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The flip-side of social capital: The distinctive influences of trust and mistrust on health in rural China☆

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ABSTRACT

Despite increasing evidence that social capital is positively associated with health, the pathways that link social capital to health are not definitive and invite further investigation. This paper uses household survey data from 22 villages in China in 2002 to test the relationship between social capital and the self-reported health status of the rural population. Focusing on the cognitive dimension of social capital, this paper complements current social capital research by introducing an overlooked distinction between trust and mistrust. Trust and mistrust are measured at the individual and aggregate levels, and the distinct ways in which they affect general and mental health are explored. We adopt an ordered logistic regression using survey procedures in SAS version 9.1 to account for the stratified and clustered data structure. The results suggest that: (1) individual-level trust and mistrust are both associated with self-reported health in rural China – trust is positively associated with both general health and mental health, while mistrust is more powerfully associated with worse mental health; and (2) the effects of individual-level trust and mistrust are dependent on village context – village-level trust substitutes for individual-level trust, while individual-level mistrust interacts positively with village-level mistrust to affect health. However, an unexpected protective health effect of mistrust is found in certain types of villages, and this unique result has yet to be examined. Overall, this study suggests the conceptual difference between trust and mistrust and the differential mechanisms by which trust and mistrust affect health in rural China. It also suggests that effective policies should aim at enhancing trust collectively or reducing mistrust at the personal level to improve health status in rural areas of China.

Introduction

Social capital, measured as either the density of social networks or general trust in other people, is documented in a large body of studies to be positively related to health status. However, the study of social capital's links to health remains incomplete in several important ways. First, researchers have not reached a consensus on whether social capital's impact on health is mainly at the individual level or is mainly a feature of a larger social–geographical area. Second, researchers have used concepts of trust in social capital studies in ambiguous and inconsistent ways. Third, certain aspects of social capital may be differently linked to health dimensions (Macinko & Starfield, 2001), but these differential effects remain poorly understood. To better understand social capital's link to health, this article investigates the relationship between trust and health in

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rural China by (1) distinguishing trust from mistrust indicators, (2) separating individual-level trust and mistrust from aggregate measures at the village level and modeling their interactions, and (3) comparing trust-based influences on mental health to those on general health.

Social capital and health

Social capital is defined as features of social organization "that can improve the efficiency of society by facilitating coordinated actions"(Putnam, 1993) and is widely recognized as a multi-dimensional concept covering indicators such as social networks, trust, adherence to norms, and information sharing (Bourdieu, 1986; Coleman, 1988; Putnam, 1995). Social capital is conventionally divided into two mutually reinforcing dimensions: a structural dimension that facilitates social interaction and a cognitive dimension that predisposes people to act in a socially beneficial way (Bain & Hicks, 1998; Harpham, Grant, & Thomas, 2002; Hjollund & Svendsen, 2000). Trust measures are most commonly used to measure cognitive social capital.

Social capital was first linked to health outcomes in the 1990s at the aggregate level, with studies showing that average levels of interpersonal trust or social networks are related to various measures of health in a state (Kawachi, Kennedy, & Glass, 1999; Kawachi, Kennedy, Lochner, & Prothrow-Stith, 1997), a region (Kennedy, Kawachi, & Brainerd, 1998), or a neighborhood (Lochner, Kawachi, Brennan, & Buka, 2003). More recently, trust analysis has been extended to the individual level, and a positive association with individual-level health status is also suggested in a variety of advanced market economies (Lindström, 2004; Phongsavan, Chey, Bauman, Brooks, & Silove, 2006; Pollack & Von dem Knesebeck, 2004; Rose, 2000; Veenstra, 2005). Researchers have also found that in developing countries, where economic resources are scarce, trust is associated with better general health (Khawaja, Abdulrahim, Soweid, & Karam, 2006), better mental health (De Silva, Huttly, Harpham, & Kenward, 2007), or both (Yip et al., 2007). The estimated relationship between trust and health is relatively strong, compared to other social determinants of health and well-being. However, several issues remain unresolved and need to be investigated conceptually and empirically.

