# Mother's social capital and child health in Indonesia

Sujarwoto Sujarwoto*, Gindo Tampubolon

Institute for Social Change, University of Manchester, Manchester M80NB, UK

**A B S T R A C T**

Social capital has been shown to be positively associated with a range of health outcomes, yet few studies have explored the association between mother's social capital and children's health. This study examines the relation between mothers' access to social capital (via participation in community activities) and child health. Instrumental variable estimation was applied to cross sectional data of the Indonesian Family Life Survey (IFLS) 2007 which consist of face-to-face interviews among the adult population in Indonesia ($N_{mothers}$ = 3450, $N_{children}$ = 4612, $N_{communities}$ = 309, and participation rate at 92%). The findings show strong evidence for the causal flow running from a mother's social capital to her children's health. All instruments are highly correlated with mothers' social capital but uncorrelated with child health. The findings are also robust to individual and community characteristics associated with child health, and suggest that enlarging mothers' social capital through various community activities is a particularly relevant intervention for reducing child health disparities in Indonesia.

© 2013 Elsevier Ltd. All rights reserved.

## Introduction

In the past two decades, social capital has increasingly gained attention in health research (Kawachi, Subramanian, & Kim, 2008). Social capital can be conceptualised as the property of individuals and communities. Portes (1998:12) believes social capital as "the capacity of individuals to command scarce resources by virtue of their membership in networks or broader social structures". In contrast, Putnam (1995:67) conceives social capital as a community-level resource and a distinctly social feature that is reflected in the structure of social relationships. He defines social capital as: "features of social organisation such as networks, norms, and social trust that facilitate coordination and cooperation for mutual benefit". In this study, we conceive social capital as a community-level resource accessed by individuals, specifically mothers. Child health is affected by mothers' access to networks via their participation in community activities. In these networks, information about health (among others) circulates. Mothers' access to networks may differentially depend on the extent to which they participate in community activities and the availability of such networks.

Kawachi and Berkman (2000) describe the mechanisms by which community social capital affect health. Firstly, social capital provides channels for the distribution of knowledge and information related to health. Health promotion can be distributed more rapidly through social networks, channels which again are found to be especially important in developing countries. Secondly, social capital can serve as a mechanism for maintaining healthy behaviour norms and exerting social control over detrimental health behaviour. Thirdly, social capital allows for the promotion of access to services and amenities, as more cohesive neighbourhoods are better equipped to mobilise collective action to champion the development of and access to health-related services. Fourthly, social capital serves as a conduit for psycho-social processes, including the development of social support and mutual respect. Such norms can translate into easier child-rearing, improved self-government, and the maintenance of a healthy social environment. In addition, the Marmot reviews (2010) notes that social capital also enables communities to be responsive to the national and local initiatives, including those instigated by government or health organisations.

The mechanisms linking mothers' social capital and children's health are channelled via improvements in mothers' knowledge that in turn affects their parenting behaviour (Anderson & Damio, 2004; De Silva & Harpham, 2007; Martin & Rogers, 2004). De Silva and Harpham (2007) suggest that social networks, through their participation, enable mothers to know more due to knowledge transfer (e.g. where to obtain additional cheap sources of food), to think differently due to attitude influences (e.g. attitudes towards hygiene practices), and to do things differently (e.g. breastfeed for longer). These mechanisms are illustrated by

* Corresponding author.
  *E-mail addresses:* sujarwoto.sujarwoto@postgrad.manchester.ac.uk, sujarwoto@hotmail.com (S. Sujarwoto).

research from the United States, which shows that women with more social capital have increased odds of breastfeeding their child for longer (Anderson & Damio, 2004). Other research shows that both household and community-level social capital is associated with reduced odds of household hunger (Martin & Rogers, 2004). In a setting such as Indonesia, where most adult females have only attained a primary level of education, social networks may provide mothers with information they have not obtained through schooling (Wibisana, Trihono, & Nurwati, 1999). This information ranges from the benefits of oral rehydration therapy to the location of preventive care providers.

Two research gaps exist within the literature on social capital and health. Firstly, most focuses on adult health in developed countries (for reviews, see Kawachi & Berkman, 2000). However, given that the effect of social capital is hypothesised to vary by subgroups and contexts (Cutrona & Russell, 2000; De Silva & Harpham, 2007), it is important to study the effect of social capital on child health in developing countries. This study provides this focus, and is thus a contrast with the far more extensive work on social capital and adult health that draws on data from developed countries, mainly the United States and Western Europe. Indonesia is particularly suitable for this study, not only because of the government concern to improve child health status, but also because many regions of the country boast a long-standing indigenous tradition of community involvement (or social capital) (Beard, 2005, 2007; Grootaert, 1999; Miller, Schiffer, Lam, & Rosenberg, 2006). Relatively little research however has examined the implications of this tradition for social capital and child health.

Secondly, several empirical studies examining the relationship between mothers' social capital and child health do not take into account the reverse causality issue which compromises the relationship (for example De Silva & Harpham, 2007; Macinko & Starfield, 2001; Tuan, Harpham, & De Silva, 2006). The characteristics that promote mother's social capital are likely to be influenced by children's health. For example, a sick child may prevent the mother from participating in community activities, hence a reduction in social capital (Tuan et al., 2006). Failure to take this into account will lead to bias estimate of the relationship between mother's social capital and child health. In this study, instrumental variable estimates are used to establish the direction of causal effect between a mother's social capital and her child's health. This method is increasingly gaining ground, even among biomedical researchers who study, among others, chronic obstructive pulmonary disease (Lindenauer et al., 2010), prostate cancer (Lu-Yao et al., 2008), and acute myocardial infarction (Stukel, 2007). Studies also show that this method performs well in ruling out reverse causality, from social capital to various determinants such as welfare (Narayan & Pritchett, 1999), poverty and welfare (Grootaert, 1999), employment (Bayer, Ross, & Topa, 2005), violent crime (Lederman, Loayza, & Menendez, 2002), and health (D'Hombres, 2010). Because this approach in part reflects the aspects of the Indonesian setting, we turn to a discussion of contexts and then describe the data and methods employed.

