



# Does social capital influence community health worker knowledge, attitude and practices towards COVID-19? Findings from a cross-sectional study in Malang district, Indonesia

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## ABSTRACT

Community health workers (CHWs) are the first point of contact with the primary health care system in many low- and middle-income countries and are situated to play a critical role in the public health response to the COVID-19 pandemic. The knowledge, attitude and practices of CHWs regarding COVID-19 may be influenced by their level of trust and participation in the community, collectively defined as their level of social capital. To assess whether social capital influences CHWs' knowledge, attitude and practices related to COVID-19, we conducted a web-based survey of CHWs (n = 478) in Malang district, Indonesia between October 2020 and January 2021. CHW social capital was measured using the Shortened Adapted Social Capital Assessment Tool. Multiple logistic regression results show that cognitive social capital was associated with higher self-reported knowledge of COVID-19, more confidence in answering COVID-related questions from the community and feeling safe from COVID-19 when working. Membership of community organisations was associated with a higher number of COVID-related tasks conducted. Thus, CHWs in Malang district with higher levels of cognitive social capital were more likely to be confident in their knowledge and ability to respond to COVID-19, and CHWs embedded in their community were more likely to be engaged in pandemic response duties. Our findings suggest that policies aimed at promoting CHW embeddedness, targeted recruitment and addressing training needs hold promise in strengthening the positive contribution of the community health workforce to the COVID-19 response.

## 1. Introduction

Community health workers (CHWs) possess a range of attributes that make them an important component of the primary health care response to the COVID-19 pandemic (Ballard et al., 2020; Bhaumik et al., 2020; Peretz et al., 2020; Rahman et al., 2021; World Health Organization & UNICEF, 2021). Globally, CHWs are often the first point of contact with the primary health care system for vulnerable, remote, and marginalized communities (WHO, 2018). Additionally, they are directly connected to the communities they serve – they live in them and are accountable to them – and are entrusted to provide culturally and contextually appropriate health services (Schneider et al., 2016; K.; Scott, Beckham, Gross, & et al., 2018a, 2018b). Beyond this linking role, CHWs can also act as

cultural brokers and social change agents in diverse socio-political environments (Maes, 2015; Schaaf et al., 2020). Evidence shows how these characteristics can be successfully leveraged to support the positive contribution of CHWs as part of the health system response to infectious disease outbreaks, including COVID-19 (Boyce & Katz, 2019; Kawee-nuttayanon et al., 2021).

### 1.1. Literature review

A growing body of research draws on the notion of social capital to conceptualise this unique position of CHWs between communities and the formal health system (Adams, 2020; Kane et al., 2021; Mohajer & Singh, 2018; Schaaf et al., 2020). Social capital is a multi-dimensional

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concept that generally refers to “the features of social organization, such as civic participation, norms of reciprocity, and trust in others, that facilitate cooperation for mutual benefit” (Szreter & Woolcock, 2004). It is commonly disaggregated into two components: structural and cognitive (Grootaert & Van Basterlaer, 2002). The former includes the extent and intensity of one’s links to community groups, and the latter covers perceptions of support, reciprocity, sharing and trust. Although some variations exist in how social capital is conceptualised and measured, it is well accepted that social capital is an important determinant of health and well-being (Agampodi et al., 2015; Rodgers et al., 2019; Shiell et al., 2020).

There is a clear overlap between the dimensions of social capital and the factors that influence CHW performance. Community values such as civic participation, reciprocity and trust are commonly recognised as important motivations for CHWs (Kok et al., 2014; Kerry Scott et al., 2018a, 2018b; WHO, 2018). Yet, beyond this, social capital may play a critical role in legitimising CHWs in the eyes of the community they serve, and allow them to act than more as a mere extension of the formal health, but as a respected and trusted local change agent (Kane et al., 2021; Schaaf et al., 2020). Recent evidence demonstrates that, in India, CHWs intentionally establish strong local networks as a means to accumulate social capital and enhance their legitimacy and credibility (Kane et al., 2021).

Conversely, high levels of social capital can also have downsides for CHWs. In some contexts, a high level of familiarity between community members and CHWs has been shown to undermine trust, raise concerns about patient confidentiality and deter care seeking (Geldsetzer et al., 2017; Grant et al., 2017). Other downsides of social capital include greater stress on individuals to support others in their network and the risk of ‘behavioural contagion’, whereby influential individuals spread misinformation or damaging health behaviours (Villalonga-Olives & Kawachi, 2017).

Social capital has also been linked to how well communities respond to pandemics. Growing evidence suggests that places with high social capital respond better to infectious disease outbreaks (Chuang et al., 2015; Rönnerstrand, 2014; Vinck et al., 2019). Since the onset of the COVID-19 pandemic, a number of studies have shown that social capital can explain why some locations are documenting higher caseloads of COVID-19 infections than others (Bartscher et al., 2020; Borgonovi & Andrieu, 2020; Ding et al., 2020). However, these studies have considered the association between social capital and the response to COVID-19 within a geographically defined population, such as the county or state. To understand the potential of CHWs to contribute to COVID-19 response effort requires analysis at the individual level of how social capital and CHW knowledge, attitude and practices are related.

## 1.2. Social capital and COVID-19 in Indonesia

Indonesia has been at the forefront of social capital research in large part due to the Indonesia Family Life Survey, a large-scale ongoing longitudinal household and community survey of living conditions conducted since 1993. Studies have used the survey to examine the relationship between social capital and healthy ageing, mental health, maternal health and child health (Miller et al., 2006; Saint Onge et al., 2018; Sujarwoto & Tampubolon, 2013). Indonesia is also home to one of the largest and longest-standing CHW programs globally, yet the social capital of CHWs (known as *kaders* in Indonesia) has not been previously studied despite their important role in service provision at the primary health care level (World Bank Group, 2018).

By March 2021 Indonesia had the greatest number of COVID-19 cases and highest case fatality rate in Southeast Asia (Sasongko, 2021). In Malang district, East Java, *kaders* have been mobilised to contribute to the COVID-19 response through promoting community awareness of the virus, including transmission channels, prevention and protection measures, while maintaining the provision of essential maternal and child health services. However, it is unknown whether *kaders* have received specific COVID-19 training and whether they are willing to work with heightened safety risks.

The pandemic has highlighted the importance of whole-of-society responses in the containment of outbreaks. This study examined whether social capital influences CHW knowledge, attitude and practices regarding COVID-19 in Malang district, East Java, Indonesia. This research is important in identifying opportunities where social initiatives can potentially value-add to the support that *kaders* receive from the health system to lead effective community COVID-19 response efforts. We hypothesised that higher levels of social capital would be associated with higher knowledge, attitudes and practices regarding COVID-19.