Simplistic and inconsistent measurement of trust

In previous studies, trust has often been modeled by dichotomizing categorical questions or aggregate indices into high-trust or low-trust individuals (e.g., Subramanian, Kim, & Kawachi, 2002; Veenstra, 2005). Consequently, it is not known whether trust is related to health linearly or whether a threshold level of trust ensures a healthy community. More importantly, inconsistencies in trust measures reflect potentially consequential conceptual ambiguities. Researchers commonly use three questions to assess trust: (1) 'Would you say that most people can be trusted, or that you can't be too careful in dealing with people?' (2) 'Would you say that most of the time people try to be helpful or that they are mostly looking out for themselves?' and (3) 'Do you think that most people would try to take advantage of you if they got the chance, or would they try to be fair?' While the first two questions stress the positive perceptions of ***trust*** and ***helpfulness***, the third question actually emphasizes ***mistrust***. Conceptually, mistrust carries different emotional and cognitive implications from the absence of trust, which carries a neutral emotional valence (Steptoe, Wardle, & Marmot, 2005). Mistrust can be measured by questions describing the negative perception toward people or by an index based on these questions, such as the eight-item Cynical Distrust Scale developed by Cook and Medley (1954). Mistrust measured by the Cynical Distrust Scale is associated with increased risk of all-cause and cause-specific mortality (Everson et al., 1997) and self-reported symptom load (Christensen et al., 2004). However, researchers have often considered mistrust equivalent to the absence of trust and used these two concepts interchangeably (Kawachi et al., 1999; Pollack & Von dem Knesebeck, 2004). A large body of social capital studies identifies mistrust as disagreement with the statement that people can be trusted (Kawachi et al., 1997; Subramanian, Lochner, & Kawachi, 2003) or combines measures of trust and mistrust into a single index, presuming that the two are inverse facets of the same concept (Hyyppä & Mäki, 2001; Poortinga, 2006a). This practice, though common, is problematic. For reasons that are developed later, lack of trust may differ from mistrust in the consequences that each has for health.

Muddled interaction of trust at individual and aggregate levels

Although studies have shown that aggregate trust predicts aggregate health outcomes and individual trust predicts individual health outcomes, it is not known whether these are two embodiments of the same relationship or whether individual- and aggregate-level trust influence health through different pathways. When simultaneously including trust at both levels, some studies suggest independent health effects of individual-level and aggregate-level trust (Poortinga, 2006b; Yip et al., 2007), while De Silva et al. (2007) found significant association between trust and mental health only at the individual-level in three of the four countries studied. Two studies examining the cross-level interactions failed to find health effects of aggregate trust after controlling individual-level trust but detected a positive cross-level interaction effect: individuals with a high level of trust are more likely to report better health in high-trust communities (Subramanian et al., 2002) or countries (Poortinga, 2006a).

Incomplete health measures

Some researchers argue that certain dimensions of social capital are most relevant to mental health (Macinko & Starfield, 2001; Phongsavan et al., 2006). However, the potentially differential effects of interpersonal trust on mental health outcomes compared to general health has, to date, been little examined. Of the studies that investigate general health and mental health for the same population (Lindström, 2004; Pollack & Von dem Knesebeck, 2004; Rose, 2000; Yip et al., 2007), discussion of the differential

health effects from various components of social capital is limited. A further distinction between trust and mistrust and their possible differential effects on mental health is also left out of current social capital research.

Framework of analysis

The theories linking social capital to health suggest that the pathways of influence are different across levels. Individual-level trust has been hypothesized to influence health either directly, through emotional influences on health and well-being, or indirectly, through instrumental influences on access to resources that enhance health or allow more effective responses to illness. State-level trust is thought to explain patterns of political participation and policy-setting that are more egalitarian and welfare-promoting (Kawachi & Kennedy, 1999) or to predict when government programs are more effectively administered (Knack, 2002). It is natural to assume that aggregate levels of mistrust and trust have opposite effects on health. However, individual-level mistrust may have subtle differences from lack of trust in their relationship to health, which result in the following testable hypotheses.

Hypothesis related to health effects of individual-level trust and mistrust

In the emotional realm, viewing individual-level trust and mistrust as inverse forms of the same attitude seems sensible. It is in the instrumental consequences for health that trust and mistrust potentially diverge. Trust can serve as a "social lubricant" that facilitates the capacity to mobilize collective resources, thus improving general health or mental health indirectly. By contrast, mistrust has been shown to be a deterrent for using health care by exacerbating suspicions about the motives of the health care system or health care professionals. These deterrent effects are particularly pronounced for stigmatized conditions, such as mental health problems (Whaley, 2001). In rural China, where mental health care systems are not robust, mistrust may undermine a person's mental health by deterring him or her from seeking informal support networks to cope with mental illness. We anticipate that individual-level trust will affect health positively and individual-level mistrust will affect health negatively, with the negative health effects of mistrust more evident for mental health.

Hypothesis related to additional health effects of aggregate-level trust and mistrust

Once one introduces the distinction between trust and mistrust, a complete taxonomy of aggregate-level social capital includes four types of collective contexts: (1) high-trust and low mistrust villages, (2) high-trust and high-mistrust villages, (3) low-trust and low mistrust villages, and (4) low-trust and high-mistrust villages (Fig. 1). In villages with high-trust and low mistrust, everyone gets along happily and peacefully. This is the social capital ideal, which we call 'communal'. In villages that have both high trust and high mistrust, neighbors are seen as both helpful and hurtful,

Intensity of Aggregate Trust	Intensity of Aggregate Mistrust: Low	Intensity of Aggregate Mistrust: High
Low	Disconnected	Antagonistic
High	Communal	Mixed-motive

Fig. 1. Taxonomy of villages by prevailing levels of trust and mistrust.

perhaps keyed to different circumstances. We call these villages 'mixed-motive'. In villages with low-trust and low mistrust, neighbors have disinterested exchanges, but feel no threat from others. We call these villages 'disconnected'. In villages with low-trust and high mistrust, social interaction has become not just distant, but hostile, and people compete for scarce resources. We call these villages 'antagonistic'. One would expect aggregate-level social capital to be highest in communal villages and lowest in antagonistic villages. We expect that compared to people in communal villages, residents in the three other types of villages will experience worse health and that this negative effect will be most pronounced for people in antagonistic villages.