## Community development and health in Indonesia

Indonesia's economic growth has been robust since the financial crisis of 1998, and appears well positioned with an average of 4–6% since 2002 (World Bank, 2008). Mother and child health status improved after the crisis. Mother mortality ratio decreased sharply from 340 per 100,000 live births in 2000 to 220 per 10,000 live births in 2010. Malnutrition, measured using both height for age and weight for age, decreased during this period (from 42% and 25% in 2000 to 37% and 18% in 2010 respectively). Female and male life expectancy at birth increased from 67 years and 64 years in 2000 to 71 years and 67 years in 2010 respectively (World Bank, 2012).

Many regions of Indonesia have been known for indigenous tradition of community involvement (Beard 2005, 2007; Bowen, 1986; Geertz, 1962; Grootaert, 1999). This tradition is often recognised with a set of key Indonesian terms: *gotong royong* (Bowen, 1986; Koentjaraningrat, 1961), *arisan* or *binda* (Geertz, 1962), *koperasi*, *rukun* and *musyawarah* (Bowen, 1986), and *kerja bakti* (Beard, 2005). In Indonesia the generalised reciprocity aspect of social capital is best illustrated by the sociocultural ethic of *gotong royong* (meaning generalised reciprocity) both in rural and urban areas; this remains a strong social norm in Indonesia as well as a powerful determinant of social capital (Bowen, 1986). In many instances, this tradition of community involvement leads to the formation of grassroots organisations, which government subsequently adopts as part of its regional and national programmes. These programmes have often been cited by donor organisations as an example of community development success stories (Shiffman, 2002). Their goals differ, but include improving healthcare, education, sanitation, security and village upkeep (Wibisana et al., 1999).

Programmes that involve mothers are found across local communities. At least one type of volunteer programme was existed in each of the 309 communities included in the 2007 IFLS. We focus on the involvement of mothers in five specific programmes: community meetings, village cooperatives, voluntary labour, village upkeep, and women's associations. Table 1 draws on the data and presents descriptive statistics of mothers volunteering in these programmes. Forty-three percent of mothers report getting involved in at least one programme in the year prior to interview. In addition, among those who participated, about one-third was involved in more than one programme. With respect to the type of activity in which the women were involved, participation is highest for voluntary labour, community meetings and the women's association.

None of these five programmes are specifically geared towards improving children's health, a feature which is essential to the interpretation of the results. If the programmes in which mothers participate did target child health, a positive association between mothers' social capital and child health would be likely to reveal the effect of the programme and not necessarily the social capital of mothers generated by participating in that programme.

## Methods

### Indonesian Family Life Survey (IFLS) 2007

IFLS is an on-going longitudinal survey that began in Indonesia in 1993. It represents 83% of Indonesia's population living in 13 provinces and 262 districts (Frankenberg & Thomas, 2000), and brings together a rich set of information on individuals and households, the communities they live in, and the facilities that are available to them. Households (defined as a group of people who reside together and 'eat from the same cooking pot') were

**Table 1**
Mothers' social capital in various community programme.

| Type of community programme | Percentage participating |
| --- | --- |
| Mother participation in any program | 43% |
| Mother participation at least in one program | 27% |
| Women association | 10% |
| Community meeting | 11% |
| Cooperatives | 3% |
| Voluntary labour | 12% |
| Village upkeep | 8% |

Source: IFLS 2007.

randomly selected from within the communities. IFLS data is representative of the non-institutionalised adult population in Indonesia. The participation rate of IFLS 2007 is high with 92% (Thomas et al., 2012).

This study uses IFLS 2007 data, applying its cross-sectional structure rather than its panel structure. The time interval between IFLS 1993 and IFLS 2007 is almost ten years. During this long interval, most of the children who were measured in 1993 have entered puberty in 2007 (age above ten years). Literature on child growth and organ development shows a marked difference in growth curves of child height and weight before and during puberty (Buckler, 1997). During puberty, factors which affect child height and weight are more complex. These factors are not only nutritional status, but also other factors, especially sex characteristics (Rogol, Clark, & Roemmich, 2000). Therefore, since this study is aimed at examining child nutritional status, using panel regression ignoring this long period is inappropriate as parameter constancy during childhood and during puberty is likely to be violated. Such an assumption is necessary for estimation (Hendry, 1995).

IFLS 2007 consists of two main sources information: household information books and community facilities information books. Information on mother and child health comes from the first books. In this study, we restricted the sample to children of whom there is complete information on height and weight, and mothers of whom there is complete information on social capital. This yields a sample of 4612 children with 3450 mothers living in 309 communities. Respondents who migrate to other regions are excluded from the analysis (about 9.2% of mothers move to other regions between 1993 and 2007). Community facilities information books consist of extensive information about community in which households are sampled. Information was collected from community leaders and from staff at schools and health facilities available to community residents. In total 309 communities representing 13 provinces were surveyed in the survey. Information about community social capital and instrumental variables are taken from this book (Frankenberg & Thomas, 2000).

### Measures

Table 2 presents summary statistics for the key measures used in the analysis. A more detailed description of each of these measures follows.

### Child height-for-age and weight-for-age

Child health is measured by child height and weight-for-age (Fogel, 1994; Foster, 1995). Child weight is widely thought to be a more responsive measure of child health to shock in the very short-run (Foster, 1995). Meanwhile, child height has been viewed as a very useful summary indicator of child health which reflects all health events since birth (Martorell & Habicht, 1986). Child height will be strongly related to final adult height, which has been increasingly used as a useful summary indicator of health of a population (Fogel, 1994).

