et al. find that self-assessed health is significantly related to access to community associations and perceived help in future [13]. A recent study from Chile finds that social capital may be an important determinant of mental rather than physical health [14].

Our research builds on this recent research on social capital and the health of older populations by focusing on Indonesia a middle-income country that has experienced major economic and social transformations and has a less developed set of social protection programs compared to high-income countries. In particular, we develop and test a model of the linkages between social capital and the health outcomes of older adults in Indonesia. Using data from the 2012 *Indonesian Family Life Survey-East*, our analysis focuses on the seven most vulnerable eastern provinces and contributes to the literature on social capital and health by: (i) Analysing whether access to social capital is associated with good health (using an array of physical and mental health measures) among older individuals aged 50 years and above in a developing country environment; and (ii) Testing the robustness of these social capital variables

across different health measures, including both physical and mental health, as well as across different demographic groups.

Indonesia offers an excellent context to analyse the associations between social capital and health outcomes of older individuals. Despite being one of the fastest ageing populations in the world with a lack of universal social safety nets, poor health infrastructure, reliance on family for old age security, there is limited research from Indonesia linking social capital with health outcomes of older individuals. Previous research from Indonesia on the role of social capital has focused on its influence on industrialisation [15, 16] and physical and mental health [17] study using the *Indonesian Family Life Survey* datasets from 1993 and 1997. Others such as Arifin et al. have focused on the well-being of the elderly, but not on social capital [18].

By 2050, Indonesia is expected to have 72 million individuals aged 60 years and above, and will be one of only six countries in the world with over 10 million individuals aged 80 years and above [19]. According to the World Health Statistics, 8.5 % of the Indonesian population is aged 60 years and above, and this figure is expected to increase to 26 % by 2050 [20]. Indonesia’s older population is unevenly distributed, with the bulk of the older population living in the more prosperous provinces of East Java, Central Java and West Java. Indonesia has among the largest number of elderly who live in a relatively low-income country with limited old-age income security [21]. Indonesia is experiencing a ‘health transition’ in which the most prevalent diseases among the elderly are chronic, non-infectious illnesses and injuries rather than acute infectious diseases [22].

Some of the key challenges facing older persons in Indonesia include the growing incidence of disability, access to appropriate living arrangements, income security and growing demand for health services [19]. These challenges are compounded due to the limited coverage of the pension program, which means that a significant proportion of older persons feel the need to engage in income-earning activities to meet basic needs. One of the key objectives of the National Plan of Action is to increase the capacity and awareness of families and communities to promote and maintain health in old age.

Individuals have limited access to pensions outside of the public sector and retirement age is relatively low. Government employees are required to retire at age 58 years, while private formal-sector workers retire at 55 years of age. With the exception of the small proportion of older persons who are retired government employees and military personnel are entitled to health coverage (ASKES), the overwhelming majority of older persons have no such cover [19]. Care arrangements in Indonesia tend to be traditional, with caregiving

responsibility for older persons lying with children and other younger relatives. Under these circumstances, social capital may have a potentially positive role to play on health outcomes and contributing to health aging, thus enabling older individuals to be self-reliant longer.

Method

The data for this analysis comes from the *Indonesian Family Life Survey-East (IFLS-East)*, conducted in 2012. The *IFLS-East 2012* is a large-scale multi-topic household and community survey of living conditions that was conducted to cover the eastern provinces in Indonesia. It is based on the *Indonesian Family Life Survey (IFLS)*, fielded by the RAND Corporation in collaboration with Survey Meter. The data has information on individuals, their households, the communities in which they live as well as the health and education facilities in those communities. The dataset is publicly available and can be obtained free of cost upon registration from RAND Corporation's website (<http://www.rand.org/labor/FLS/IFLS/ifls-east.html>).

The survey was administered in 2012 to around 10,000 individuals from some 2500 households living in 99 communities (enumeration areas) that are spread over seven provinces in the eastern part of Indonesia. These seven provinces include Nusa Tenggara East, Kalimantan East, Southeast Sulawesi, Maluku, Maluku North, West Papua and Papua. Booth and Hill *et. al's* studies have shown that households in the Eastern provinces tend to be both poorer in financial resources as well as less developed in other respects than those in the Western part of Indonesia [23, 24].

The dataset contains detailed information on a wide range of demographic, economic, labour market and social characteristics of households. It also includes several measures of health, household expenditure on consumption and health expenditures, access to health care facilities and the availability of public insurance. Our sample consists of 1226 individuals aged 50 and above in 2012. It is important to stress that our choice of age 50 to study older individuals is reasonable in the current context. Firstly, the focus of our research is on healthy ageing, which encompasses the WHO definition of active ageing to imply not just physical activity or participation in the labour market, but also participation in social, economic, cultural activities. Secondly, this is in keeping with previous research on health of older adults from Indonesia who also define older individuals as those over 50 years [25, 26]. Finally, the current age for retirement in the private sector is 55 years in Indonesia and it is important to note that our focus is on the more vulnerable Eastern provinces where life expectancy is considerably lower than in Java, Sumatra and Bali. Therefore, the choice of 50 is in keeping with the presence of a much

lower proportion of older individuals in our sample. Table 1 presents the descriptive statistics for all the variables considered in the analyses.

Measures of health

As discussed above the aim of our analysis is to examine the linkages between health and social capital among older Indonesians. To this end our key dependent variables include measures of physical and mental health. The IFLS-East has several objective and self-assessed health measures and we use (i) Self-assessed health status (SAHS), (ii) Activities of Daily Living (ADL) and (iii) Chronic illnesses for measures of physical health followed by a self-assessed measure of mental health.

Self-assessed health status (SAHS)

All respondents aged 50 years and above were asked to rate their health. More specifically, respondents were asked: (a) In general, how would you rate your health on the scale from 'very healthy', 'fairly healthy', 'in poor health' to 'very sick?', and (b) Given your current condition, rank how likely you expect your health to improve in the next 12 months from 'very likely', 'likely', 'unlikely' to 'very unlikely'? Whereas (a) asks respondents to rate their current health, (b) gives a picture of the respondents' future expectation of their health. Using these responses we create two binary measures: SAHS_1 which relates to 'current health' and SAHS_2 which refers to 'future health expectations'.