Hypothesis related to interactive effects across two levels of trust and mistrust

When the pathways through which social capital influences health are distinct across different levels, one would expect individual and aggregate social capital to have ***independent*** effects on well-being. There are two possible alternative forms of interaction: ***substitution*** (either individual or aggregate social capital is related to health when taken in isolation from one another, but once one is present, the other contributes no additional health benefit) and ***positive interaction*** (the health effect is most pronounced when both individual and aggregate social capital are present). The potential interactive relationship depends on how trust and mistrust affect health. If the principal pathways that link trust to health are through emotional responses, one might expect substitution effects between the two levels because the positive effect could be produced by either personal feelings of trust or a trustworthy environment. On the other hand, if mistrust undermines health primarily through its instrumental effects—that is, by hindering access to collective resources—then one might expect individual and aggregate mistrust to have a positive interaction, the former associated with reduced collective resources, the latter with an individual's inability to tap into those resources.

The complex cross-level interactive effects can be examined by the relative role of individual-level trust and mistrust in the four types of villages. Obviously, if individual and aggregate effects are independent, these community characteristics become irrelevant for predicting the effects of individual-level trust and mistrust. If trust reflects substitution and mistrust reflects positive interaction, as hypothesized, one ought to observe the following patterns. First, the positive effects of individual-level trust ought to be found in disconnected and antagonistic villages, since low levels of village-level trust mean that the primary emotional benefits to well-being are generated

through individual perceptions. Second, the strongest negative effects of individual-level mistrust ought to be in mixed-motive and antagonistic villages, since these villages have high village-level mistrust, a prerequisite for positively interacted health effects.

Methods

Data and sampling

We drew data for this analysis from the baseline household survey of the Rural Mutual Health Care Project conducted in October 2002 (Hsiao et al., 2004). China has four main levels of administration: provinces, counties, townships, and villages. The survey was conducted in five townships in Guizhou and Shanxi provinces. The survey population was chosen through multi-stage sampling. First, 22 villages were chosen randomly from selected townships. Then, all 'high health-risk' households and about one out of three of the remaining households in each selected village, chosen at random, were included. 'High health-risk' households were defined as those with members who were single and elderly, had dementia or were disabled, had been pregnant in the previous year or at the time of interview, had serious medical conditions, or had been hospitalized in the previous year. Once a household was selected, all household members aged 15 years or older were surveyed. If a household member could not be reached in three visits, the household head answered the questionnaire for that member.

The survey included 10,643 subjects 15–85 years of age. The final sample used in this paper is 9608, after we excluded 1064 people (9.9%) who did not answer all questions.

Measurement of health and independent variables

Health measures

This study employs a self-reported general health measure and a proxy measure for mental health. *Self-rated health* (SRH) was assessed on a five-point Likert scale on which respondents rated their health as very good (1), good (2), fair (3), poor (4), and very poor (5) compared to people their own age. SRH has been shown to be significantly associated with mortality, even after controlling for medical diagnoses (Hornbrook & Goodman, 1996; Idler & Benyami, 1997).

Self-rated mental health (SRMH) was measured crudely using a question from the depression/anxiety dimension of the EQ-5D. The severity of depression/anxiety was assessed on a three-point Likert scale: no problem at all (1), moderate problems (2), severe problems (3). We did not validate the SRMH measure, but it has been found to be significantly associated with a validated measure of mental health, the mental component score from the SF-12 (Johnson & Coons, 1998; Ware, Kosinski, & Keller, 1996).

Social capital measures

Trust and mistrust were measured using 10 statements about attitudes toward social interaction (Table 1). These statements were based on the trust section of the Integrated Questionnaire for the Measurement of Social Capital (Grootaert, Narayan, Jones, & Woolcock, 2003), and the wording was adjusted to the context of rural China. The study subjects were asked to express their agreement with these 10 statements on a five-point Likert scale from strongly disagree to strongly agree. Two statements (Q2 and Q3) are mistrust measures, focusing on the negative perceptions that other people are self-interested and will take advantage of others for their own benefits. The remaining statements (Q1, Q4–Q10) are various trust measures. Principle component analysis on the 10 statements returned two factors, with 8 trust statements loaded on the first factor (eigenvalue 2.19, 0.94 of variance) and 2 mistrust statements loaded on the second factor (eigenvalue 0.59, 0.25 of variance). Q9 and Q10 were excluded in the subsequent analysis to avoid ambiguity since they were modestly loaded on both factors.

At the individual level, *trust* was constructed by aggregating the six trust items using the factor scores. *Mistrust* was comparably constructed using the two mistrust items. Five trust categories and five mistrust categories were formed to examine the possible non-linear health effects. The reference group of trust (*Trust Level 1*) included all people with a trust index of 10.5 or lower. Each higher category of trust was formed with an additional 1.5 unit increase (*Trust Level 2–Trust Level 5*). The reference group of mistrust (*Mistrust Level 1*) was those who reported a mistrust index score of 1.8 or lower. A higher category of mistrust was created for each 0.8 unit increase in mistrust (*Mistrust Level 2–Mistrust Level 5*).