IFLS 2007 used data on height and weight measures for all household members collected by trained nurses. Since height and weight vary systematically with age and gender, we standardise children height and weight relative to sex- and age-specific height and weight medians of children in the United States (Nobles & Frankenberg, 2009; Strauss et al., 2004). For each child, a z-score is computed that expresses the child's height-for-age and weight-for-age as the number of standard deviations above or below the median for a child of that sex and age in the United States. As most Indonesian children are shorter and less heavy than the American

**Table 2**
Descriptive statistics of analytic sample.

|  | Percent | Mean | Median | S.D. | Range |
|---|---|---|---|---|---|
| Mother's social capital |  | 0.50 |  | 0.84 | 0–5 |
| **Children characteristics: (n = 4612)** |  |  |  |  |  |
| Height-for-age z score (median) |  |  |  |  |  |
| Boys |  |  | −1.60 | 1.32 | −4.99/4.25 |
| Girls |  |  | −1.70 | 1.39 | −4.79/4.97 |
| Weight-for-age z score (median) |  |  |  |  |  |
| Boys |  |  | −1.47 | 1.36 | −4.96/4.98 |
| Girls |  |  | −1.41 | 1.33 | −4.93/4.47 |
| Age |  | 5.9 |  | 2.5 | 2/10 |
| A boy | 52% |  |  | 50% |  |
| Birth weight (kg) |  | 3.18 |  | 0.32 | 1/5.5 |
| **Mothers characteristics: (n = 3450)** |  |  |  |  |  |
| Age |  | 33 |  | 7 | 17/60 |
| Completed primary education or less | 44% |  |  | 50% |  |
| Height (in cm) |  | 151 |  | 5 | 133/169 |
| Poor health | 3% |  |  | 5% |  |
| Household size |  | 5 |  | 2 | 2/14 |
| Kinship ties | 45% |  |  | 50% |  |
| Household below median per capita expenditure | 49% |  |  | 50% |  |
| **Community characteristics: (n = 309)** |  |  |  |  |  |
| Community social capital |  | 5 |  | 2 | 0/10 |
| Village head with graduate education or above | 41% |  |  | 49% |  |
| Average community per capita expenditure (IDR1000) |  | 428 |  | 1810 | 155/2000 |
| Total community population |  | 11,419 |  | 16,444 | 260/206,000 |
| Received underdeveloped village funds | 18% |  |  | 38% |  |
| Urban areas | 47% |  |  | 50% |  |
| **Instruments:** |  |  |  |  |  |
| Program dissemination | 74% |  |  | 55% |  |
| Number of neighbourhood association |  | 9 |  | 13 | 0/297 |
| Number of saving and borrowing institution |  | 1 |  | 1 | 0/6 |
| Presence of kinship groups | 8% |  |  | 28% |  |
| Ethnic similarity | 87% |  |  | 17% |  |

Source: IFLS 2007.

children, the median $z$-score for Indonesian children is negative. The median $z$-score for height is $-1.70$ for females and $-1.60$ for males, while the median $z$-score for weight is $-1.41$ for females and $-1.47$ for males.

### Mothers' social capital

Mothers' social capital is measured through their links in five key community activities: community meetings, cooperatives, voluntary labour, village upkeep, and women's associations. These community activities are commonly found in both urban and rural communities in Indonesia; their goals vary, and include improving healthcare, education, sanitation, financial support and community upkeep (Wibisana et al., 1999). Higher mothers' social capital is related to more access to the resources that reside in network ties in those activities.

IFLS 2007 asks respondents about their participation in these activities in the 12 months prior to the interview. Interviewers asked respondents: "During the last 12 months did you participate in or use these activities?" A list of activities is presented to respondents. This item has been validated and generally used in social capital study (for Indonesia see among others Beard, 2005, 2007; Miller et al. 2006; Nobles and Frankenberg, 2009). A continuous score was created that takes on a value between zero and five, which measures the number of activities in which mothers participate. Mothers' social capital is modest with about a half of mothers reporting that they participate at least in one programme in the last year.

### Control variables

Mother characteristics such as education, age, kinship ties, height and general health are included as control variables. To measure their level of education a dummy determinant indicating mother completing primary education or less is constructed; this accounted for about 44% of the sample. We create an indicator of whether mothers report having frequent person-to-person contact with their own mothers to measure kinship ties. Around a half of mothers say that they do.

Mothers' height and child birth weight are included as indicators for health endowment. A mother's height captures many aspects of her background, including health behaviours and genetic predisposition that may be related to child health (Kuh & Wadsworth, 1989). Child birth weight captures the health condition of the child during pregnancy, which has been shown to have a strong relationship with a child's physical development (Conley, Bennet, & Strully, 2003). The mean of the mothers' height and the children's birth weight is 151 cm and 3.2 kg respectively. We include a control for whether mothers are in good health and poor health. All respondents in the sample report on self-rated health which predicts chronic disease in many settings, including Indonesia (Frankenberg & Jones, 2004). This information is elicited by the question: "In general, would you say that your health is very healthy, sufficiently healthy, less than healthy, and unhealthy?" The first two categories are combined to be good health, while the last two categories are combined to be poor health. Three percent of mothers report having poor health.

Household controls include household size and household with below median per capita expenditure. Household size is included to address the issue that women with more household members may have less time to participate in community programmes or otherwise acquire social capital. Household size is relatively large, with an average of five to six members per household. Household with below median per capita expenditure is used to control whether household financial resources affect mother's social

capital. We prefer to use monthly per capita household expenditure rather than income to capture household financial resources: in developing countries such as Indonesia, it is not income but expenditure measured from consumption that more accurately captures levels of long-term economic resources (Deaton & Zaidi, 2002). The authors further explain that formal employment is less common in developing country, many households have multiple and continually changing sources of income and home production is more widespread. In these contexts, income data is less accurate than consumption data to measure financial resources. Since the price levels of consumer goods and services in Indonesia vary across rural and urban regions (Strauss et al., 2004), the household expenditure figures were deflated with the consumer price index for urban and rural regions. Rural inflation is taken to be 5% higher than urban inflation (Resosudarmo & Jotso, 2009). This calculation produces real household expenditure adjusted with urban and rural inflation. The Consumer Prices Index 2006 data are retrieved from the government central bureau of statistics. The average real household expenditure in 2007 was IDR575,000 (US$57,5). About 49% of households are living below median per capita expenditure.

Community control variables include community social capital, community per capita expenditure, community leadership capacity, community receipt of underdeveloped village funds, community population and urban status. IFLS 2007 provides information about various community activities, i.e. village cooperatives, youth groups, religious activities, family groups and neighbourhood security groups, which were conducted on a routine basis. Aggregate number of those activities per each community is calculated to measure community social capital. To control for the effect of community wealth we include community per capita expenditure, the average being IDR428,000 (US$42,8). Village heads with graduate education and above is included to control whether community leadership capacity affects child health. The level of community receipt of undeveloped village funds captures many aspects of village social, economic and political conditions in Indonesia including poverty and low institutional capacity. The model also includes community population and urban/rural status; the proportion of respondents living in rural and urban areas was relatively balanced.