## 2. Methods

### 2.1. Study setting

*Kaders* in Malang district, East Java, Indonesia, were invited to participate in this research. Malang is the second largest district in East Java Province with a population of 2,542,963 people (2015 census) distributed across 33 sub-districts and 390 villages, 273 (70%) rural and 117 (30%) urban. Malang has 39 primary health centres or *Pusat Kesehatan Masyarakat (Puskesmas)* (1 per ~65,000 individuals) and 390 village health clinics or *Pondok Kesehatan Desa (Ponkesdes)* (1 per ~7,000 individuals) (Malang District Statistics Bureau, 2019) (see Fig. 1). In 2020, 10.2% of the population in Malang district was ‘poor or near poor’ (Malang Regency Statistics Center, 2020).

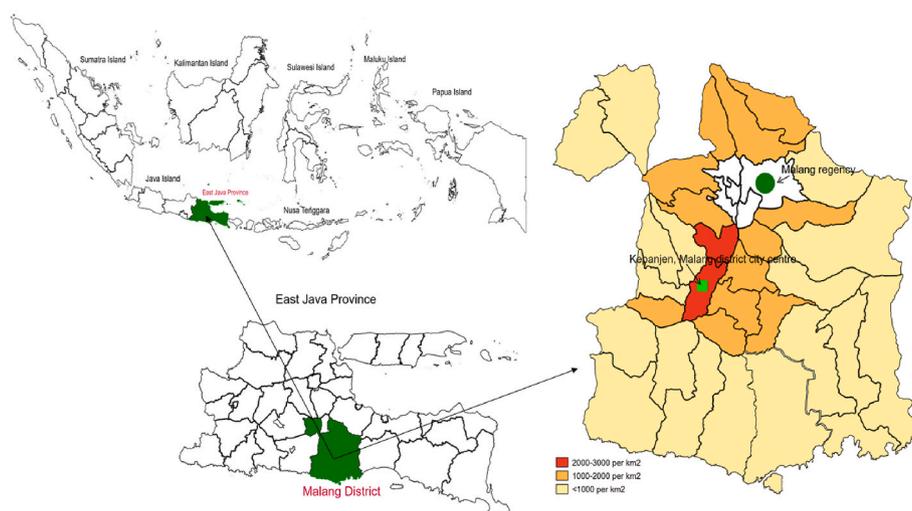


Fig. 1. Map of study setting, Malang District, East Java, Indonesia.

## 2.2. Participants

Kaders are village-based volunteers whose primary task is to conduct monthly village health posts, known as *Posyandu*, where they deliver health and nutrition awareness, immunization campaigns, monitoring and screening activities for diabetes and hypertension, and maternal and child health programs (Ministry of Health, 2012). Outside of these events, kaders visit households to follow-up with families, promote attendance at *Posyandu* and provide additional services as needed. Kaders are required to attend a three-day training course during which they learn the *Posyandu* curriculum, including health promotion, anthropometry and blood pressure and glucose measurement (USAID, 2020). A village committee appoints kaders from within their village to which they are accountable. Kaders receive a monthly financial 'gift', the amount of which is set at the discretion of the Village Government, which typically varies between 25,000 and 50,000 (US\$ 2–4) Indonesian Rupiah.

## 2.3. Study design

A self-administered cross-sectional survey was conducted using a web-based data collection tool (Research Electronic Data Capture, REDCap) (Harris et al., 2009) (see). The survey was co-designed by the research team based on a literature review of social capital surveys, with a focus on low- and middle-income countries and health workers, and World Health Organization guidance on developing rapid surveys to gain behavioural insights regarding COVID-19 (WHO Regional Office for Europe, 2020).

To assess knowledge, kaders were asked three questions using a four-point Likert scale: (1) rate your knowledge of COVID-19 (very poor, poor, good, very good); (2) rate your confidence in answering COVID-related questions from the community (not at all confident, not confident, moderately confident, very confident); and (3) rate whether you need for further training to support the public health response (strongly disagree, disagree, agree, strongly agree). Kaders were also asked to select the symptoms and transmission pathways of COVID-19.

Kaders' attitudes were assessed through three questions using a four-point Likert scale, including their perception of their safety when working (not at all confident, not confident, moderately confident, very confident) and their level of agreement with statements regarding the community's behaviour (strongly disagree, disagree, agree, strongly agree). Kaders' practices were assessed by three questions including whether they had been given tasks related to COVID-19, which COVID-related tasks they had conducted, and which personal protective actions they had taken.

Social capital was measured using an adapted version of the Shortened Adapted Social Capital Assessment Tool (SASCAT) (see Section 4 of Appendix A) (Harpham, 2008). The validated tool is designed to measure social capital within larger surveys and is recommended for use in low- and middle-income countries (Agampodi et al., 2015; De Silva et al., 2006). It has previously been used with CHWs in Lao P.D.R. and to examine the relationship between social capital and mental health in China in the context of COVID-19 (Sato et al., 2014; Sun & Lu, 2020).

The survey included eight questions that focus on two components of social capital—structural and cognitive social capital. The structural social capital component of the SASCAT assesses the extent and intensity of one's links to community groups through three questions: number of community group memberships (from 0 to 7), number of community groups that they received support from in the past 12 months (from 0 to 7) and the number of individuals that they received support from in the past 12 months (from 0 to 8). A mean score was calculated for each question. The structural social capital component of the SASCAT also includes two questions to assess the citizenship activities of respondents (i.e. joining other community members to address an issue and talking to

a local authority about problems in the community). Cognitive social capital is assessed through three questions regarding the respondent's perception of trust, reciprocity, and belonging in the community. A score was calculated for responses to citizenship (i.e. 0–2) and cognitive social capital (0–3) components, respectively, and a mean calculated.

An initial draft of the survey was designed, translated into simple Bahasa (the local language) and piloted with a small sample of kaders ( $n = 5$ ) to ensure comprehension. With guidance from research team members from the University of Brawijaya, villages were purposively sampled to reflect the breadth of rural/urban, sociographic and economic variation across Malang district. A URL link to the survey was disseminated to kaders by the kader coordinator in each village, using WhatsApp. WhatsApp chat groups are a common form of communication for frontline health workers in Indonesia (Sitepu et al., 2020). The survey required 15–20 min to complete and a series of scheduled reminders were sent to kaders. Data collection took place between October 2020 and January 2021.