Table 1
Factor loadings on ten social capital items

		Factor 1	Factor 2	Contribution to factors
Q1	I can trust most residents in my village.	**0.57**	0.03	0.27
Q2	Most village residents are self-interested and do not care about what happens to other people.	−0.24	**0.50**	0.21
Q3	My village is a place where I can never be too careful because most residents will take advantage of other people for their own benefit.	−0.24	**0.51**	0.24
Q4	If someone in my village needs help, most other village residents will help him/her.	**0.55**	0.05	0.26
Q5	Most other residents will return a lost outfit to its owner.	**0.47**	0.13	0.20
Q6	If my neighbor needs to borrow money to see a doctor, I will lend it to him/her.	**0.53**	0.11	0.24
Q7	If you describe my village as a big family, I think I am a family member.	**0.53**	−0.02	0.23
Q8	I can trust most of my neighbors.	**0.64**	−0.02	0.33
Q9	I will contribute financially to a project that will benefit the village even if I may not benefit from it directly.	0.34	0.16	0.20
Q10	I am willing to save my money in a credit union managed by the village officials.	0.25	0.15	0.16

The values in bold in column 'Factor 1' and column 'Factor 2' indicate those items that will be used to construct each of the two factors.

Continuous measures of *village trust* and *village mistrust* were simply the village averages of the individual indices. Using mean levels of *village trust* and *village mistrust* as the cut points, four categories of villages based on combined village-level trust and mistrust were formed: *communal villages* (high trust and low mistrust), *mixed-motive villages* (high trust and high mistrust), *disconnected villages* (low trust and low mistrust), and *antagonistic villages* (low trust and high mistrust).

Control variables

This study considered a wide range of control variables, including demographic information, socioeconomic status, physical accessibility to health services, presence of pre-survey chronic conditions, and survey-design effects.

Age was introduced in the model as seven dichotomous variables, with 10-year cohorts defining each group. *Marital status* was grouped into three categories, married, single, and separated or other. *Family size* was used as a proxy for within-family social networks and defined as the number of people who maintain long-term residence in the household.

Education responses were grouped into three categories: illiterate, those who finished elementary school, and those who finished middle school or higher levels of education.

Income was introduced in this study using average annual non-medical expenditure per person in the household as a proxy. Current expenditure can be a better measure of permanent income in rural areas because monetary incomes tend to be quite volatile (Narayan & Pritchett, 1999), and reliable current income of self-employed peasants is tremendously difficult to get (Deaton, 1997). Medical expenditure was excluded from the proxy measure of income to exclude the potentially endogenous effects of health and medical spending.

Wealth index was measured by an index constructed from principle component analysis of 12 items indicating ownership of household durables and dwelling characteristics. The items include whether the household had a color TV, motorcycle, refrigerator, washing machine, automobile, sewing machine, telephone, or radio; whether the family house was made of brick and cement; whether bedrooms were separate from the kitchen; whether tap water was available; and whether residents used a flushed toilet. This methodology is recommended for measuring the living standards in contexts similar to rural China (Montgomery, Gragnolati, Burke, & Paredes, 2000).

Physical access to health facilities was captured by the *distance to the nearest village health post* and the *distance to the township health center* because rural residents mainly go to these health facilities for preventive medicine or outpatient visits.

Pre-survey chronic condition was a dummy variable indicating whether respondents had any of the six categories of chronic conditions: arthritis, back pain, sight problems, hearing problems, speaking problems, and deformity in limbs.

Survey-design effects included two variables indicating whether the respondents were from defined *high health-risk households* or whether they answered the questionnaire themselves (*self-answered questionnaire*).

Stages of analysis

Ordered logistic regression models were used for both SRH and SRMH measures. All regressions were performed using SURVEYLOGISTIC procedures in SAS software package, version 9.1. The SURVEYLOGISTIC procedures provide us with robust estimators by adjusting standard errors to reflect the correlations of error terms among people from the same cluster (village and household) or strata (high health-risk households vs. other). Because high health-risk households were oversampled, we conducted weighted analyses to adjust the unequal probability of people from different strata being included. We estimated the following models using comparable control variables on both health measures.

(1) A model that included only individual-level trust and mistrust measured in either continuous (**model 1a**) or categorical (**model 1b**) forms.

(2) A model that included trust and mistrust at both individual and village levels measured in either continuous (**model 2a**) or categorical (**model 2b**) forms. The categorical forms of village-level social capital were captured by the four types of villages: communal, mixed-motive, disconnected, and antagonistic.

(3) A model with individual-level trust and mistrust included as either indices (**model 3a**) or categories (**model 3b**) was estimated in each of the four types of villages. We conducted the stratified analysis to explore cross-level interaction effects because the data contains a limited number of villages to support too many interaction terms.