For SAHS_1, using (a) we combine the categories 'very healthy' and 'fairly healthy' into one category (healthy) and those who reported being 'in poor health' and 'very sick' are categorised as unhealthy, which takes on a value of 1. Similarly, for SAHS_2, we combine the 'very likely' and 'likely' responses into one category, and the 'unlikely' to 'very unlikely' responses are categorised as being pessimistic towards future health and take on a value of 1. The descriptive statistics in Table 1 show that more than 40 % of the respondents fall in the 'currently unhealthy' category for SAHS_1, and 25 % of the sample does not expect their health to improve in future.

Next we include measures of Activities of Daily Living (ADL). The ADL assess functional status as a measurement of the individual's ability to perform activities of daily living independently. The ADL measures include the ability to perform everyday tasks such as feeding oneself, dressing, bathing and using the toilet where individuals are scored for their level of independence in each activity. The complete list of daily activities includes the following activities: the ability to climb stairs, to communicate, to lift water, to bow, squat and kneel, to walk for 1 km and to carry a heavy load for 20 m unassisted or otherwise. For each activity, individual responses can be in one of the following four mutually

Table 1 Descriptive statistics

Variable description	Mean/Proportion
<i>Dependent variables</i>	
Katz ADL:	20.31 %
0 = Require assistance	
1 = Moderately independent	35.81 %
2 = Highly independent	43.88 %
Self-assessment of general health status (SAHS_1): 1 = Generally unhealthy, 0 = Generally healthy	0.41
Self-assessment of future health (SAHS_2): 1 = Unlikely to improve, 0 = Likely to improve	0.25
Chronic illness: hypertension = 1 if diagnosed with hypertension, 0 if otherwise	0.23
Chronic illness = 1 if diagnosed with at least one chronic illness, 0 if otherwise	0.32
Self-assessed Mental health = 1 if respondent experienced at least one adverse issue, 0 if otherwise	0.26
<i>Instrumental variable</i>	
Community conflicts:	
No violence/conflicts	39.80 %
Occasional violence/conflicts	49.84 %
More frequent violence/conflicts	10.36 %
<i>Independent variables</i>	
50 years old and older	59.27
Age 50–60 years	0.65
Aged 61–70	0.27
Aged 71 or more	0.08
Male = 1, female = 0	0.54
Married = 1, 0 otherwise	0.77
Rural = 1, 0 = urban	0.73
Household size	4.39
DV with 1 = disaster occurred in the area within the past five years, 0 = otherwise	0.25
DV with 1 = there are health centres for the elderly in the area, 0 = otherwise	0.28
DV for 1 = not Islam, 0 = otherwise	0.46
DV for No education	0.14
DV for Elementary education or equivalent	0.56
DV for Junior high education or equivalent	0.13
DV for Senior high education or equivalent	0.11
DV for University education or higher	0.06
DV for Employed	0.71
DV for Housekeeper	0.18
DV for Other employment avenues or unemployed	0.10
Log of monthly HH expenditure	14.74
The number of medical workers who service this community	1.42

Table 1 Descriptive statistics (*Continued*)

<i>Social Capital I – Neighbourhood Trust</i>	
Little/No trust	1.71 %
Moderate level of trust	47.39 %
Highly trusting	50.90 %
<i>Social Capital II – Community Participation</i>	
No participation	16.15 %
Little participation	42.82 %
Moderate to active participation	41.03 %

exclusive categories- (i) No trouble, (ii) Somewhat difficult, (iii) Very difficult, and (iv) Unable to do it at all.

For purposes of parsimony and ease in interpretation, the original four responses from the questionnaire (*No trouble, Somewhat difficult, Very difficult and Unable to do it at all*) are condensed into three ordinal categories as indicated in Table 1. The choices in the number of categories and the cut-off points within these categories are made via an iterative process: first, by plotting the combined ADL values onto a histogram we are able to visually identify points of discontinuity and, accordingly, divided the ADL scores into the fewest number of categories which we consider to have adequately captured the pattern in the data distribution. We then regressed this ordinal variable against various health measures and conducted T-tests to verify that each category is statistically distinct from another. The results thus obtained are then used to further refine the choice of the number categories and the threshold points therein.

In our analyses, we adopt the Katz Index of Independence in Activities of Daily Living (referred to as the Katz ADL), by first summing the individual ADL scores and then categorising them into three groups: 'Require assistance,' 'Moderately independent' and 'Highly independent' based on the distribution of the total score. The summation of individual ADL scores ranges from 1 to 22. A score between 1 and 17 is placed within the 'Require assistance' group, the 'Moderately independent' group consists of scores from 18 to 21 and an individual with a score of 22 is placed within the 'Highly independent' group. From Table 1, we observe that while 43.88 % of the sample is in the 'highly independent' category, 35.81 % are 'moderately independent' and 20.31 % require assistance.

Finally we include measures of *chronic illnesses* to analyse the extent to which a more objective measure of health relates to social capital. Respondents were asked if a health professional had informed them that they currently have or have previously experienced hypertension, diabetes, asthma, heart conditions, stroke, depression and/or high cholesterol. We focus on hypertension as our proxy for chronic illnesses, since 23 % of the

respondents report being diagnosed with hypertension, whereas the proportion of individuals who reported being in any of the other categories is negligible (at 5 % or less). However, as a robustness check, we also create a new binary variable which takes a value of 1 if the individual experiences at least one chronic illness. From Table 1 we observe that about 32 % of the respondents have been diagnosed with at least one chronic illness.

Measures of mental health

The dataset also includes self-reported measures of mental health such as whether the respondent had experienced depression, stress, loneliness, lack of energy and/or sleeping difficulties in the last week. The aggregate mental health variable is constructed by summing all the adverse mental health issues for each individual. Individuals with a score of 0 are categorised as being of ‘sound mental health’, and those with a score of 1 or above are categorised as ‘experiencing at least one mental health issue’. The inclusion of these four different health measures in the analyses allows us to check the robustness of our results.