### Instrumental variables

Instruments are elicited not from the mothers but from independent informants in community facilities information books (Frankenberg & Thomas, 2000). This enhances accuracy or at least reduces measurement error. The use of instrumental variables data from separated sources also alleviates concerns arising from the use of aggregate of individual and household variables using same sources in the estimation (Deaton, 2001).

Five instruments are used in the analysis. Firstly, social and financial associations that facilitate social interaction feature prominently in the day-to-day activities of Indonesians (Beard, 2005; Geertz, 1962; Grootaert, 1999). They include neighbourhood associations, self-help groups, and saving and borrowing institutions. In Indonesia, they are more than mere economic institutions. These institutions also function to strengthen the solidarity of the community (Beard, 2005; Grootaert, 1999). Likewise, neighbourhood associations and self-help groups (*rukun warga*) facilitate people within the neighbourhood to carry out such cooperation and joint activities. The function of *rukun warga* in the daily life of Indonesians is important as the present media for meeting together and for strengthening solidarity among neighbourhood members, including mothers (Koentjaraningrat, 1961). Thus we expect that mother's social

capital is likely to increase in communities which have more of these kinds of financial and social institutions. The presence of these associations, however, is not affected directly by child health, nor do they affect child health directly except through mother's social capital.

Secondly, we turn to dissemination of information about community activities. Lack of access to information is well-documented as an important factor causing low participation of women and men in community programmes across developing countries (World Bank, 2004). This is important, particularly in rural Indonesia, since women in those areas often lack access to information about community programmes. Hence whether local community volunteers inform mothers about the programmes is likely to motivate them to attend and to engage within such activities. For example, mother participation in community women association (*perkumpulan wanita*) is higher when local community volunteers regularly disseminate information about the programmes (Wibisana et al., 1999). Likewise, mothers are likely to engage within cooperatives when they are informed the benefits of such activities for improving their family well-being (i.e. provide cheap financial credit). There is also no reason to assume that dissemination of information about community programmes will directly affect children's health, except through mothers participating.

Thirdly, ethnic similarity and presence of kinship groups are assumed directly correlated with mothers' social capital. The ethnographic literature on Indonesia suggests that ethnic customs and languages have an important role in shaping community activities or social groups (Bowen, 1986; Geertz, 1962; Koentjaraningrat, 1961). Individuals within the same ethnic groups are more likely to interact in social settings, due to similarities of custom or language. For example, in Javanese ethnic regions women and men engagement in village labour (*kerja bakti*) and community meeting (*pertemuan masyarakat*) is bonded within traditional custom namely *sambatan* and *rukun* (Koentjaraningrat, 1961). Such ethnic custom also exists throughout the archipelago; and they are known in each ethnic by a local name (i.e. *subak* in Bali, *pangalo* in Aceh, *paralek* and *bangalek* in eastern Kalimantan, *mapalus* in northern Sulawesi and so on) (Bowen, 1986; Davidson & Henley, 2007). Hence, the possibility for mothers to join and be active in community programmes may increase due to higher ethnic similarity and the presence of kinship groups: mothers living in communities that have both are likely to participate more or have more social capital. We have no reason to assume that ethnic similarity and the presence of kinship groups have a direct effect on child health except through mothers' participation.

*Instrumental variable estimates*

Our empirical model of child health can be represented by the following estimation equation:

$$H_{ij} = \beta_0 + C_j\beta_1 + X_{ij}\beta_2 + SC_{ij}\gamma + \varepsilon_{ij}$$

Where the subscript $i$ stands for the individual, the subscript $j$ for the community; $C_j$ is a vector of explanatory variables at community, $X_{ij}$ is vector of explanatory variables at individual, $SC_{ij}$ are mother social capital indicator defined at the individual, $\varepsilon_{ij}$ is the disturbance term, and $H_{ij}$ is child height and weight for age. Standard OLS estimates of the coefficient associated with $SC_{ij}$ yield unbiased results if $E(SC_{ij}\varepsilon_{ij}) = 0$ holds. However, Durlauf and Fafchamps (2005) explain that the orthogonally condition could fail due to reverse causality. To address this problem, we use instrumental variable estimates (Baum, 2006). The validity of the instrumental variable results will depend on the admissibility of the exclusion restrictions. Therefore, we need to identify variables that satisfy the two necessary conditions for instrument validity. First, they must be both strongly correlated with mother social capital ('relevance condition') and orthogonal to the disturbance term of the child health equation ('orthogonality' condition) (D'Hombres, Rocco, Suhrcke, & McKee, 2010).

Instrumental variable estimates also mitigate bias which arises if unobserved mother's characteristics affect both her social capital and her child health. For instance, some evidence suggests that people who participate in voluntary community programmes are advantaged with respect to otherwise unobserved socio-economic status (Schady, 2001; Thoits & Hewitt, 2001). If we fail to control for these factors and they are also positively related to child health, as is almost certainly the case, regression results will bias the contribution of social capital. To address this issue, we identify variables related to mothers' social capital and control for these in the first stage regression. A number of individual, household and community predictors, including the instruments associated with mothers' social capital, are included in the regression.

## Results

*Mothers' social capital and child health*

We begin by presenting bivariate correlation of mother's social capital, community social capital and instrumental variables in Table 3. Mothers' social capital and community social capital are positively associated with child health. All instruments are significantly associated with mothers' social capital.