We also examined the robustness of the stratified analyses results under five alternative model specifications: restricting the sample to respondents 15–65 years old, using an alternative pre-survey chronic conditions measure that included all chronic conditions, excluding the pre-survey chronic conditions variable, using an alternative income measure including medical expenditure, and excluding all proxy respondents.

Results

Descriptive statistics

Respondent characteristics are presented in Table 2. The sample was balanced in gender. Only 8.8% of the subjects was older than 65. Seventy-three percent of the sample was married, and 92% lived in a household of three or more people. About a quarter of the sample did not finish elementary school. Average per person income was 1680 Yuan (US$210), lower than the average per capita income of 2210 Yuan ($275) in rural China in 1999 (National Bureau of Statistics of China, 2000). People from 'high health-risk' households accounted for 27% of the sample. Sixty-three and one-half percent of the respondents provided

Table 2
Descriptive statistics of the variables in the model ($n = 9608$)

Variables		Percent/mean
Health measures		
Self-rated health	Very good	14.2%
	Good	25.9%
	Fair	41.3%
	Poor	16.1%
	Very poor	2.5%
Self-rated mental health	No problem	80.6%
	Moderate	17.1%
	Severe	2.3%
Social capital measures		
Trust		13.8/2.1
Mistrust		2.8/1.2
Trust categories		
Trust level 1	4–10.5	7.7%
Trust level 2	10.5–12	10.8%
Trust level 3	12–13.5	21.5%
Trust level 4	13.5–15	28.4%
Trust level 5	15–16.5	31.7%
Mistrust categories		
Mistrust level 1	1–1.8	21.0%
Mistrust level 2	1.8–2.6	26.8%
Mistrust level 3	2.6–3.4	19.9%
Mistrust level 4	3.4–4.2	20.5%
Mistrust level 5	4.2–5.1	11.8%
Combined village trust/mistrust		
High trust low mistrust	Communal	32.3%
High trust high mistrust	Mixed-motive	23.5%
Low trust low mistrust	Disconnected	19.4%
Low trust high mistrust	Antagonistic	24.9%
Village trust		13.8/0.96
Village mistrust		2.8/0.42
Control variables		
Age	15–25	19.2%
	25–35	23.5%
	35–45	20.3%
	45–55	17.1%
	55–65	11.1%
	65–75	6.2%
	75–85	2.6%
Female		47.0%
Married	Married	72.6%
	Single	20.6%
	Separate and other	6.8%
Education	Illiterate	24.4%
	Elementary school	38.4%
	Middle school+	37.2%
Family size	1	1.5%
	2	7.2%
	3	18.7%
	4	30.6%
	5	24.1%
	6+	17.9%
Income (thousands)		1.68/1.53
Wealth index		1.16/0.84
Distance to village health post		0.98/1.07
Distance to town health center		5.23/3.29
Pre-survey chronic conditions	Yes	19.4%
High health-risk household	Yes	27.5%
Self-answered questionnaire	Yes	62.5%

information for themselves. Both health measures had skewed distribution, with 2.5% reporting very poor health and 2.5% reporting severe mental health problems. The distribution of *trust* was skewed, with a mean score of 13.8 (4.4–16.5). *Mistrust* was more evenly and symmetrically distributed, with a mean score of 2.8 (1.01–5.01). Villages with a high level of trust were more likely to have a low level of mistrust (32.3%) and vice versa (23.5%), but a substantial number of people were from each of the four strata of villages. Overall, the distribution of trust and mistrust at both levels reflected sufficient variation to adequately power the proposed analyses. The correlation coefficients between independent variables are generally small or moderate, but none of these correlations are so high as to raise undue concerns about multi-collinearity.

Regression results

The regression coefficients and statistical significance for control variables were similar across all model specifications, so are reported only for the simplest model specification (**model 1a**) in Table 3. The results for trust and mistrust measures in models **1a**, **1b**, **2a**, and **2b** are consolidated and presented in Table 4. Results from **model 1a** show that individual-level trust was strongly and positively related to both SRH [OR = 1.06, 95% CI (1.02, 1.09)] and SRMH [OR = 1.11, 95% CI (1.07, 1.16)]. Individual-level mistrust was negatively associated with SRMH [OR = 0.89, 95% CI (0.83, 0.95)] as hypothesized, but it was not significantly associated with SRH. The results of **model 1b** indicate a non-linear relationship of trust to health, with significant effects shown only for the top two trust categories on SRH and the top three trust categories on SRMH. Although all mistrust categories were significantly related to SRMH, there were some gradient health effects of mistrust indicating a non-linear effect.

The health effect of individual-level trust disappeared once village trust was incorporated in the model (**model 2a**). Village trust was shown to be positively related to both SRH [OR = 1.21, 95% CI (1.12, 1.31)] and SRMH [OR = 1.59, 95% CI (1.43, 1.76)], suggesting a cross-level substitution effect for trust. Among the mistrust measures, individual-level mistrust was consistently and negatively related to SRMH [OR = 0.83, 95% CI (0.78, 0.90)] when we added village mistrust in the model. Village mistrust, however, was positively associated with SRMH [OR = 1.61, 95% CI (1.30, 2.01)].