Explanatory variables

The main explanatory variables used in the analysis are measures of social capital which are expected to have an influence on healthy ageing. Following Riumallo-Herl et al. we measure social capital using: (i) Measures of participation in community¹ activities and (ii) Measures of neighbourhood trust [14].

In keeping with the methodology for the creation of the Katz ADL variable, to construct the Community Participation variable we first added up the number of ‘yes’ responses to the following questions: Did you: (a) participate in community meetings?, (b) participate in voluntary labour?, (c) participate in programs to improve

village/neighbourhood?, and (d) participate in religious activities? The combined scores for community participation range from 0 to 4. Based on responses to this question, we divide the final score into three categories – ‘no participation’ (16.15 %), ‘little participation’ (42.82 %) and ‘active participation’ (41.03 %).

With regard to the measure of neighbourhood trust, we use responses to the survey question ‘In most parts of the village, is it safe for you to walk alone at night?’ We consider this question to be the most appropriate as it centres on the respondent’s assessment of his/her trust in the community. In other words, this question both avoids unnecessary individual heterogeneity and is a related, complementary measure to Community Participation.

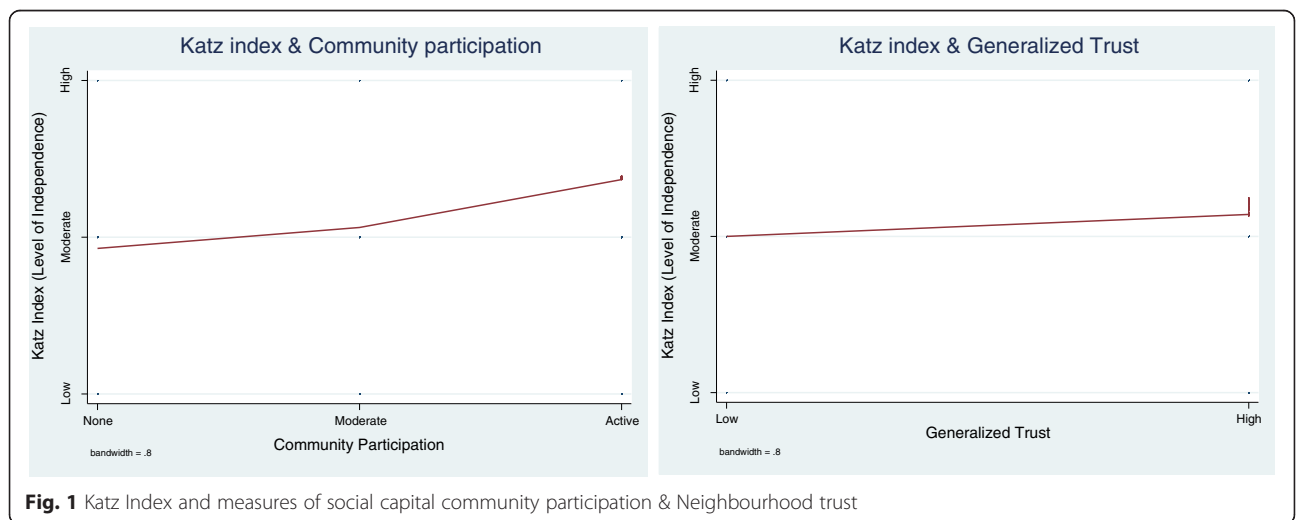
From Table 1, we observe that neighbourhood trust is high in the sample, with only 1.71 % of the respondents reporting ‘no trust’, 47.39 % reporting moderate levels of trust and just over half the respondents at 50.9 % reporting high levels of trust.

We acknowledge that being infirm or in ill health may act as a constraint on participation in community activities, creating the potential for endogeneity issues, which we address below.

Figure 1 depicts the relationship between elderly health (as measured by Katz ADL) and the two social capital variables using locally weighted regression at 80 % bandwidth. The slope of the curve suggests a positive relationship: i.e. a more active engagement in community activities is associated with greater physical independence in daily activities. This is corroborated by the correlation between our Katz ADL and the social capital measure of neighbourhood trust.

Socio-economic characteristics

The dataset also contains detailed information on the demographic characteristics of the household and



indicators of economic well-being at the household level, including household per capita expenditures (a proxy for economic status), number of household members, a dummy variable for rural residence and indicator variables for province. For each household member, we also have information on their gender, marital status, religion, labour market status (whether employed or not) and education level. There is also information on the availability of health centres for the elderly (Posyandu), the number of medical workers in the district and whether the area has been affected by disaster(s) within the past five years (proxy for unanticipated financial shocks). A variable relating to individuals' access to pensions was incorporated in earlier estimates, but was discarded because it was statistically insignificant in all the estimates. This may be because the majority of sample (93.72 %) does not have access to pensions.

In the full sample, 20.31 % of the respondents are found to require assistance (poor health), 35.81 % are moderately independent and 43.88 % are highly independent (good health). Table 2 contains the main variables used in the estimations. We note that while more than half of the male sample report being in good health, the female sample is more evenly divided between the three categories with the majority (39.71 %) belonging to 'moderately independent'. Similarly, a larger proportion of currently married individuals are in good health (48.41 %) relative to those that are not married (28.87 %.) In terms of employment status, a relatively higher proportion of the unemployed (42.4 %) are in poor health. Individuals living in households with an average household expenditure that is higher than the mean are likely to be in the highest category (independent), relative to those living in households with expenditures below the average. Finally, with regards to community participation, among those who report 'no community participation' 28.51 % require assistance, 49.4 % are moderately independent and 22.09 % are highly independent.