## 2.4. Statistical analysis

Descriptive comparisons of knowledge, attitude, practices and social capital constructs between urban and rural respondents were performed with Pearson's chi-squared tests. Logistic regression models were used to assess the association between social capital variables (as independent variables) and each outcome of interest. Appropriate functional models were used: logistic regression for dichotomous outcomes and ordinal logistic regression for Likert scale outcomes. Where Likert scales had small cell counts (<5%), they were collapsed to produce dichotomous outcome variables, including self-reported knowledge of COVID-19 (good/poor), confidence in safety from COVID-19, (confident/not confident) and agreement with the statement 'it's difficult to know which information to trust' (agree/disagree).

Using a stepwise forward selection process, unadjusted (univariable) analyses were conducted, and a likelihood ratio test was used to screen for variables to be included in the adjusted (multivariable) models (Table C1., Appendix C). The nested model with the lowest Akaike Information Criterion (AIC) was selected and known confounders were added to each model. Odds ratios (ORs) and their 95% confidence intervals (95% CIs) were computed, and p values less than or equal to 0.05 were considered statistically significant in all analyses. As a form of sensitivity analysis, we performed multiple imputation by chained equations for missing data, pooling results from 20 imputed data sets. The results were nearly identical and thus we only report the results using complete case analysis. Statistical analyses were performed using STATA version 17.

## 2.5. Ethics and consent

The online survey was prefaced by a web-based participant information statement and consent form in simple Bahasa. Participants were required to confirm that they had understood the participant information statement in order to proceed to the online survey; completion of the survey constituted consent. Ethics approval was granted by the Human Research Ethics Committees of the University of New South Wales (HC190048) and Medical Faculty of University of Brawigaya (Reference: 10/EC/KEPK/04/2018).

## 3. Results

Table 1 presents the characteristics of participants. A total of 478 kaders from 27 villages in Malang district completed the survey (response rate: 89%); 1.5% identified as male, 41.0% were aged 30–39 years, and most had a high school education (51.2%).

**Table 1**  
Participant characteristics.

Characteristics	n	%	Missing values*
Gender			
Female	470	98.3	0.2
Male	7	1.5	
Age			
18–29	57	11.9	0
30–39	196	41.0	
40–49	148	31.0	
50+	77	16.1	
Education attainment			
Primary	43	9.1	0.6
Junior secondary	142	29.9	
High school	243	51.2	
University	47	9.9	
Years worked as a kader			
Less than 1	22	4.6	0.2
1–5	157	32.9	
6–10	104	21.8	
More than 10	194	40.7	
Rural/Urban Village			
Rural	382	83.6	4.4
Urban	75	16.4	

Notes: \* Presented are %.

### 3.1. Kaders' knowledge, attitude and practices

#### 3.1.1. Knowledge

Table 2 shows kaders' knowledge, attitude and practices by urban/rural status. Nearly all respondents (93.1%) rated their knowledge of COVID-19 as good or very good, most (91.8%) were moderately or very confident that they could answer questions about COVID-19 if asked by a community member and nearly all (98.1%) agreed or strongly agreed that they required further training to support the COVID-19 response. The majority of kaders accurately identified dry cough (79.0%), fever (86.4%), and fatigue (62.4%) as the symptoms and direct physical contact (83.2%) and air (86.7%) as the transmission pathways of COVID-19 (see Table B1. in Appendix B).

#### 3.1.2. Attitude

The majority of respondents (94.5%) reported feeling moderately or very confident that they were safe from COVID-19 when working. These proportions differed by rurality, with kaders in urban villages less likely than those in rural villages to report feeling confident of their safety (85.3% vs 96.1%,  $p = 0.005$ ) (Table 2). The majority of respondents agreed with the statement that the community trusts and listens to them (92.4%), and that 'it is difficult to decide which information I receive about the COVID-19 is real, fake, or just rumours' (73.7%).

#### 3.1.3. Practices

The majority of respondents (85.3%) reported that they had been allocated COVID-19 related tasks. While 15.5% of respondents reported that they had not conducted any COVID-19 related tasks, 69.6% reported conducting 1 to 2 tasks. Again, this was higher in rural compared to urban villages (72.3% v. 56.0%,  $p = 0.036$ ). The most common reported task was health promotion (67.2%). While 28.7% of kaders reported taking at least one personal protective measure, almost half (50.6%) reported taking four protective measures. The most common personal protective measure reported was wearing a face mask (85.3%). A full summary of data on COVID-19 practices is provided in Table B2., Appendix B.

**Table 2**

Kader knowledge, attitude and practices regarding COVID-19, by urban/rural status.

Outcome	Total* N = 478	Rural* n = 382	Urban* n = 75	p- value**	Missing values***
High self-reported COVID knowledge	394 (93.1)	320 (86.4)	64 (85.3)	0.080	8.2
Confident answering COVID questions	391 (91.8)	327 (85.6)	64 (85.3)	0.021	7.5
Need COVID training	418 (98.1)	352 (92.2)	66 (88.0)	0.041	7.5
Confident in safety from COVID	431 (94.5)	367 (96.1)	64 (85.3)	0.005	0.2
Agree 'the community listens to and trusts me'	365 (92.4)	310 (81.2)	55 (73.3)	0.003	14.6
Agree 'it is difficult to know which information to trust'	289 (73.7)	245 (64.1)	44 (58.7)	0.007	15.3
Assigned COVID- related tasks	389 (85.3)	331 (86.7)	8 (77.3)	0.198	0.2
No COVID-related tasks conducted	77 (15.5)	53 (13.9)	18 (24.0)	0.001	4.4
Four protective measures taken	231 (50.6)	204 (53.4)	27 (36.0)	0.102	4.4

Notes: \* Presented are frequency (%); \*\* Bivariate analyses were performed using Pearson's chi-squared tests; \*\*\* Presented are %.

### 3.2. Social capital

#### 3.2.1. Structural social capital

The social capital of the kaders is described in Table 3. Of the 478 respondents, 70.9% reported being a member of at least one community group, yet it was most common to report only one group membership (28.5%). Mean scores for group membership, support from groups, and support from individuals were 2.0 ( $\pm 2.4$ ), 1.6 ( $\pm 2.3$ ), and 2.8 ( $\pm 3.4$ ), respectively.

The majority of respondents (70.7%) had a low number of community group memberships (defined as being a member of 0–2 community groups), while only 29.3% of respondents had a high number (defined as being a member of 3–7 community groups). Kaders in rural villages were more likely than those in urban villages to have a high number of group memberships (33.0% vs 10.7%,  $p < 0.001$ ). A breakdown of group memberships by rural and urban village can be found in Table B3. in Appendix B.