**Table 3**
Bivariate correlation of selected variables.

| | Child height for age | Child weight for age | Mothers' social capital | Community social capital | Program dissemination | Presence of kinship groups | Number of saving and borrowing institution | Ethnic similarity | Number of neighbourhood association |
|---|---|---|---|---|---|---|---|---|---|
| Child height for age | 1.00 | | | | | | | | |
| Child weight for age | 0.66*** | 1.00 | | | | | | | |
| Mothers' social capital | 0.04** | 0.08** | 1.00 | | | | | | |
| Community social capital | 0.05*** | 0.09*** | 0.12*** | 1.00 | | | | | |
| Program dissemination | 0.11*** | 0.11*** | 0.37*** | 0.13*** | 1.00 | | | | |
| Presence of kinship groups | 0.04** | 0.04*** | 0.05*** | 0.08*** | 0.05 | 1.00 | | | |
| Number of saving and borrowing institution | 0.12*** | 0.12*** | 0.15*** | 0.35*** | 0.17*** | 0.00 | 1.00 | | |
| Ethnic similarity | 0.08*** | 0.07*** | 0.07*** | 0.00 | 0.04 | 0.00 | 0.10*** | 1.00 | |
| Number of neighbourhood association | 0.04** | 0.04** | 0.08*** | 0.02 | 0.04 | 0.05*** | 0.15*** | −0.03 | 1.00 |

**p < 0.05; ***p < 0.001.
Source: IFLS 2007.

Table 4 presents the results of OLS and IV (second stage) for the relationship between mother's social capital and child health. The estimated effect of mother's social capital in IV is substantially larger than in the OLS estimates and is strongly statistically significant. One standard deviation increase in mother's social capital is associated with an increase in the initial height-for-age by nearly 18% and weight-for-age by 15%.

The effect of children, mothers, household and community characteristics show expected results. Mothers' height and child birth weight which capture health endowment are significantly associated with child health. The importance of mothers' health status for their children health is shown from the significance of mothers' health endowment and self-rated health (Frankenberg & Jones, 2004; Kuh & Wadsworth, 1989). Children whose mothers are educated only up to the end of primary school are less healthy than those with more educated mothers. These confirm the results found by Thomas (1997) in developed and developing countries. Likewise, children living in poor households (as measured by household below median expenditure) are less healthy than children from better-off households. The detrimental effect of poverty on child health in both developed and developing countries has also been well-documented in prior studies (Aber, Bennet, Conley, & Li, 1997).

Controlling for household resources, community per capita expenditure is strongly related to child health. A negative association is shown between indicators of community underdevelopment (i.e. in receipt underdeveloped funds) and child health. This evidence reflects the fact that children living in poor communities are more disadvantaged with respect to their health compared to those living in better-off communities (Nobles & Frankenberg, 2009). Furthermore, living in urban areas increases children health, due to the existence of better public health services in urban areas. The number of community activities or community social capital increases child health but it is only significant for child weight. Community leadership seems not to matter for child health.

## Mothers' social capital and child health: two-way causality?

Table 5 shows results of the first stage regression. All instruments are highly correlated with mothers' social capital. Tests of instrument strength and relevance (Hansen, Lagrange multipliers, Wald, Kleibergen–Paap statistics) reveal their usefulness in identifying the effects of mothers' social capital. The Hansen test of over-identifying restrictions does not lead one to reject the orthogonality of our instrument set with respect to the disturbance term with $p$-values greater than 0.64. The weakness of the set of instruments is rejected with a $p$-value lower than 0.001. $F$-statistics, testing the hypothesis that the coefficient on the excluded instruments are all zero in each first-stage estimate, are well above the threshold of 10 indicated by Staiger and Stock (1997) as the rule of thumb criterion of instrument weakness. Taken together with the non-rejection of the test of over-identification, this suggests that our set of instruments is reasonable. We also tested the robustness of our results by estimating the model with different sets of instruments. The results were very similar to the results described in this paper (see Supplementary data online).

The coefficient estimates of instruments show that dissemination of information about community activities and kinship groups are strongly associated with mother's social capital. The magnitude effect of kinship groups is the largest, at 23%. Mothers living in communities with higher numbers of neighbourhood associations have more social capital than those living in less well-endowed neighbourhoods. Likewise, mothers' social capital is positively associated with the number of social and informal financial institutions in their community. We expect the higher percentage of ethnic similarity to be related to mothers' social capital, and the expectation is confirmed. Community social capital in the form of community activities provides more mothers' social capital. The magnitude of this effect indicates that one standard deviation increase (measured at the community level) in the number of community activities is associated with an increase in mothers' social capital by 2–3%.

**Table 4**
Mothers' social capital and child health, second stage regression.

| | OLS | | | | IV | | | |
|---|---|---|---|---|---|---|---|---|
| | Height for age | | Weight for age | | Height for age | | Weight for age | |
| | Coef. | se | Coef. | se | Coef. | se | Coef. | se |
| Mother's social capital | 0.023** | 0.022 | 0.051** | 0.023 | 0.179*** | 0.069 | 0.147** | 0.071 |
| Community social capital | 0.019* | 0.010 | 0.026** | 0.010 | 0.014 | 0.013 | 0.043** | 0.017 |
| **Children characteristics: ($n = 4612$)** | | | | | | | | |
| Age | −0.139*** | 0.008 | −0.065*** | 0.008 | −0.141*** | 0.008 | −0.067*** | 0.008 |
| A boy | −0.075 | 0.036 | −0.003 | 0.037 | −0.064 | 0.036 | −0.002 | 0.036 |
| Birth weight (kg) | 0.227*** | 0.055 | 0.303*** | 0.057 | 0.248*** | 0.056 | 0.267*** | 0.061 |
| **Mothers characteristics: ($n = 3450$)** | | | | | | | | |
| Age | 0.000 | 0.003 | 0.010*** | 0.003 | 0.000 | 0.003 | 0.008*** | 0.003 |
| Completed primary education or less | −0.207*** | 0.039 | −0.171*** | 0.041 | −0.178*** | 0.047 | −0.152*** | 0.05 |
| Height (cm) | 0.058*** | 0.004 | 0.046*** | 0.004 | 0.058*** | 0.004 | 0.046*** | 0.004 |
| Poor health | −0.066 | 0.325 | −0.470 | 0.339 | −0.107 | 0.433 | −0.508*** | 0.176 |
| Household size | −0.025** | 0.011 | −0.021* | 0.011 | −0.024** | 0.012 | −0.018 | 0.012 |
| Kinship ties | −0.098** | 0.038 | −0.076* | 0.039 | −0.097** | 0.042 | −0.071 | 0.044 |
| Household below median per capita expenditure | −0.228*** | 0.042 | −0.272*** | 0.043 | −0.206*** | 0.047 | −0.266*** | 0.05 |
| **Community characteristics: ($n = 309$)** | | | | | | | | |
| Log average community per capita expenditure | 0.389*** | 0.064 | 0.358*** | 0.066 | 0.375*** | 0.075 | 0.336*** | 0.094 |
| Log total community population | 0.042* | 0.025 | 0.017 | 0.026 | 0.047 | 0.03 | 0.011 | 0.031 |
| Received underdeveloped village funds | −0.124** | 0.048 | −0.156** | 0.050 | −0.133** | 0.067 | −0.170** | 0.088 |
| Village head with graduate education or above | −0.021 | 0.040 | −0.028 | 0.042 | 0.03 | 0.053 | 0.022 | 0.058 |
| Urban areas | 0.177** | 0.045 | 0.141** | 0.047 | 0.172*** | 0.054 | 0.151** | 0.066 |
| Constant | −16.449*** | 1.197 | −15.199*** | 1.247 | −16.284*** | 1.352 | −14.664*** | 1.64 |
| $R^2$ | 21% | | 14% | | 19% | | 13% | |