Econometric strategy

We begin by considering the associations between measures of health and social capital whilst controlling for the role of the other explanatory variables. We run separate estimates for each of the four health outcomes: Self-assessed health status, Katz ADL, chronic illness and self-assessed mental health. Our main equation of interest is:

$$h_{ijk}^* = x'_{ijk}\beta + y'_{jk}\gamma + z'_k\lambda + u_{ijk} \tag{1}$$

Where, h_{ijk}^* refers to the latent health status of individual i in household j and community k . The vector x_{ijk} includes a vector of individual characteristics such as

Table 2 Summary statistics of main variables used in estimations

Variable	Require assistance %	Moderately independent %	Highly independent %
Age category: 50–60	10.86	34.47	54.67
Age category: 61–70	34.44	38.07	27.49
Age category: 70+	47.57	38.83	13.59
Female	26.48	39.71	33.81
Male	15.14	32.53	52.32
Married	16.45	35.14	48.41
Not married	33.10	38.03	28.87
Rural	22.45	36.48	41.08
Urban	14.63	34.03	51.34
HH Size (5 people or fewer)	21.07	36.33	42.60
HH Size (More than 5 people)	18.39	34.48	47.13
Disaster	21.78	34.32	43.89
Posyandu	11.85	36.42	51.73
Not Islam	19.68	38.84	41.68
No education	33.73	39.76	26.51
Elementary education	22.53	35.32	42.15
Junior high education	11.54	38.46	50.00
Senior high education	11.43	27.86	60.71
University or higher	5.26	40.79	53.95
Other employment	14.73	35.27	50.00
Housekeeper	29.78	40.44	29.78
Unemployed	42.40	31.20	26.40
ln(HH Expenditure): Above average	18.15	33.73	48.12
ln(HH Expenditure): Below average	22.27	37.69	40.03
Medical workers (at least 1)	15.77	38.26	45.97
No medical workers	21.77	35.02	43.21
Neighbourhood Trust			
Little/No trust	1.61	46.59	51.81
Moderate level of trust	2.28	44.65	53.08
Highly trusting	1.30	50.00	48.70
Community Participation			
No participation	28.51	49.40	22.09
Little participation	15.95	46.01	38.04
Moderate to active participation	10.59	37.17	52.23

Note: Each row sum to 100 %

respondent's age, gender, marital status, educational attainment, labor market status, religion and his/her social capital (as measured by neighbourhood trust and community participation). The term y_{jk} includes variables relating to household characteristics such as household expenditure and household size. z_k includes community

and geographical characteristics such as the rural–urban residence of the respondent, an indicator variable for the respondent's province of residence, as well as other community-level variables such as access to health centres, number of medical workers and whether the respondent's community experienced any financial shock as caused by natural disasters.

Ordered Probit model

Given the natural ordering of the ADL categories, we estimate an Ordered Probit model for this dependent variable where respondents are classified into three categories: highly independent, moderately independent and require assistance.

Probit models

The dependent variables for all other health measures are binary in nature, and accordingly we estimate separate Probit models for each of the two SAHS measures, chronic and self-reported mental health measures. The

explanatory variables are the same as those used in the Ordered Probit estimates.

Econometric issues: endogeneity

Our hypothesis is that social capital is positively associated with individual health, so individuals with better social capital networks are generally likely to be in good health. However, the validity of these results may be potentially undermined by the presence of endogeneity: social capital may be endogenous if individuals who report poor health (in the SAHS variables particularly) may correspondingly be unable to participate in community activities. Hence, instead of higher social capital being associated with better health, one can equally hypothesize that healthy individuals are much more likely to participate in community activities.

To untangle this question of causality, we estimate instrumental variable regression models. To qualify as an instrumental variable we require the inclusion of a variable which is correlated with community participation,

Table 3 Ordered probit model using the Katz indices (all ADL)

	Require assistance [1]	Moderately independent [2]	Highly independent [3]
Age category: 61–70	0.17*** (0.02)	0.11*** (0.02)	−0.27*** (0.03)
Age category: 70+	0.24*** (0.03)	0.15*** (0.02)	−0.39*** (0.05)
Male	−0.09*** (0.02)	−0.06*** (0.01)	0.14*** (0.03)
Married	−0.04* (0.02)	−0.02* (0.01)	0.06* (0.03)
Rural	−0.00 (0.02)	−0.00 (0.02)	0.01 (0.04)
HH Size	−0.00 (0.00)	−0.00 (0.00)	0.00 (0.01)
Maluku North	0.08** (0.03)	0.05** (0.02)	−0.13*** (0.05)
Nusa Tenggara East	0.08*** (0.03)	0.05*** (0.02)	−0.14*** (0.04)
Papua	0.03 (0.03)	0.02 (0.02)	−0.05 (0.05)
Papua West	0.03 (0.03)	0.02 (0.02)	−0.05 (0.05)
Southeast Sulawesi	0.16*** (0.03)	0.10*** (0.02)	−0.26*** (0.05)
Disaster	0.04* (0.02)	0.02* (0.01)	−0.06* (0.03)
Posyandu	−0.06*** (0.02)	−0.04*** (0.01)	0.10*** (0.04)
Not Islam	0.06*** (0.02)	0.046*** (0.01)	−0.01*** (0.03)
Elementary education	−0.03 (0.03)	−0.02 (0.02)	0.05 (0.04)
Junior high education	−0.03 (0.03)	−0.02 (0.02)	0.06 (0.06)
Senior high education	−0.07** (0.04)	−0.05** (0.02)	0.12** (0.06)
University or higher	−0.08* (0.04)	−0.05* (0.03)	0.13* (0.07)
Housekeeper	0.06** (0.02)	0.04*** (0.02)	−0.10*** (0.04)
Unemployed	0.14*** (0.03)	0.09*** (0.02)	−0.24*** (0.05)
log(HH Expenditure)	0.00 (0.01)	0.00 (0.01)	−0.01 (0.02)
Medical workers	−0.01** (0.00)	−0.00** (0.00)	0.01** (0.00)
Neighbourhood Trust	−0.10*** (0.03)	−0.06*** (0.02)	0.16*** (0.05)
Community Participation	−0.05*** (0.01)	−0.03*** (0.01)	0.08*** (0.02)
	N = 249	N = 439	N = 538

Note: We report marginal effects at means. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

but does not affect an individual's health. We therefore create a community-level index using questions relating to the frequency of violence/conflicts in the community. The community index is based on questions such as whether there have been conflicts on land/building between citizen and government and/or those arising from abuses of authority and/or from the election of public officials and/or between members of different religions. These variables may influence community participation but have no direct impacts on health. As with the Katz ADL index, the IV is created by first summing these individual responses and classifying them into three different groups based on the distribution of the final score.