Respondents in rural villages were more likely to have received support from groups and from individuals. Of those who reported a high level of support from groups (defined as 3–7 groups) (23.2%), all were from rural villages ( $p < 0.001$ ). Of those who reported a high level of support from individuals (34.8%), 98.7% ( $n = 157$ ) were from rural villages ( $p < 0.001$ ).

The mean score for citizenship activities was 1.7 ( $\pm 0.6$ ). Kaders in rural villages were more likely than those in urban villages to report joining together with other community members to address a common issue (72.0% vs 53.3%,  $p = 0.005$ ) or talk to a local authority about problems in the community (61.8% vs 49.3%,  $p = 0.009$ ).

#### 3.2.2. Cognitive social capital

On questions related to cognitive social capital, 81.2% individuals scored 3 out of 3, with a mean score of 2.8 ( $\pm 0.5$ ). Kaders in rural villages were more likely than those in urban villages to report that people

**Table 3**

Kader social capital components by urban/rural status.

Social Capital Component		Total* N = 478	Rural* n = 382	Urban* n = 75	p-value**	Missing values***
<b>Structural</b>	High number of community group memberships	134 (29.3)	126 (33.0)	8 (10.7)	<0.001	4.4
	High level of support from groups	106 (23.2)	106 (27.8)	0 (0.0)	<0.001	4.4
	High level of support from individuals	159 (34.8)	157 (41.1)	2 (2.7)	<0.001	4.4
<b>Citizenship</b>	Joined community members to address a common issue	315 (91.0)	275 (72.0)	40 (53.3)	0.005	25.1
	Talked with local authority about problems in the community	268 (77.9)	236 (61.8)	32 (49.3)	0.009	25.5
<b>Cognitive</b>	Can the majority of people in this community be trusted?	290 (83.3)	253 (66.2)	37 (49.3)	0.113	24.7
	Do people in this community get along with each other?	338 (97.7)	292 (76.4)	46 (61.3)	0.010	25.1
	Do you feel as though you are really a part of this community?	343 (98.9)	294 (77.0)	49 (65.3)	0.042	24.9

Note: \* Presented are frequency (%); \*\* Bivariate analyses were performed using Pearson's chi-squared tests; \*\*\* Presented are %.

in the community get along with each other (76.4% vs 61.3%,  $p = 0.010$ ) and feeling as part of the community (77.0% vs 65.3%,  $p = 0.042$ ).

### 3.3. Association between social capital and kader knowledge, attitude and practices regarding COVID-19

#### 3.3.1. Knowledge

In univariable analysis, kaders knowledge of COVID-19 and confidence answering COVID-19 related questions were associated with all dimensions of social capital (Table B.4. Appendix B). After adjusting for age, urban/rural status, education level and social capital components, kaders with higher levels of cognitive social capital were 7.02 times more likely to report a high knowledge of COVID-19 (95%CI = 3.13 to 15.73) and 2.95 times more likely to be confident answering COVID-related questions from the community (95%CI = 1.59 to 5.47) (Table 4). Kaders who reported receiving a high level of support from groups had 90% higher odds of being confident in answering COVID-related questions (95%CI = 1.57 to 2.29), after adjusting for age, other demographics and social capital components.

#### 3.3.2. Attitude

Unadjusted logistic regression models demonstrated consistent significant associations between group membership, support from groups and support from individuals, and kaders' attitude (Table B4., Appendix B). However, in the adjusted multivariate logistic regression models, only citizenship activities and cognitive social capital remained statistically significantly associated with attitude.

A kaders' level of cognitive social capital (OR = 4.36, 95%CI = 1.82 to 10.45) and citizenship activities (OR = 2.64, 95%CI = 1.22 to 5.73) were associated with greater confidence in their safety from COVID-19. Kaders agreeing with the statement "the community listens to and trusts the information that I provide to them" were more likely to have a higher level of cognitive social capital (OR = 6.68, 95%CI = 3.11 to 14.34) and conduct more citizenship activities (OR = 2.42, 95%CI = 1.37 to 4.28).

Kaders' from urban villages were 4.21 times more likely to agree with the statement "it is difficult to decide which information I receive about the COVID-19 is real, fake, or just rumours" (95%CI = 1.61 to 11.00) while those with a higher level of education were 39.5% less likely to agree with the statement (95%CI = 0.41 to 0.89), after adjusting for age, other demographics and social capital components.

#### 3.3.3. Practices

Structural social capital components (group membership, support from groups, support from individuals and citizenship activities) were significantly associated with kaders' COVID-19 practices in both unadjusted and adjusted regression models. Kaders with a high number of group memberships were 2.27 times more likely to report being assigned COVID-related tasks (95%CI = 1.37 to 3.78) and 53% more likely to report conducting a higher number of COVID-related tasks (95%CI = 1.14 to 2.05), after adjusting for age, other demographics and social capital components. Kaders who conducted more citizenship activities

were also 2.25 times more likely to report being assign COVID-related tasks (95%CI = 1.36 to 3.73) and 4.95 times more likely to report conducting a higher number of COVID-related tasks (95%CI = 2.79 to 8.77), after adjusting for age, other demographics and social capital components. Kaders who reported receiving a high level of support from individuals had 86% higher odds of taking more protective actions (95% CI = 1.57 to 2.21), after adjusting for age, other demographics and social capital components.

## 4. Discussion

This study examines the influence of social capital on the COVID-19 related knowledge, attitude and practices of CHW in Indonesia. Notably, to our knowledge, this is the first study to assess the social capital of CHWs in Indonesia. Results confirm our hypothesis that CHWs with higher levels of social capital are more likely to demonstrate higher levels of knowledge, attitude and practices regarding COVID-19. However, the interaction between the different components of social capital and kader behaviour is nuanced. Our findings suggest that cognitive social capital was closely aligned with kader knowledge and attitude, including self-reported knowledge, confidence answering COVID-related questions, confidence in their safety from COVID-19 and agreement with the statement that the community trusts and listens to them. Comparatively, structural social capital, primarily participation in community organisations and citizenship activities, was associated with having been assigned COVID-related tasks and the likelihood of conducting these tasks. Levels of social capital were much higher among kaders in rural compared to urban villages, a finding likely reflective of the higher level of cohesiveness in rural areas (Hofferth & Iceland, 1998).

We found that higher levels of cognitive social capital exhibited strong and consistently positive associations with kader knowledge and attitude. This may suggest that kaders who perceive their community as trustworthy and cohesive are likely to be more confident in their knowledge and ability to respond to COVID-19. Several mechanisms might explain this process. Perceptions of trust and community safety may increase one's perceived sense of control over their environment, while others suggest that higher levels of cognitive social capital may facilitate cooperation and promote public acceptance of and compliance with COVID-19 control measures (Bai et al., 2020; Wu, 2021). Previous studies in Indonesia have found that neighbourhood trust was associated with better self-assessed health status (Cao & Rammohan, 2016; Saint Onge et al., 2018).