Results from **model 2b** confirmed that the significant association between individual-level trust and SRH disappeared after combined village-level trust and mistrust items were added in the model. These village characteristics were significantly related to health, after controlling for individual-level mistrust and trust. Contrary to expectations, however, the largest differences in SRH and SRMH emerged between communal and disconnected villages, not between communal and antagonistic villages. The significant anomalistic results involving village mistrust on SRMH were limited to mixed-motive villages.

The specific pattern of cross-level interaction can be better understood through the stratified analysis results in Table 5. Results from **model 3a** and **model 3b** suggest that the impact of individual-level trust and mistrust was powerfully mediated by the prevalence of these aspects of social capital at the village level. In antagonistic settings, individual-level trust and mistrust each predicted health; higher levels of trust were associated with improved health

Table 3
Ordered logistic regression results of health on individual-level trust and mistrust

	SRH		SRMH	
	OR	95% CI	OR	95% CI
Age 25–35	0.79*	0.65, 0.95	0.62*	0.43, 0.89
Age 35–45	0.55*	0.46, 0.67	0.39*	0.27, 0.57
Age 45–55	0.53*	0.43, 0.65	0.37*	0.25, 0.53
Age 55–65	0.44*	0.35, 0.56	0.35*	0.23, 0.53
Age 65–75	0.47*	0.35, 0.62	0.35*	0.22, 0.54
Age 75–85	0.51*	0.35, 0.73	0.27*	0.16, 0.46
Female	0.91*	0.85, 0.97	1.04	0.95, 1.14
Single	1.19	0.93, 1.54	1.50*	1.01, 2.22
Married	0.98	0.81, 1.19	0.95	0.73, 1.23
Elementary school	1.08	0.95, 1.23	1.10	0.93, 1.30
Middle school and above	1.22*	1.05, 1.42	1.31*	1.06, 1.61
Family size	1.02	0.97, 1.07	0.93*	0.87, 0.98
Income (thousands)	1.00	0.96, 1.04	0.94*	0.90, 0.99
Wealth index	1.21*	1.11, 1.31	1.27*	1.13, 1.43
Distance to village health post	0.91*	0.85, 0.97	0.97*	0.91, 1.04
Distance to town health center	0.94*	0.92, 0.95	0.97*	0.95, 0.99
Pre-survey chronic conditions	0.32*	0.26, 0.38	0.35*	0.28, 0.43
High health-risk household	0.59*	0.52, 0.67	0.42*	0.36, 0.49
Self-answered questionnaire	0.70*	0.63, 0.77	0.38*	0.33, 0.45
Trust	1.06*	1.02, 1.09	1.11*	1.07, 1.16
Mistrust	0.99	0.94, 1.04	0.89*	0.83, 0.95

*Significant at 0.05 level.

Table 4
Ordered logistic regression results of health on social capital variables in four models

	SRH		SRMH	
	OR	95% CI	OR	95% CI
Model 1a				
Trust	1.06*	1.02, 1.09	1.11*	1.07, 1.16
Mistrust	0.99	0.94, 1.04	0.89*	0.83, 0.95
Model 1b				
Trust level 2	1.09	0.86, 1.38	1.32	0.98, 1.79
Trust level 3	1.21	0.96, 1.52	1.49*	1.13, 1.98
Trust level 4	1.41*	1.12, 1.77	1.78*	1.34, 2.36
Trust level 5	1.36*	1.07, 1.72	1.96*	1.47, 2.62
Mistrust level 2	0.97	0.82, 1.14	0.80*	0.63, 1.00
Mistrust level 3	0.91	0.76, 1.09	0.69*	0.54, 0.88
Mistrust level 4	0.81*	0.68, 0.97	0.69*	0.54, 0.88
Mistrust level 5	1.05	0.86, 1.29	0.63*	0.47, 0.84
Model 2a				
Trust	1.03	0.99, 1.06	1.04	1.00, 1.09
Mistrust	1.00	0.95, 1.05	0.83*	0.78, 0.90
Village trust	1.21*	1.12, 1.31	1.59*	1.43, 1.76
Village mistrust	0.87	0.74, 1.02	1.61*	1.30, 2.01
Model 2b				
Trust level 2	1.05	0.82, 1.34	1.26	0.93, 1.70
Trust level 3	1.13	0.89, 1.43	1.35*	1.02, 1.78
Trust level 4	1.23	0.97, 1.57	1.40*	1.05, 1.86
Trust level 5	1.12	0.87, 1.44	1.26	0.93, 1.69
Mistrust level 2	1.00	0.85, 1.18	0.79*	0.62, 0.99
Mistrust level 3	0.94	0.78, 1.13	0.65*	0.51, 0.83
Mistrust level 4	0.84	0.70, 1.01	0.59*	0.46, 0.76
Mistrust level 5	1.11	0.89, 1.37	0.46*	0.34, 0.62
Communal villages	1.00		1.00	
Mixed-motive villages	0.79*	0.65, 0.95	2.49*	1.82, 3.41
Disconnected villages	0.46*	0.39, 0.55	0.42*	0.33, 0.54
Antagonistic villages	0.56*	0.47, 0.67	0.46*	0.37, 0.59