A higher measure of the instrument should lead to lower levels of social capital, but should have no influence on an individual's health (as defined here). In the first stage, we regress 'community participation' (the suspected endogenous social capital variable) against the instrumental variable and the same vector of exogenous variables in Eq. (1). The predicted values of 'community

participation' from this regression are saved. In the second stage, the original equation of interest is estimated with the inclusion of predicted values of 'community participation'. We then test for the presence of endogeneity using: (i) The Wald test for dichotomous dependent variable H_0 : There is no endogeneity; and (ii) Wooldridge's test score and regression-based F-test for continuous dependent variable H_0 : Variables are exogenous.

Although *a priori* we expect the self-assessed dependent variables to be endogenous, for robustness purposes, the same instrumental variables (IV) procedure is repeated for the Katz ADL as well.

Results

The main results from our empirical analyses are presented in Tables 3, 4, 5, 6, 7, 8 and 9. Tables 3 and 4 present the Ordered Probit results for the Katz index using: (a) all the Katz ADL variables, and (b) only the six ADL variables suggested in Shelkey & Wallace [27]. In Table 5 we assess the association between ADL and

Table 4 Ordered probit model using the Katz index (six ADL)

	Require assistance [1]	Moderately independent [2]	Highly independent [3]
Age category: 61–70	0.03*** (0.01)	0.08*** (0.02)	−0.11*** (0.03)
Age category: 70+	0.05*** (0.01)	0.14*** (0.03)	−0.19*** (0.04)
Male	−0.01* (0.01)	−0.03* (0.02)	0.05* (0.03)
Married	0.00 (0.01)	−0.01 (0.02)	0.01 (0.03)
Rural	0.00 (0.01)	0.01 (0.02)	−0.01 (0.03)
HH Size	0.00 (0.00)	−0.01 (0.00)	0.01 (0.01)
Maluku North	0.01 (0.01)	0.03 (0.03)	−0.04 (0.04)
Nusa Tenggara East	0.02* (0.01)	0.05** (0.03)	−0.07** (0.04)
Papua	0.02 (0.01)	0.05 (0.03)	−0.07 (0.04)
Papua West	0.00 (0.01)	−0.01 (0.03)	0.01 (0.05)
Southeast Sulawesi	0.01 (0.01)	0.03 (0.03)	−0.04 (0.04)
Disaster	0.01 (0.01)	0.02 (0.02)	−0.03 (0.03)
Posyandu	−0.02** (0.01)	−0.05** (0.02)	0.06** (0.03)
Not Islam	0.02** (0.01)	0.06** (0.02)	−0.08*** (0.03)
Elementary education	0.01 (0.01)	0.02 (0.03)	−0.02 (0.03)
Junior high education	0.01 (0.01)	0.04 (0.03)	−0.05 (0.05)
Senior high education	0.00 (0.01)	0.00 (0.04)	0.00 (0.05)
University or higher	−0.01 (0.02)	−0.02 (0.05)	0.02 (0.06)
Housekeeper	0.01* (0.01)	0.04* (0.02)	−0.06* (0.03)
Unemployed	0.05*** (0.01)	0.13*** (0.03)	−0.187*** (0.04)
log(HH Expenditure)	0.00 (0.01)	0.01 (0.01)	−0.01 (0.02)
Medical workers	0.00* (0.00)	−0.01* (0.00)	0.01* (0.00)
Neighbourhood Trust	−0.03*** (0.01)	−0.08*** (0.03)	0.11*** (0.04)
Community Participation	−0.01*** (0.00)	−0.04*** (0.01)	0.05*** (0.02)
	N = 62	N = 209	N = 955

Note: We report marginal effects at means. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

Table 5 Robustness tests: ordered probit model using the Katz index

	Require assistance [1]	Moderately independent [2]	Highly independent [3]
<i>Female sample</i>			
Neighbourhood trust	-0.16*** (0.05)	-0.02* (0.01)	0.19*** (0.06)
Community participation	-0.07*** (0.02)	-0.01 (0.01)	0.08*** (0.03)
	N = 148	N = 222	N = 189
<i>Male sample</i>			
Neighbourhood trust	-0.00 (0.04)	-0.00 (0.05)	0.00 (0.10)
Community participation	-0.04*** (0.01)	-0.05*** (0.02)	0.09*** (0.03)
	N = 101	N = 217	N = 349
<i>Rural sample</i>			
Neighbourhood trust	-0.14*** (0.04)	-0.07*** (0.02)	0.20*** (0.06)
Community participation	-0.06*** (0.02)	-0.03*** (0.01)	0.09*** (0.02)
	N = 200	N = 325	N = 366
<i>Urban sample</i>			
Neighbourhood trust	-0.03 (0.04)	-0.04 (0.05)	0.06 (0.09)
Community participation	-0.04** (0.02)	-0.05** (0.02)	0.09** (0.04)
	N = 49	N = 114	N = 172
<i>Age category: 50–60</i>			
Neighbourhood trust	-0.04 (0.02)	-0.06 (0.04)	0.10 (0.06)
Community participation	-0.02** (0.01)	0.04* (0.01)	0.06** (0.03)
	N = 86	N = 273	N = 433
<i>Age category: 61–70</i>			
Neighbourhood trust	-0.24** (0.10)	0.04 (0.02)	0.20** (0.08)
Community participation	-0.11*** (0.03)	0.02* (0.01)	0.09*** (0.03)
	N = 114	N = 126	N = 91
<i>Age category: 70+</i>			
Neighbourhood trust	-0.29 (0.31)	0.18 (0.19)	0.11 (0.12)
Community participation	-0.23*** (0.07)	0.14** (0.06)	0.09** (0.03)
	N = 49	N = 40	N = 14

Note: We report marginal effects at means. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

social capital variables across different demographic groups to test the robustness of the previous results. Table 6 presents the empirical estimates for the Probit model for the SAHS variables and the Probit estimates for physical and mental health measures are shown in Table 7.