*$p < 0.10$; **$p < 0.05$; ***$p < 0.001$.
Source: IFLS 2007.

**Table 5**
Mothers' social capital and child health, first stage regression.

|  | OLS | | IV | |
| --- | --- | --- | --- | --- |
|  | Coef. | se | Coef. | se |
| **Child characteristics:** | | | | |
| (**n** = 4612) | | | | |
| Age | 0.017*** | 0.005 | 0.016*** | 0.005 |
| A boy | −0.051** | 0.023 | −0.051** | 0.023 |
| Birth weight (kg) | 0.036 | 0.035 | 0.035 | 0.035 |
| **Mothers characteristics:** | | | | |
| (**n** = 4612) | | | | |
| Age | 0.007*** | 0.002 | 0.008*** | 0.002 |
| Completed primary education or less | −0.065** | 0.025 | −0.068** | 0.035 |
| Height (cm) | −0.002 | 0.002 | −0.002 | 0.003 |
| Poor health | 0.298 | 0.205 | 0.301 | 0.389 |
| Household size | 0.009 | 0.007 | 0.010 | 0.010 |
| Kinship ties | −0.021 | 0.024 | −0.021 | 0.030 |
| Household below median per capita expenditure | −0.120*** | 0.026 | −0.119*** | 0.031 |
| **Community characteristics:** | | | | |
| (**n** = 309) | | | | |
| Community social capital | 0.029** | 0.006 | 0.028** | 0.014 |
| Log average community per capita expenditure | 0.056 | 0.042 | 0.06 | 0.080 |
| Log total community population | −0.056** | 0.016 | −0.057** | 0.033 |
| Received underdeveloped village funds | −0.027 | 0.031 | −0.034 | 0.062 |
| Village head with graduate education or above | 0.080** | 0.026 | 0.088 | 0.057 |
| Urban areas | 0.011 | 0.030 | 0.007 | 0.057 |
| **Instruments:** | | | | |
| Program dissemination | 0.193*** | 0.008 | 0.193*** | 0.012 |
| Number of neighbourhood association | 0.004*** | 0.001 | 0.004*** | 0.001 |
| Ethnic similarity | 0.003** | 0.001 | 0.004** | 0.001 |
| Number of saving and borrowing institutions | 0.037** | 0.010 | 0.038** | 0.023 |
| Presence of kinship groups | 0.253** | 0.043 | 0.227** | 0.120 |
| Constant | −1.114 | 0.806 | −1.209 | 1.500 |
| Kleibergen−Paap LM stats (under id) | | | 117.962 | |
| LM p value | | | 0.000 | |
| Hansen's J | | | 2.526 | |
| J p value | | | 0.64 | |
| Cragg−Donald Wald F stats (weak id) | | | 144.388 | |

*$p < 0.10$; **$p < 0.05$; ***$p < 0.001$.
Source: IFLS 2007.

Mothers' education and age as well as the age of their children are significantly associated with social capital. Mothers who have completed primary education or less have less social capital than those with a higher level of education. Mothers with older children are likely to have more social capital than those with younger children. They who have a boy are likely to have lower social capital than those who have a girl. However, there is no evidence that other characteristics (such as the mothers' height, general health, and kinship ties) are associated with mother's social capital.

Living in a household with below median per capita expenditure decreases mother's social capital. Living in a denser population also decreases social capital. Mothers living in richer communities are likely to have more social capital than those living in poor communities. They who living in community which received community underdeveloped programme has lower social capital. However, the association between both variables and mothers' social capital is not significant.

## Discussion

The study aims to examine the association between mothers' social capital and their children's health in Indonesia. It improves a number of methodological points in earlier literature. Using instrumental variable estimates, this study mitigates reverse causality between mother's social capital and her children's health. Moreover, we examine not only individual social capital but also community social capital. By analysing both types of social capital we are able to examine their effect on child health from both the supply and the demand sides. Furthermore, it uses height- and weight-for age to measure child health. This means we are able to examine the effect of mothers' social capital not only on the long-term measure but also on the short-term measure of child health (Fogel, 1994; Foster, 1995).

The main results show that mother's social capital is positively and significantly associated with children's health. These results being true with least squares estimators as well as when relying on instrumental variable estimators. All instruments are highly correlated with mother's social capital; tests of their strength and relevance also reveal their usefulness to mitigate bias estimate of the relationship between mother's social capital and child health.

Community social capital in the form of active community activities also improves child health particularly for child weight-for-age. The null findings for child height but significant findings for child weight may signal the benefits of community social capital for buffering children from health shocks as child weight is widely thought to be a more responsive measure of child health to shock in the short-run (Foster, 1995). Community social capital matters in terms of buffering community members (including women and children) from health shocks such as those incurred by economic crisis and natural disaster (Putnam, 1995) (and the latter did occur in Indonesia during the period of the IFLS survey). The fact that a child living in a community with denser community activities is likely to have better health status may signal the benefit of these groups for buffering children well-being from such shocks.