Note: the regression results controlled all variables in model 1a as presented in Table 3.
*Significant at 0.05 level.

and higher levels of mistrust with impaired health. In contrast, individual-level trust and mistrust were not consistent predictors of general health in communal cultures, with a minor anomaly (people with the highest levels of mistrust were healthier than those with the lowest levels of mistrust from **model 3b**). The findings from the other two strata of villages suggest the distinctive health effects of trust and mistrust. The health influence of individual-level trust was not evident in either mixed-motive villages or disconnected villages. The negative health influence of individual mistrust on SRH and SRMH in both mixed-motive and disconnected villages was pronounced, not evident only on SRH in mixed-motive settings. In fact, results in mixed-motive villages indicated positive association between individual-level mistrust and SRH when using mistrust categories. Overall, the stratified results suggest a cross-level substitution for trust (since individual-level trust had the strongest association with health in antagonistic settings where village trust is low) and a cross-level positive interaction for mistrust (since individual-level mistrust had consistent negative association with SRMH in high-mistrust villages). The stratified analysis results were consistently repeated in the sensitivity analyses under five alternative specifications (results available upon request).

Not surprisingly, better health was more likely to be reported by those who were young, single, or male, and by those who lived in a big family. Among the set of socioeconomic variables, higher education and a greater household wealth index were significantly associated with better health. Higher income was not related to general health but was associated with worse mental health. The finding about income may also be due to a larger measurement error or a substantive difference in the health effect of current income and that of permanent income. People who had chronic diseases, were from a high-risk household, lived farther from medical facilities, or answered the questionnaire themselves were more likely to report poorer health.

Discussion

This study advances our understanding of the relationship between social capital and health in various ways. This study suggests that in rural developing contexts, social capital—as measured by interpersonal trust and mistrust—predicts health outcomes. The relevance of trust for health policy extends beyond advanced market economies or urbanized settings in developing countries. The study further suggests that only when the personal trust level reaches a certain point does it start to be associated with health. In the context of rural China, the cutoff point for trust is slightly above the mean (14.5) for general health and slightly lower than the mean (13.5) for mental health. This finding supports the current practice of modeling trust in a binary manner.

This study suggests a health effect of mistrust separate from that of trust. The individual-level effects of mistrust are more pronounced for mental health than for general health. Mistrust is more linearly related to the mental

Table 5
Ordered logistic regression results of health on individual-level trust and mistrust in four groups of villages

	Individual-level trust and mistrust	Village-level trust and mistrust							
		Communal		Mixed-motive		Disconnected		Antagonistic	
		OR	95% CI	OR	95% CI	OR	95% CI	OR	95% CI
SRH	Model 3a								
	Trust	1.04	0.97, 1.11	0.98	0.91, 1.05	1.01	0.95, 1.07	1.06*	1.01, 1.11
	Mistrust	1.09	0.98, 1.21	1.05	0.95, 1.17	0.80*	0.70, 0.90*	0.91	0.83, 1.01
	Model 3b								
	Trust level 2	0.69	0.28, 1.66	1.36	0.62, 2.98	0.66	0.43, 1.02	1.19	0.90, 1.58
	Trust level 3	0.79	0.36, 1.75	1.70	0.84, 3.41	0.73	0.49, 1.10	1.20	0.91, 1.60
	Trust level 4	0.62	0.28, 1.38	1.41	0.89, 2.25	0.85	0.56, 1.29	1.50*	1.10, 2.03
	Trust level 5	0.78	0.35, 1.72	1.35	0.71, 2.58	0.80	0.50, 1.28	1.36	0.93, 1.97
	Mistrust level 2	1.00	0.77, 1.30	2.09*	1.29, 3.39	0.78	0.56, 1.10	0.49*	0.36, 0.67
	Mistrust level 3	1.34	0.87, 2.06	2.03*	1.06, 3.87	0.51*	0.35, 0.76	0.41*	0.29, 0.57
	Mistrust level 4	0.84	0.59, 1.21	1.55*	1.13, 2.13	0.51*	0.34, 0.75	0.53*	0.38, 0.74
	Mistrust level 5	2.14*	1.39, 3.30	1.43	0.94, 2.17	0.52*	0.32, 0.86	0.67*	0.45, 0.99
SRMH	Model 3a								
	Trust	0.91	0.80, 1.02	1.09	0.98, 1.21	1.05	0.97, 1.14	1.07*	1.00, 1.15
	Mistrust	0.86	0.73, 1.03	0.77*	0.64, 0.93	0.79*	0.69, 0.90	0.77*	0.68, 0.88
	Model 3b								
	Trust level 2	0.61	0.11, 3.52	0.66	0.21, 2.12	0.85	0.51, 1.41	1.78*	1.19, 2.65
	Trust level 3	0.95	0.19, 4.88	0.49	0.16, 1.49	0.85	0.52, 1.40	1.87*	1.28, 2.74
	Trust level 4	0.88	0.17, 4.49	0.60	0.22, 1.59	1.03	0.61, 1.72	1.99*	1.33, 2.97
	Trust level 5	0.64	0.12, 3.27	0.93	0.34, 2.50	0.98	0.55, 1.76	1.34	0.85, 2.10
	Mistrust level 2	1.09	0.71, 1.68	0.11*	0.03, 0.41	0.72	0.48, 1.08	0.53*	0.34, 0.83
	Mistrust level 3	1.02	0.62, 1.68	0.09*	0.03, 0.33	0.47*	0.29, 0.74	0.51*	0.33, 0.81
	Mistrust level 4	0.86	0.52, 1.43	0.07*	0.02, 0.22	0.42*	0.26, 0.68	0.62*	0.39, 0.97
	Mistrust level 5	0.50	0.20, 1.26	0.09*	0.03, 0.30	0.76	0.42, 1.39	0.24*	0.15, 0.40