Influence of social capital measures on health measures

The key point to note is that for all characterizations of the Katz index, both measures of social capital (neighbourhood trust and community participation) are statistically significant and positively correlated with better health, measured using ADL. Our results show that the magnitude of the association is larger for neighbourhood trust, and is about twice the magnitude of the community participation measure. In particular, the results in

Table 3 suggest that a unit increase in neighbourhood trust is predicted to decrease the probability of an individual being in the 'require assistance' and 'moderately independent' categories by 10 and 6 percentage points respectively, and increase the probability of being in the 'most independent' category by 16 percentage points.

The influence of social capital measures on ADL is also robust across different samples, we estimate separate regressions for males and females, urban and rural and for different age categories (50–60 years, 61–70 years, and 70+).²

To account for the possibility that the benefits from social networks on health may be gender specific, we re-estimated the Katz ADL model separately for males and females. The reasons to expect gender differences in health outcomes include: first, gender-based occupational

Table 6 Probit models using the self-assessed health status

	General health [1]	Future health expectation [2]
Age category: 61–70	0.07*** (0.03)	0.13*** (0.03)
Age category: 70+	0.09 (0.06)	0.14*** (0.05)
Male	−0.04 (0.04)	0.00 (0.03)
Married	0.06 (0.04)	−0.04 (0.03)
Rural	0.03 (0.04)	−0.02 (0.04)
HH Size	0.01 (0.01)	0.01** (0.01)
Maluku North	0.16*** (0.05)	0.10** (0.05)
Nusa Tenggara East	0.15 (0.05)	0.10** (0.04)
Papua	0.10* (0.06)	−0.02 (0.05)
Papua West	0.02 (0.06)	−0.02 (0.05)
Southeast Sulawesi	0.18*** (0.05)	0.07* (0.04)
Disaster	0.09** (0.04)	−0.00 (0.03)
Posyandu	−0.04 (0.04)	−0.07** (0.03)
Not Islam	0.08** (0.04)	0.08** (0.03)
Elementary education	−0.02 (0.04)	−0.05 (0.04)
Junior high education	0.03 (0.06)	−0.04 (0.05)
Senior high education	−0.07 (0.07)	−0.03 (0.06)
University or higher	−0.17** (0.08)	−0.13* (0.07)
Housekeeper	0.06 (0.04)	0.07* (0.03)
Unemployed	0.19*** (0.05)	0.10** (0.04)
log(HH Expenditure)	−0.03 (0.03)	−0.06*** (0.02)
Medical workers	−0.00 (0.00)	0.00 (0.00)
Neighbourhood Trust	−0.14*** (0.05)	−0.03 (0.05)
Community Participation	−0.00 (0.02)	−0.01 (0.02)

N = 1226

Note: We report marginal effects at means. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

segregation may imply gender-based differences in exposure to the risks of disabling occupational injuries; second, differences in educational attainment may impact differently on women's and men's ability to perform certain activities and, finally, gendered segregation of familial roles (e.g. child care and care of the elderly) may lead to differences in their ability to access household resources. The results illustrate the importance of both social capital measures in the health of older females, with neighbourhood trust increasing the probability of being in the 'highly independent' category by 19 percentage points, and community participation increasing the probability of being in the 'highly independent' category by 8 percentage points. It is noteworthy that while the social capital measure neighbourhood trust is not statistically significant in the male sample, the community participation measure is statistically significant and increases the probability of being in the 'highly independent' category by around 9 percentage points.

The results from the age disaggregated samples show that the social capital measures generally play a positive role in fostering good health among older individuals. We observe that the size of the association increases monotonically as we move to older groups. More specifically, we observe that amongst individuals in the age category of 70 years and above, community participation is associated with a 23 percentage point decline in the probability of requiring assistance, and a 9 percentage point increase in the probability of being in the 'highly independent' category. However, the social capital measure neighbourhood trust is statistically insignificant for this group, and for individuals in the 50–60 age category.

The Probit estimates from the SAHS measures reported in Table 6 show that social capital has a much more modest influence on self-assessed health measures, compared to its influence on ADL. While the community participation measure is statistically insignificant, we observe that the variable neighbourhood trust is statistically significant, and reduces the probability of being currently healthy by 14 percentage points, but has no influence on future health expectations.

In Table 7 we can see that there is no statistically significant association between social capital measures and chronic illnesses, but the social capital measure neighbourhood trust alone is estimated to reduce the likelihood of experiencing some mental health issues by 14 percentage points.

The inconsistent correlations between the social capital variables vis-à-vis to the Katz ADL and the self-assessed measures of health outcomes may be due to the fact that these are not similar measures of health. Figure 2 is a scatterplot for the Katz ADL and self-assessed general health. The scales are ordinal and a larger number implies better health. Therefore, we would expect to see a pattern resembling a positive, linear relationship if these two dependent variables are substitutes of one another. The plot, however, reveals that is not the case as, for instance, a high Katz ADL score is just as likely to be associated with a participant answering that he/she is of good health as of poor health.