The significant association of instruments explains channels for mother's social capital improvement. These findings relate to prior explanations where social and financial associations have an important function to strengthen solidarity among community members (Beard, 2005; Grootaert, 1999). Within these associations, mothers can get to health services as well as access knowledge and information, all of which provide benefits for their children. In addition, the significant relation between the dissemination of information and mothers' social capital signals those activities are vital for Indonesia, a country where access to information or community programmes is very limited due to geographic remoteness. Lack of access to information is also widely documented as being one of the most important factors causing lower participation of women and men in community programmes in many developing countries (World Bank, 2004).

This study leaves a number of limitations needing to be addressed, some of which may be dealt with in future research. We are unable to control for all unobservable features of communities that might simultaneously generate relatively high levels of mothers' social capital and better child health. We try to include a number of socio-demographic characteristics within a community that potentially affect child health. However, unobservable features (such as climate or language across communities) might drive both a women's choice to get involved in community activities and also have an effect on her child's health. Moreover, this study examines lack of specific measures of trust, social support, and what community activities mean to the women in the sample. The IFLS 2007 data is rich in many ways, but is not specifically geared towards measuring those features of social networks that matter for children well-being.

Despite these limitations, the findings have important implications, both for the literature and for the practices of development in developing countries. Firstly, recent works on public health and

epidemiology in developed countries find that social capital predominantly improves adult health and well-being (Farquhar, Yvonne, & Wiggins, 2005; Subramanian, Kim, & Kawachi, 2002). The empirical results of this study confirm the validity of the positive effect of social capital on child health formation in the context of a developing country, thus demonstrating that the potential benefits of social capital are not limited to developed countries. Secondly, the types of community activities examined in this study are found not only in Indonesia: similar activities are widespread in other developing countries. Thus, Narayan and Pritchett (1999) illustrate how such activities help to improve household welfare in rural Tanzania, while Grootaert and Bastelaar (2002) codify the important roles these types of activities hold in enhancing development across developing countries from Cambodia, India, Bangladesh, Madagaskar, Kenya and South Africa. However, very few studies have examined the effect of community activities on child health. This study suggests that such activities are not only beneficial for household economy, but also for other aspects of citizens' well-being. Thirdly, the fact that mother's social capital largely benefits children's health in developing countries suggests that enhancing this capital through enlarging community activities, specifically those that facilitate mother's access to health information and programme, may provide a channel for reducing disparities in child health and well-being in those countries. Lastly, because child health status has been shown to be related with health and well-being in later life (Barker & Osmand, 1986), this type of social capital may provide another way to reduce intergenerational socio-economic inequality in health.

## Appendix A. Supplementary data

Supplementary data related to this article can be found at http://dx.doi.org/10.1016/j.socscimed.2013.04.032.

## References

Aber, J., Bennet, N., Conley, D., & Li, J. (1997). The effects of poverty on child health and development. *Annual Review of Public Health, 18*(1), 463–483.

Anderson, A., & Damio, G. (2004). Social capital, acculturation, and breastfeeding initiation among Puerto Rica women in the United States. *Journal of Human Lactation, 20*(1), 1–21.

Barker, D. J., & Osmand, C. (1986). Infant mortality, childhood nutrition, and ischaemic heart disease in England and Wales. *Lancet, 1*(311), 1077–1081.

Baum, C. F. (2006). *An introduction to modern econometrics using Stata*. Texas: Stata Press.

Bayer, P., Ross, S., & Topa, G. (2005). *Place of work and place of residence: Informal hiring networks and labor market outcomes*. NBER Working Paper 11019. USA.

Beard, V. (2005). Individual determinants of participation in community development in Indonesia. *Environment and Planning C: Government and Policy, 23*(1), 21–39.

Beard, V. (2007). Household contributions to community development in Indonesia. *World Development, 35*(4), 607–625.

Bowen, J. (1986). On the political construction of tradition: *gotong royong* in Indonesia. *The Journal of Asian Studies, 45*(3), 545–561.

Buckler, J. (1997). A reference manual of growth and development. In C. Kelnar (Ed.), *Growth disorder*. Oxford: Blackwell Scientific Publications.

Conley, D., Bennet, N., & Strully, K. (2003). *The starting gate: Birth weight and life chances*. Berkeley: University of California Press.

Cutrona, C., & Russell, D. (2000). Direct and moderating effects of community context on the psychological well-being of African American women. *Journal of Personality and Social Psychology, 79*(6), 1088–1101.

Davidson, S., & Henley, D. (2007). *The revival of tradition in Indonesian politics*. New York: Routhledge.

Deaton, A. (2001). *Health, inequality, and economic development*. National Bureau of Economic Research Working Paper No 8318. USA.

Deaton, A., & Zaidi, S. (2002). *Guidelines for constructing consumption aggregates for welfare analysis*. Washington, DC: World Bank.

De Silva, M., & Harpham, T. (2007). Maternal social capital and child nutritional status in four developing countries. *Health and Place, 13*(2), 341–355.

D'Hombres, B., Rocco, L., Suhrcke, M., & McKee, M. (2010). Does social capital determine health? Evidence from eight transition countries. *Health Economics, 19*(1), 56–74.

Durlauf, S., & Fafchamps, M. (2005). Social capital. In S. Durlauf, & P. Aghion (Eds.). *Handbook of economic growth*, Vol. IB, . Amsterdam: North Holland.

Farquhar, S., Yvonne, L., & Wiggins, S. (2005). Building on leadership and social capital to create change in urban communities. *American Journal of Public Health, 95*(4), 596–601.

Fogel, R. (1994). Economic growth, population theory and physiology: the bearing of long-term processes on the making of economic policy. *American Economic Review, 84*(3), 369–395.

Foster, A. (1995). Rice prices, credit markets and child growth in rural Bangladesh. *Economic Journal, 105*(430), 551–570.

Frankenberg, E., & Jones, N. (2004). Self-rated health and mortality: does the relationship extend to a low income setting? *Journal of Health and Social Behavior, 45*(4), 441–452.

Frankenberg, E., & Thomas, D. (2000). *The Indonesia Family Life Survey (IFLS): Study design and results from waves 1 and 2 DRU-1195 DRU2238/1NIA/NICHD*. Santa Monica: RAND.