Higher levels of structural social capital were associated with being assigned and conducting COVID-related tasks. This may suggest that kaders who are more embedded in the community (i.e. have a higher number of community memberships) and have connections with important figures and other community members (i.e. citizenship activities) are more likely to contribute to the public health response to COVID-19. Participating kaders were already tapped into social networks and therefore may be more easily mobilised in times of crisis. This reflects a finding from the 2014 Ebola outbreak response that it was

**Table 4**  
Associations between social capital and the knowledge, attitude and practices of kaders regarding COVID-19.

Social capital measures	Adjusted outcome measures (OR, 95%CI)														
	Knowledge					Attitude					Practices				
	Self-reported COVID knowledge	Confidence answering COVID questions	Require COVID-19 related training	Confidence in safety from COVID	'The community listens to and trusts me'	'It's difficult to know which information to trust'	Assigned COVID-related tasks	Number of COVID-related tasks conducted	Number of protective actions taken						
Age	0.73 (0.37-2.67)	0.86 (0.64-1.16)	0.50 (0.05-5.25)	1.85 (0.84-4.11)	1.06 (0.78-1.43)	1.11 (0.80-1.53)	1.14 (0.71-1.84)	1.17 (0.84-1.62)	0.72 (0.50-1.05)						
Urban/rural village	0.98 (0.19-5.20)	0.61 (0.27-1.35)	-	0.31 (0.07-1.33)	1.04 (0.42-2.59)	<b>4.21*</b> (1.61-11.00)	0.33 (0.11-0.99)	0.46 (0.18-1.14)	1.38 (0.59-3.23)						
Education attainment	1.32 (0.65-2.67)	0.96 (0.68-1.34)	1.95 (0.16-23.59)	0.76 (0.32-1.77)	0.99 (0.71-1.38)	<b>0.61*</b> (0.41-0.89)	1.07 (0.64-1.79)	0.89 (0.62-1.26)	0.82 (0.54-1.26)						
Group membership	-	<b>1.70**</b> (1.44-2.01)	-	-	-	-	<b>2.27*</b> (1.37-3.78)	<b>1.53*</b> (1.14-2.05)	-						
Support from groups	-	-	-	-	<b>1.27*</b> (1.08-1.49)	<b>1.58**</b> (1.32-1.89)	-	<b>0.72*</b> (0.52-0.99)	-						
Support from individuals	-	-	-	1.54 (0.94-2.53)	1.09 (0.96-1.25)	-	0.86 (0.72-1.03)	0.90 (0.78-1.04)	<b>1.86**</b> (1.57-2.21)						
Citizenship activities	-	<b>1.91**</b> (1.82-6.30)	<b>3.84</b> (0.38-38.99)	<b>2.64*</b> (1.22-5.73)	<b>2.42*</b> (1.37-4.28)	-	<b>2.25**</b> (1.36-3.73)	<b>4.95**</b> (2.79-8.77)	-						
Cognitive social capital	<b>7.02**</b> (3.13-15.73)	<b>3.38**</b> (1.82-6.30)	-	<b>4.36*</b> (1.82-10.45)	<b>6.68**</b> (3.11-14.34)	-	-	-	-						

Notes: Presented are adjusted odds ratio (aOR) (by age, urban/rural village and education attainment) and 95% confidence intervals. Significance: \* = p < 0.05, \*\* = p < 0.001.

difficult to engage communities unless there was already a well-developed network of health workers who are accountable to and embedded within communities (Scott et al., 2016). Additionally, this finding aligns with the wealth of literature on the importance of community-embeddedness and support received from the community as a form of motivation for CHWs (Kok et al., 2014; Lehmann et al., 2019; Schaaf et al., 2020; Kerry Scott et al., 2018a, 2018b). Given their high level of engagement, it's possible that the kaders in our study were motivated by a greater sense of duty or altruism to contribute to the COVID-19 response.

That structural and cognitive social capital influence different behaviours is not unexpected. Cognitive and structural social capital are understood to have different relationships with health outcomes and our results are reflected by similar studies in China, and a multi-country study in Peru, Ethiopia and Vietnam (De Silva & Harpham, 2007; Wu, 2021; Yip et al., 2007). However, the effects of community membership on kaders' behaviour may have been subsumed within the other indicators of social capital, cognitive social capital in particular (De Silva & Harpham, 2007). Indeed, if, as others have argued, group membership leads to increased trust, then including cognitive social capital in the analysis will mitigate the effects of group membership (Coleman, 1990; Putnam, 2001). This may explain why the consistently positive crude associations between group membership and kader behaviours are substantially decreased in the multiple logistic regression results when other aspects of social capital are taken into account.

#### 4.1. Policy implications

These findings have policy implications, albeit tentative, of relevance to health system planners in terms of CHW engagement, selection and training. First, our results suggest that policies that promote community embeddedness and integration of CHWs hold promise in improving their performance during times of crisis. As shown in previous pandemics, embedded CHWs represent a trusted and respected voice in the community that is capable of thwarting fear and misinformation (Boyce & Katz, 2019; Scott et al., 2016). Previous research in Indonesia enhanced community support for the kader program through community mobilization strategies and increased community awareness (Bait et al., 2019). Furthermore, strong incentives may be important to retain CHWs in communities, particularly long serving individuals, in order to avoid the loss of social capital and thus workforce capability. In Malang district, this may be particularly relevant in urban villages, where kaders consistently reported lower levels of social capital, a higher distrust of information sources and where the risks of COVID-19 infection are highest (Eryando et al., 2020).

Second, when recruiting kaders, village authorities could take into account the structural and cognitive social capital of candidates. As recommended elsewhere, track records of cooperation with residents and relationships with local authorities may be suggestive of future performance (Sato et al., 2014). However, any such approach would require caution as it has the potential to perpetuate existing social inequalities. Recruitment based on social capital may further exclude the poor and marginalized by restricting social mobility. While this recommendation could be practical in Indonesia, where the main motivation for kaders as village health volunteers is commonly reported to be the cultural value of volunteering for one's community, it may not be applicable to contexts where financial remuneration is a key concern for CHWs (Ormel et al., 2019; USAID, 2020). Previous research highlights the complexities in recruiting the most "effective" CHWs when opportunities for career progression are limited (Wintrop, 2021). Furthermore, evidence from India shows that disadvantaged members of the community can be effectively excluded from becoming CHWs partly due to the meagre and inconsistent financial income (Kane et al., 2021).