The role of other factors

The other factors which are predicted to improve health outcomes include variables such as the number of medical workers and elderly health centres (Posyandu) at the community-level, having an occupation other than being a housekeeper and higher education levels. Notably, males are predicted to be in better health than females and have a 14 percentage point higher probability of being in the 'highly independent' category in the full Katz ADL index. Furthermore, being married raises one's probability of being healthier as does residing in a community unaffected by disasters in the recent past. When

Table 7 Probit model using measure of chronic illness and mental health

	Chronic illness (Hypertension) [1]	Chronic illness (All) [2]	Mental health [3]
Age category: 61–70	0.07** (0.03)	0.09*** (0.03)	0.03 (0.03)
Age category: 70+	0.11** (0.05)	0.12** (0.05)	0.07 (0.05)
Male	−0.13*** (0.03)	−0.15*** (0.03)	0.01 (0.03)
Married	0.02 (0.03)	0.05 (0.04)	−0.02 (0.03)
Rural	0.02 (0.03)	−0.03 (0.04)	0.01 (0.04)
HH Size	0.00 (0.01)	−0.02** (0.01)	0.00 (0.01)
Maluku North	0.03 (0.04)	0.03 (0.05)	0.06 (0.05)
Nusa Tenggara East	−0.02 (0.04)	−0.01 (0.04)	0.06 (0.04)
Papua	−0.12** (0.05)	−0.14*** (0.06)	0.02 (0.05)
Papua West	−0.08* (0.05)	−0.09 (0.05)	−0.11** (0.05)
Southeast Sulawesi	0.00 (0.04)	−0.01 (0.05)	0.03 (0.04)
Disaster	−0.01 (0.03)	−0.04 (0.03)	0.06* (0.03)
Posyandu	0.03 (0.03)	0.04 (0.04)	−0.04 (0.03)
Not Islam	−0.02 (0.03)	−0.01 (0.04)	0.07** (0.03)
Elementary education	0.07* (0.04)	0.09** (0.05)	−0.01 (0.04)
Junior high education	0.14** (0.05)	0.13** (0.06)	0.03 (0.05)
Senior high education	0.11** (0.06)	0.18*** (0.06)	−0.12** (0.06)
University or higher	0.21*** (0.06)	0.22*** (0.07)	−0.14* (0.07)
Housekeeper	0.03 (0.03)	0.08** (0.04)	0.05 (0.04)
Unemployed	0.08** (0.04)	0.12** (0.05)	0.11*** (0.04)
log(HH Expenditure)	0.06*** (0.02)	0.09*** (0.03)	0.00 (0.02)
Medical workers	0.00 (0.00)	0.01 (0.00)	0.00 (0.00)
Neighbourhood trust	0.00 (0.04)	−0.01 (0.05)	−0.14*** (0.04)
Community participation	−0.01 (0.02)	−0.01 (0.02)	−0.01 (0.02)

N = 1226

Note: We report marginal effects at means. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

using only six ADL as the dependent variable, the above findings are not materially changed other than that factors including marriage and occurrence of disasters cease to be statistically significant.

It is noteworthy that in the sample of individuals aged 60 years and above household size becomes statistically significant. Although household size was not statistically significant previously, in contrast, here a unit increase in the number of household members is positively associated with one being in the ‘highly independent’ category by 2 percentage points, demonstrating the greater reliance on close family members as one ages.

Endogeneity tests

To test for the presence of endogeneity in the ‘community participation’ variable, we estimated Instrumental Variable estimations separately for the self-assessed measures of health (SAHS_1 and SAHS_2). Further, we also tested for endogeneity using a binary and continuous version of the Katz ADL. The results are presented in

Tables 8 and 9. The Wald test, Wooldridge score test and regression-based F test are consistent with one another in showing there is insufficient evidence in our sample to reject the null hypothesis that there is no endogeneity. Therefore, we are confident in the validity of the interpretations and conclusions we stated above.

Discussion

In this paper we examined the links between measures of social capital and health of older individuals, using a unique dataset from seven of the most vulnerable Eastern provinces in Indonesia. Our study finds that access to better social capital (using measures of neighbourhood trust and community participation) is associated with a higher degree of physical mobility and independence, but has no influence on chronic illnesses. In keeping with previous research from developing countries that have used an array of health measures for China and Chile [14, 15] our study also finds that the social capital measure neighbourhood trust shows positive

Table 8 IV estimations: 6a: first-stage results from IV estimations

	Community participation [1]
Age category: 61–70	-0.13*** (0.05)
Age category: 70+	-0.37*** (0.08)
Male	0.22*** (0.05)
Married	0.14*** (0.05)
Rural	0.19*** (0.06)
HH Size	0.00 (0.01)
Maluku North	0.05 (0.07)
Nusa Tenggara East	0.04 (0.06)
Papua	0.08 (0.08)
Papua West	0.09 (0.08)
South West Sulawesi	-0.30*** (0.07)
Disaster	0.05 (0.05)
Posyandu	0.10* (0.05)
Not Islam	0.26*** (0.05)
Elementary education	0.14** (0.06)
Junior high education	0.19** (0.08)
Senior high education	0.28*** (0.09)
University or higher	0.16 (0.11)
Housekeeper	-0.13** (0.06)
Unemployed	-0.15** (0.07)
Log(HH expenditure)	-0.05 (0.04)
Medical workers	0.00 (0.01)
Neighbourhood trust	-0.07 (0.07)
Community conflicts/violence	0.03 (0.03)

Note: We report coefficients. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

associations with physical, mental and SAHS. However, unlike Riumallo-Herl et al.’s study, we find that the influence of social capital is stronger for physical rather than for mental health measures. In the full sample, the robust and consistently positive associations between the health measure ADL and the social capital measures trust in neighbourhood and community participation is important, as it suggests that our results are not driven by subjective bias (as may be the case with self-reported

measures). In the urban sample, neighbourhood trust does not appear to play any role, while community participation is significantly and positively correlated with being highly independent.

In the rural sample, however, both social capital measures are positively signed and statistically significant in increasing the probability of being highly independent, with the magnitude of the impact larger for neighbourhood trust. We speculate that these differences may be due to the possibility that rural communities tend to be more cohesive. Also, it is possible that the manner in which we have defined our neighbourhood trust variable in terms of personal safety is much more likely to hold in rural areas, where crime rates are generally lower.

There are however, important differences across different cohorts. We find that while the social capital measure neighbourhood trust is consistently more influential than community participation in the full sample, amongst individuals aged over 70 years and in the urban sample, only community participation is statistically significant. Our findings are consistent with previous research from Western countries where social capital measures have a positive association with rural residence. This is in contrast to studies from China which find that social capital is more influential in urban areas.