Geertz, C. (1962). The rotating credit association: a "middle rung" in development. *Economic Development and Cultural Change, 10*(3), 241–263.

Grootaert, C. (1999). *Social capital, household welfare, and poverty in Indonesia*. World Bank Policy Research Working Paper Number 2148. Washington, DC: World Bank.

Grootaert, C., & Bastelaar, V. (2002). *Understanding and measuring social capital*. Washington, DC: World Bank.

Hendry, D. (1995). *Dynamic econometrics*. New York: Oxford University Press.

Kawachi, I., & Berkman, L. (2000). Social cohesion, social capital, and health. In L. F. Berkman, & I. Kawachi (Eds.), *Social epidemiology*. New York: Oxford University Press.

Kawachi, I., Subramanian, S. V., & Kim, D. (2008). Social capital and health. A decade of progress and beyond. In I. Kawachi, S. V. Subramanian, & D. Kim (Eds.), *Social capital and health*. New York: Springer.

Koentjaraningrat. (1961). *Some social anthropological observations on gotong royong practices in two villages of central Java*. Ithaca, NY: Cornell University Press.

Kuh, D., & Wadsworth, M. (1989). Parental height: childhood environment and subsequent adult height in a national birth cohort. *International Journal of Epidemiology, 18*(3), 663–668.

Lederman, D., Loayza, N., & Menendez, A. (2002). Violent crime: does social capital matter? *Economic Development and Cultural Change, 50*(3), 509–539.

Lindenauer, P., Pekow, P., Lahti, M., Lee, Y., Benjamin, E., & Rothberg, M. (2010). Association of corticosteroid dose and route of administration with risk of treatment failure in acute exacerbation of chronic obstructive pulmonary disease. *Journal of the American Medical Association, 303*(23), 2359–2367.

Lu-Yao, G., Albertsen, P., Moore, D., Shih, W., Lin, Y., DiPaola, R., et al. (2008). Survival following primary androgen deprivation therapy among men with localized prostate cancer. *Journal of the American Medical Association, 300*(2), 173–181.

Macinko, J., & Starfield, B. (2001). The utility of social capital in research on health determinants. *Milbank Quarterly, 79*(3), 387–427.

Marmot, M. (2010). *Fair society, healthy lives: A strategic review of health inequalities in England post-2010*. London: University College London.

Martin, K., & Rogers, B. (2004). Social capital is associated with decreased risk of hunger. *Social Science & Medicine, 58*(12), 2645–2654.

Martorell, R., & Habicht, J. (1986). Growth in early childhood in developing countries. In F. Falkner, & J. Tanner (Eds.), *Human growth: A comprehensive treatise*. New York: Plenum Press.

Miller, D., Schiffer, R., Lam, S., & Rosenberg, R. (2006). Social capital and health in Indonesia. *World Development, 34*(6), 1084–1098.

Narayan, D., & Pritchett, L. (1999). Cents and sociability: household income and social capital in rural Tanzania. *Economic Development and Cultural Change, 47*(4), 871–897.

Nobles, J., & Frankenberg, E. (2009). Mothers community participation and child health. *Journal of Health and Social Behavior, 50*(1), 16–30.

Portes, A. (1998). Social capital: its origins and applications in modern sociology. *Annual Review of Sociology, 24*(1), 1–24.

Putnam, R. (1995). *Bowling alone: The collapse and revival of American community*. New York: Simon and Schuster.

Resosudarmo, B., & Jotzo, F. (2009). *Working with nature against poverty: Development, resources, and the environment in Eastern Indonesia*. Singapore: ISEAS.

Rogol, A., Clark, P., & Roemmich, J. (2000). Growth and pubertal development in children and adolescents: effects of diet and physical activity. *The American Journal of Clinical Nutrition, 72*(1), 521S–528S.

Schady, N. (2001). *Who participates? The supply of volunteer labour and the distribution of government programs in rural Peru*. World Bank Policy Research 2671. Washington, DC: World Bank.

Shiffman, J. (2002). The construction of community participation: village family planning groups and the Indonesian state. *Social Science & Medicine, 54*(8), 1199–1214.

Staiger, D., & Stock, J. H. (1997). Instrumental variables regression with weak instruments. *Econometrica, 65*(1), 557–586.

Strauss, J., Beegle, K., Sikoki, B., Dwiyanto, A., Herawati, Y., & Witoelar, F. (2004). *The third wave of the Indonesia Family Life Survey (IFLS): Overview and field report*. WR144/1NIA/NICHD. Santa Monica: RAND.

Stukel, T., Fisher, E., Wennberg, D., Alter, D., Gottlieb, D., & Vermeulen, M. (2007). Analysis of observational studies in the presence of treatment selection bias: effects of invasive cardiac management on AMI survival using propensity score and instrumental variable methods. *Journal of the American Medical Association, 297*(3), 278–285.

Subramanian, S., Kim, D., & Kawachi, I. (2002). Social trust and self-rated health in US communities: a multilevel analysis. *Journal of Urban Health, 79*(4), S21–S34.

Thoits, P., & Hewitt, L. (2001). Volunteer work and well-being. *Journal of Health and Social Behavior, 42*(2), 115–131.

Thomas, D., & Strauss, J. (1997). Health and wages: evidence on men and women in urban Brazil. *Journal of Econometrics, 77*(1), 159–185.

Thomas, D., Witoelar, F., Frankenberg, E., Sikoki, B., Strauss, J., Sumantri, C., et al. (2012). Cutting the costs of attrition: results from the Indonesia Family Life Survey. *Journal of Development Economics, 98*(1), 108–123.

Tuan, T., Harpham, T., & De Silva, M. (2006). Maternal social capital and child health in Vietnam. *Journal of Epidemiology & Community Health, 60*(1), 865–871.

Wibisana, W., Trihono, T., & Nurwati, S. (1999). *Community participation in health development: Indonesian experience*. Jakarta: Indonesia Ministry of Health.

World Bank. (2004). *Making services work for poor people*. Washington, DC: World Bank.

World Bank. (2008). *Investing in Indonesia's health: Challenges and opportunities for future public spending*. Washington, DC: World Bank.

World Bank. (2012). *World development indicator 2012*. Washington, DC: World Bank.