Lastly, our finding that nearly all kaders reported that they require further training for COVID-19 suggests another consideration for policymakers. A recent study in Indonesia's South Aceh district also found

that kaders received limited guidance about providing services during the pandemic, suggesting this may not be an isolated issue (Hanifah, 2021). Other countries have met training needs for health workers through online courses, in-person from local health officers and the use of mobile applications, while the World Health Organization recommends refresher trainings, simulation scenarios and access to clear protocols and guidelines (Kaweenuttayanon et al., 2021; Otu et al., 2021; World Health, 2020). Previous research has shown that enhanced training can improve kader performance outcomes (Limato et al., 2018; Tumbelaka et al., 2018).

#### 4.2. Limitations

Limitations to our study should be noted. First, the survey was distributed non-randomly via WhatsApp and, as a result, a selection bias may exist. Therefore, our results may not be generalizable to all kaders within Malang district. In particular, the study under-represents urban kaders, a group which may possess differences such as social capital, higher wealth, and education. Second, given the cross-sectional nature of our data, the interpretation of results is limited to associations and not causation. Third, we only used self-report measures to assess kaders knowledge and practices. Lastly, a strength of our study is that data collection occurred as the first wave of COVID-19 reached its peak in Indonesia. From October 2020 to January 2021 the daily number of confirmed COVID-19 cases doubled from approximately 4,000 to 8,000 and the number of COVID-19 deaths per day increased from roughly 100 to 200 (Ritchie et al., 2020). As such, respondents likely already had a number of months experience within the pandemic response.

#### 5. Conclusion

Kaders with higher levels of structural and cognitive social capital may be better positioned to contribute to public health response efforts to the COVID-19 pandemic in Malang district, Indonesia. Our results suggest that cognitive social capital has a greater impact on kaders' self-reported knowledge and attitude, while the influence of structural social capital is largely confined to their practices. Social capital was much higher among kaders in rural villages, yet nearly all kaders reported a need for further training to support their role in the COVID-19 response. Policies aimed at promoting CHW embeddedness, targeted recruitment and addressing training needs, hold promise in strengthening the

contribution of kaders in Malang district to the ongoing response to COVID-19 as well as future public health emergencies.

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#### Author statement

**Thomas Gadsden:** Conceptualization, Methodology, Formal analysis, Writing- Original draft preparation. **Asri Maharani:** Conceptualization, Methodology, Formal analysis, Writing - Review & Editing. **Sujarwoto Sujarwoto:** Conceptualization, Methodology, Writing - Review & Editing, Resources, Project administration. **Budiarto Eko Kusumo:** Resources, Project administration. **Stephen Jan:** Conceptualization, Methodology, Writing - Review & Editing, Supervision. **Anna Palagyi:** Conceptualization, Methodology, Writing - Review & Editing, Supervision.

#### Ethical statement

This study was approved by the Human Research Ethics Committees of the University of New South Wales (HC190048) and Medical Faculty of University of Brawijaya (Reference: 10/EC/KEPK/04/2018). The online survey was prefaced by a web-based participant information statement and consent form in simple Bahasa. Participants were required to confirm that they had understood the participant information statement in order to proceed to the online survey; completion of the survey constituted consent.

#### Declaration of competing interest

None.

#### Acknowledgements:

None.

#### Appendix A. Kader Online Survey

Section 1: Demographic data	
Gender	<ul style="list-style-type: none"> <li>• Female</li> <li>• Male</li> </ul>
Age	<ul style="list-style-type: none"> <li>• 18–29</li> <li>• 30–39</li> <li>• 40–49</li> <li>• 50 +</li> </ul>
What is the highest level of schooling completed?	<ul style="list-style-type: none"> <li>• Primary school</li> <li>• Junior secondary school</li> <li>• High school</li> <li>• University</li> </ul>
Name of village	Free text
How many years have you worked as a kader?	<ul style="list-style-type: none"> <li>• Less than 1 year</li> <li>• 1–5 years</li> <li>• 6–10 years</li> <li>• More than 10 years</li> </ul>
On average, how many hours per week do you work as a kader?	<ul style="list-style-type: none"> <li>• Less than 1 h</li> <li>• 1–5 h</li> <li>• 6–12 h</li> <li>• More than 12 h</li> </ul>
<b>Section 2: Willingness</b>	
Have you been instructed to conduct specific tasks in response to COVID-19 in your neighbourhood?	<ul style="list-style-type: none"> <li>• Yes</li> </ul>

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(continued)

Section 1: Demographic data

If yes, please check which tasks you have been instructed to conduct:

- No
- Disseminating COVID-19 information to people around you
- Health promotion for healthy life during "new normal" to people around you
- Reporting person with suspected COVID-19 to authority in your area
- Support Ponkesdes nurses to monitor high risk individual during self-isolation
- Support Ponkesdes nurses to screen high risk individual
- I have not taken any protective action
- Washing your hands with soap and water for 20 s.
- Standing 6 feet/2 m apart from people
- Staying at home (unless it is absolutely necessary to go outside)
- Wear mask to cover nose and mouth
- Very confident
- Moderately confident
- Not very confident
- Not at all confident

Do you routinely conduct any of the following to protect yourself from COVID-19?

- Very good knowledge
- Good knowledge
- Poor knowledge
- Very poor knowledge
- Very confident
- Moderately confident
- Not very confident
- Not at all confident
- Dry cough
- Urinary infection
- Fever
- Swollen lymph nodes
- Fatigue/tiredness
- Hypertension
- Diabetes
- Direct physical contact
- From mosquitoes
- Through food or drinking water
- Through the air
- Through masks and clothes
- Other
- Strongly agree
- Agree
- Disagree
- Strongly disagree
- Strongly agree
- Agree
- Disagree
- Strongly disagree
- Strongly agree
- Agree
- Disagree
- Strongly disagree

Are you confident that you are safe from COVID-19 when working as a kader?

**Section 3: Knowledge**

How would you rate your knowledge of how to prevent the spread of COVID-19?

If a concerned community member had questions for you about COVID-19, how confident do you feel about your ability to answer those questions?

Which of the following can be symptoms of COVID-19? (Please select as many as apply)

How is COVID-19 spread between people? (Please select as many as apply)

Do you feel that you require additional training to support the public health response to COVID-19?

Do you agree or disagree with the following statement: "the community listens to and trusts the information that I provide to them"?

Do you agree or disagree with the following statement: "it is difficult to decide which information I receive about the COVID-19 is real, fake, or just rumours"?