Using ADL health measures we find that the influence of social capital differs across different demographic groups, with females, rural residents and individuals aged between 61–70 years, having a higher probability of being in the highly independent category with better access to both social capital measures. From a policy perspective these results point to the importance of social capital measures in moderating the influence of poor health, particularly in the ADL.

Our analysis shows that the community participation measure is only positively associated with physical mobility measures (ADL), but not with SAHS, chronic illness or mental health. This weak link is also found in other non-Western studies, and it may be because in developing country environments, community and voluntary groups may not be as organised as those found in more developed Western societies. Therefore, our

Table 9 IV estimations: 6b: second stage results

	SAHS 1 [1]		SAHS 2 [2]		Katz ADL (Binary) [6]		Katz ADL (Continuous) [7]	
	Coef.	$P > z$	Coef.	$P > z$	Coef.	$P > z$	Coef.	$P > z$
Wald test of exogeneity ($\theta = 0$):	chi2(1) = 0.18	Prob > chi2 = 0.67	chi2(1) = 1.64	Prob > chi2 = 0.20	chi2(1) = 1.33	Prob > chi2 = 0.25		
Wooldridge score test							Robust score chi2(1) = 2.50	$p = 0.11$
Regression-based F test							Robust regression F(1,1200) = 2.45	$p = 0.12$

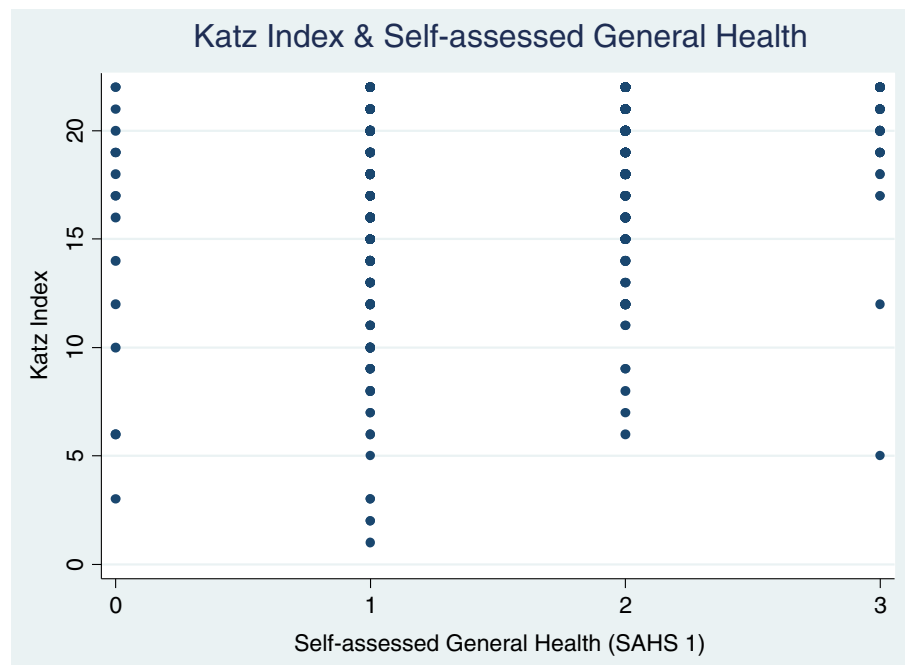


Fig. 2 Scatter plot of original Katz index and Self-assessed current health

community participation measure which included memberships of formal organisations may have missed out on other informal types of community networks.

In particular, for self-assessed health measures, our analysis did not find any association between community participation and respondent's self-reported current or future health expectations. However, neighbourhood trust was associated with a significantly lower reported poor current health. Similarly, while there are no statistically significant relationships between chronic health measures and either of our two social capital measures, neighbourhood trust is associated with a significantly lower probability of being depressed.

One of the strengths of our study is that we use an array of health measures (physical, mental and self-assessed) to analyse the links between social capital measures and health in Eastern Indonesian provinces which are among the most vulnerable, and which have among the lowest life expectancies. Our finding of the positive association between social capital measures and health among older individuals is critical in a country whose elderly population is growing at a rapid rate.

The study also has some short-comings. The data are only available for one year. This has meant that we are unable to infer causality between social capital measures and health, so our analysis can only identify associations between social capital measures and health. Next our choice of social capital measures is to some degree influenced by data availability and is by no means comprehensive.

Conclusion

The influence of social capital on the health of individuals is well documented in the literature from developed countries. There is, however, limited empirical evidence from developing countries finding a positive association between social capital and health. In this paper we examined the links between measures of social capital and health of older individuals using data from the IFLS-East. Our results suggest that there is a positive association between social capital and several measures of health. However, the precise influence, or lack of it, is likely to depend on the context (rural versus urban), cohort and the type of social capital measure used.

Endnotes

¹The term community refers here to the enumeration area, which is a geographical area defined by Statistics Indonesia. In this context a community may be part of a village or a neighbourhood in an urban setting. There are 98 unique communities in our sample.

²For space considerations, although we included the same explanatory variables as in Tables 3 and 4, we only report the marginal effects from the social capital measures in Table 5.

Abbreviations

ADL, activities of daily living; IFLS- East, Indonesian family life survey-east; SAHS, self-assessed health status.

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Availability of data and materials

The dataset is publicly available and can be obtained free of cost upon registration from RAND Corporation's website (<http://www.rand.org/labor/FLS/IFLS/ifls-east.html>).

Authors' contributions

AR conceived the study, participated in its design and acquired the dataset. JC conducted the empirical analysis and contributed to the interpretation of the data. Both authors were involved in the drafting of the manuscript and intellectual content. Both authors have read and approved the final draft.

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Competing interests

The authors declare that they have no competing interests.

Consent for publication

Not applicable.

Ethics approval and consent to participate

The analyses used secondary data that is publicly available. Ethics approval was obtained by RAND Corporation and Survey Meter who fielded the survey.

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