**Section 4: Social Capital**

In the last 12 months have you been a member of any of the following types of groups in your community?

In the last 12 months, did you receive from the group any emotional help, economic help or assistance in helping you know or do things?

In the last 12 months, have you received any help or support from any of the following, this can be emotional help, economic help or assistance in helping Friends who are not neighbours you know or do things?

- Work related/trade union
- Community association/co-op
- Women's group
- Political group
- Religious group
- Credit/funeral group
- Sports group
- Work related/trade union
- Community association/co-op
- Women's group
- Political group
- Religious group
- Credit/funeral group
- Sports group
- Family
- Neighbours
- Friends who are not neighbours
- Community leaders
- Religious leaders
- Politicians

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(continued)

Section 1: Demographic data	
In the last 12 months, have you joined together with other community members to address a problem or common issue?	<ul style="list-style-type: none"> <li>• Government officials/civil service</li> <li>• Charitable organisations/NGO</li> <li>• Yes</li> <li>• No</li> </ul>
In the last 12 months, have you talked with a local authority or governmental organization about problems in this community?	<ul style="list-style-type: none"> <li>• Yes</li> <li>• No</li> </ul>
In general, can the majority of people in this community be trusted?	<ul style="list-style-type: none"> <li>• Yes</li> <li>• No</li> </ul>
Do the majority of people in this community generally get along with each other?	<ul style="list-style-type: none"> <li>• Yes</li> <li>• No</li> </ul>
Do you feel as though you are really a part of this community?	<ul style="list-style-type: none"> <li>• Yes</li> <li>• No</li> </ul>

**Appendix B**

**Table B.1**

Knowledge of COVID-19 symptoms and transmission

Knowledge of symptoms and transmission pathways of COVID-19	Total <sup>**</sup> >* N = 478	Rural <sup>**</sup> >*n = 382	Urban <sup>**</sup> >*n = 75	p-value <sup>***</sup> >**	Missing values <sup>***</sup> >***
<b>Symptoms</b>					
Dry cough	361 (79.0)	307 (80.4)	54 (72.0)	0.111	4.4
Urinary infection	12 (2.6)	9 (2.4)	3 (4.0)	0.533	4.4
Fever	395 (86.4)	335 (87.7)	60 (80.0)	0.009	4.4
Swollen lymph nodes	11 (2.4)	10 (2.6)	1 (1.3)	0.645	4.4
Fatigue	285 (62.4)	247 (64.7)	38 (50.7)	0.006	4.4
Hypertension	43(9.4)	34 (8.9)	9 (12.0)	0.538	4.4
Diabetes	30 (6.6)	23 (6.0)	7 (9.3)	0.231	4.4
<b>Transmission pathways</b>					
Direct physical contact	380 (83.2)	321 (84.0)	59 (78.7)	0.005	4.4
Mosquitoes	13 (2.8)	10 (2.6)	3 (4.0)	0.711	4.4
Food/drinking water	64 (14.0)	53 (13.9)	11 (14.7)	0.830	4.4
Air	396 (86.7)	332 (86.9)	64 (85.3)	0.035	4.4
Masks and clothes	168 (36.8)	138 (36.1)	30 (40.0)	0.776	4.4

Notes: \* Presented are frequency (%); \*\* Bivariate analyses were performed using Pearson’s chi-squared tests; \*\*\* Presented are %.

**Table B.2**

Number of COVID-related tasks conducted, and protective actions taken by respondents

COVID-related tasks and protective actions	Total <sup>**</sup> >* N = 478	Rural <sup>**</sup> >*n = 382	Urban <sup>**</sup> >*n = 75	p-value <sup>***</sup> >**	Missing values <sup>***</sup> >***
<b>COVID-related tasks</b>					
Disseminate COVID-19 information to public	250 (54.7)	225 (58.9)	25 (33.3)	<0.001	4.4
Health promotion	307 (67.2)	267 (69.9)	40 (53.3)	0.004	4.4
Report with suspected COVID-19 cases to authorities	58 (12.7)	45 (11.8)	13 (17.3)	0.297	4.4
Support Ponkesdes nurses to monitor individuals in isolation	73 (16.0)	57 (14.9)	16 (21.3)	0.248	4.4
Support Ponkesdes nurses to screen high risk individual	58 (12.7)	46 (12.0)	12 (16.0)	0.583	4.4
<b>Protective actions</b>					
Washing hands with soap	341 (74.6)	289 (75.7)	52 (69.3)	0.373	4.4
Social distancing	265 (58.0)	238 (62.3)	27 (36.0)	<0.001	4.4
Staying at home unless necessary	295 (64.6)	248 (62.9)	47 (62.7)	0.014	4.4
Wearing a face mask	390 (85.3)	334 (87.4)	56 (74.7)	0.004	4.4

Notes: \* Presented are frequency (%); \*\* Bivariate analyses were performed using Pearson’s chi-squared tests; \*\*\* Presented are %.

**Table B.3**

Kader social capital by rural, urban village

Structural and cognitive social capital	Total <sup>**</sup> >* N = 478	Rural <sup>**</sup> >*n = 382	Urban <sup>**</sup> >*n = 75	p-value <sup>***</sup> >**	Missing values <sup>***</sup> >***
<b>Member of community group</b>					
Work related/trade union	105 (23.0)	105 (27.5)	0 (0)	<0.001	4.4
Community group	102 (22.3)	95 (24.9)	7 (9.3)	0.011	4.4
Women’s group	283 (61.9)	244 (63.9)	39 (52.0)	0.065	4.4
Political group	57 (12.5)	56 (14.7)	1 (1.3)	0.001	4.4
Religious group	132 (28.9)	125 (32.7)	7 (9.3)	<0.001	4.4
Funeral/credit group	136 (29.8)	128 (33.5)	8 (10.7)	<0.001	4.4
Sports/social group	128 (28.0)	114 (29.8)	14 (18.7)	0.094	4.4
None	130 (28.5)	98 (25.7)	32 (42.7)	0.021	4.4
<b>Support from individuals and networks</b>					

(continued on next page)

**Table B.3** (continued)

Structural and cognitive social capital	Total**>* N = 478	Rural**>*n = 382	Urban**>*n = 75	p-value**>***	Missing values***>***
Family	223 (48.8)	206 (53.9)	17 (22.7)	<0.001	4.4
Neighbours	172 (37.6)	167 (43.7)	5 (6.7)	<0.001	4.4
Friends	175 (38.3)	168 (44.0)	7 (9.3)	<0.001	4.4
Community leaders	157 (34.4)	153 (40.1)	4 (5.3)	<0.001	4.4
Religious leaders	156 (34.1)	153 (40.1)	3 (4.0)	<0.001	4.4
Politicians	135 (29.5)	134 (35.1)	1 (1.3)	<0.001	4.4
Government officials	184 (40.3)	174 (45.6)	10 (13.3)	<0.001	4.4
Charitable organisations	127 (27.8)	126 (33.0)	1 (1.3)	<0.001	4.4
No support from networks	183 (40.0)	136 (35.6)	47 (62.7)	<0.001	4.4

Notes: \* Presented are frequency (%); \*\* Bivariate analyses were performed using Pearson’s chi-squared tests; \*\*\* Presented are %.

**Table B.4**

Unadjusted associations between demographic, social capital and the knowledge, attitude and practices of kaders regarding COVID-19

Social capital measures	Unadjusted outcome measures (OR, 95%CI)								
	Knowledge			Attitudes			Practices		
	Self-reported Covid knowledge	Confidence answering Covid questions	Require COVID-19 related training	Confidence in safety from COVID	‘The community listens to and trusts me’	‘It’s difficult to know which information to trust’	Assigned COVID-related tasks	Number of COVID-related tasks conducted	Number of protective actions taken
Age	0.84 (0.47–1.50)	0.88 (0.68–1.1)	0.47 (0.05–4.81)	1.42 (0.76–2.65)	0.96 (0.74–1.25)	1.01 (0.75–1.37)	1.15 (0.77–1.72)	1.28 (0.95–1.72)	<b>0.65*</b> <b>(0.48–0.88)</b>
Urban/rural village	0.97 (0.21–4.46)	<b>0.28**</b> <b>(0.14–0.55)</b>	0.56 (0.11–2.85)	<b>0.18**</b> <b>(0.06–0.54)</b>	<b>0.37*</b> <b>(0.18–0.77)</b>	1.45 (0.60–3.47)	<b>0.25*</b> <b>(0.11–0.57)</b>	<b>0.44*</b> <b>(0.19–0.99)</b>	<b>0.31*</b> <b>(0.15–0.65)</b>
Education attainment	1.13 (0.61–2.09)	0.95 (0.72–1.25)	2.27 (0.22–22.94)	0.52 (0.25–1.09)	0.94 (0.71–1.26)	0.74 (0.53–1.05)	0.88 (0.57–1.36)	0.90 (0.65–1.25)	0.78 (0.56–1.08)
Group membership	<b>1.34*</b> <b>(0.98–1.84)</b>	<b>1.92**</b> <b>(1.64–2.26)</b>	1.24 (0.40–3.78)	<b>2.88**</b> <b>(1.37–6.03)</b>	<b>1.56**</b> <b>(1.39–1.76)</b>	<b>1.36**</b> <b>(1.17–1.58)</b>	<b>2.48**</b> <b>(1.60–3.85)</b>	<b>1.14*</b> <b>(1.02–1.28)</b>	<b>1.69**</b> <b>(1.40–2.05)</b>
Support from groups	<b>1.43*</b> <b>(1.02–2.01)</b>	<b>2.13**</b> <b>(1.77–2.56)</b>	1.08 (0.46–2.55)	<b>2.64*</b> <b>(1.25–5.56)</b>	<b>1.53**</b> <b>(1.37–1.71)</b>	<b>1.46**</b> <b>(1.24–1.72)</b>	<b>1.94**</b> <b>(1.37–2.78)</b>	1.05 (0.95–1.16)	<b>2.76**</b> <b>(1.96–3.89)</b>
Support from individuals	<b>1.22*</b> <b>(1.03–1.46)</b>	<b>1.46**</b> <b>(1.35–1.59)</b>	1.25 (0.61–2.58)	<b>1.67**</b> <b>(1.16–2.38)</b>	<b>1.37**</b> <b>(1.26–1.49)</b>	<b>1.21**</b> <b>(1.11–1.32)</b>	<b>1.24**</b> <b>(1.10–1.39)</b>	1.03 (0.95–1.10)	<b>1.85**</b> <b>(1.36–2.19)</b>
Citizenship activities	1.35 (0.62–2.95)	<b>3.93**</b> <b>(2.53–6.13)</b>	3.68 (0.37–36.62)	<b>4.35**</b> <b>(2.25–8.46)</b>	<b>4.39**</b> <b>(2.69–7.16)</b>	1.30 (0.84–2.03)	<b>4.99**</b> <b>(2.96–8.41)</b>	<b>4.31**</b> <b>(2.63–7.06)</b>	<b>2.09**</b> <b>(1.36–3.21)</b>
Cognitive social capital	<b>6.62**</b> <b>(2.99–14.67)</b>	<b>5.90**</b> <b>(3.23–10.80)</b>	1.69 (0.45–6.35)	<b>5.29**</b> <b>(2.44–11.48)</b>	<b>11.86**</b> <b>(5.53–25.41)</b>	1.38 (0.80–2.38)	<b>2.54*</b> <b>(1.39–4.65)</b>	1.04 (0.56–1.94)	<b>2.09**</b> <b>(1.22–3.60)</b>

Notes: Presented are odds ratio (OR) and 95% confidence intervals. Significance: \* = p < 0.005, \*\* = p < 0.001.

**Appendix C**

**Table C.1**

Example of model specification strategy

Model	Log Likelihood	Likelihood ratio test			
		X <sup>2</sup>	P-value	Vs	AIC
1. Constant	- 61.74	N/A	N/A	N/A	N/A
2. Education	- 61.66	0.16	0.69	1	127.31
3. Urban/rural status	- 61.74	0.00	0.97	1	127.47
4. Structural SC	- 59.49	4.49	0.03	1	122.98
5. Group SC	- 58.49	6.50	0.01	1	120.98
6. Individual SC	- 58.67	6.14	0.01	1	121.33
7. Citizenship SC	- 61.48	0.52	0.47	1	126.95
8. Cognitive SC	- 50.13	23.21	0.00	1	104.26
9. Cognitive SC + Education	- 49.86	0.54	0.46	8	105.72
10. Cognitive SC + Urban	- 50.13	0.00	0.95	8	106.26
11. Cognitive SC + Structural SC	- 49.93	0.39	0.53	8	105.87
12. Cognitive SC + Group SC	- 49.62	1.02	0.31	8	105.24
13. Cognitive SC + Individual SC	- 49.78	0.69	0.41	8	105.57
14. Cognitive SC + Citizenship SC	- 50.10	0.07	0.79	8	106.20
15. Cognitive SC + Urban/rural status + Education	- 50.13	0.00	0.95	9	106.26

Therefore, based on the above model 8 is the best model.

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