Note: the regression results controlled all variables in model 1a as presented in Table 3.
*Significant at 0.05 level.

health measure, while health effects emerge only on the highest levels of trust. In general, mistrust effects are more pronounced and consistent at the individual level, while trust effects are more pronounced at the village level. These findings, together with the fact that individual-level trust and mistrust have differential effects in various village contexts, support the hypothesis that mistrust influences health separately from trust. The separate health effects of trust and mistrust in turn support the hypothesized differential pathways in the context of rural China: trust is linked to health directly from emotional connectedness while mistrust may be more likely to be linked to health through instrumental channels. The distinctive health effects of trust and mistrust also reinforce the practice to treat mistrust as a different concept from absence of trust when examining their links to health.

The empirical results support the conclusion reached by other researchers about the interactions between individual trust and aggregate trust on health (Poortinga, 2006a; Subramanian et al., 2002). But our findings suggest that the interactions between individual trust and aggregate trust in rural developing settings may be different from those in developed countries. Subramanian and Poortinga found a positive interaction between individual and aggregate trust, rather than the substitution effects that we identified. This difference may reflect differences in causal pathways. In developed countries, aggregate trust may be related to the generosity and effectiveness of government programs, whose effective use may require high levels of trust at the individual level. In contrast, aggregate trust in a village may more closely substitute for individual-level trust, working through emotional connectedness.

The consistent anomaly in these results involves mistrust: village-level mistrust is positively related to mental health, whereas individual-level mistrust is positively related to general health in mixed-motive villages. The data in this study offers some clues to understanding the social dynamics of mixed-motive villages. There is little correlation between trust and mistrust reported by individuals in mixed-motive villages. This finding suggests that the mixed attitudes involving trust in these villages occur not because people are trusting and distrusting others at the same time, but because residents trust some of their neighbors but not others. This scenario might occur if these villages were divided into high-trust and high-mistrust "camps". A close-knit circle of allies could be even more beneficial for a mistrusting individual's general health if there is also a group of antagonists in the same locale, though the reasons for the protective effects of village-level mistrust on mental health remain obscure.

The levels of impact for trust and mistrust and their distinctive health effects, which are delineated in our findings, have important policy implications for rural China. The results suggest that trust is similarly associated with general health and mental health at the village level. However, mistrust is consistently related to only the mental health measure at the individual level. Social capital policies can only be successful when the effective level of interventions is ascertained. The findings in this study suggest that effective policies in rural China should target building a trusting environment to improve general health and reducing interpersonal mistrust to improve mental well-being.

Limitations

These findings must be considered in light of the following methodological limitations. First, the analysis was based on cross-sectional association between social capital and health measures and is limited in its ability to pin down direction of causality. It is possible that health status affects people's perception of trustworthiness of their neighbors.

Second, the small number of villages and thus limited variance in aggregate social capital restricts extensive exploration of contextual factors. It also prevents the use of hierarchical linear modeling to delineate contextual effects from individual effects. Bearing in mind the data limitation, we applied random effects models, which suggested a consistent pattern of association to our major findings (results available upon request).

Third, there are certain limitations in measures of mistrust, mental health, and village social capital. While the two mistrust questions are similar to questions from the Cynical Distrust Scale, the validity of measuring the mistrust index as a distinctive set of attitudes is subject to further examination. The proxy mental health measure used is crude, and it will be more convincing using objective or validated measures of mental health. Although it is not uncommon for researchers to use the aggregate measures of individual-level indices as a proxy for a collective measure of social capital (Poortinga, 2006a), this method is subject to potential measurement error. A further concern is that aggregated measures are heavily correlated with their individual counterparts, which can cause biased estimation due to multi-collinearity. To examine the severity of such a problem, we checked the Variance Inflation Factor (VIF) scores for trust, mistrust, village trust, and village mistrust. The VIF scores for the four measures are all smaller than two, suggesting multicollinearity is not severe enough to bias the estimation results (Allison, 1999).

In addition, an endogeneity problem may emerge from the subjectively measured social capital and health status. If people who feel well are more likely to report higher levels of trust, the model could exaggerate the effect of trust on health. Similarly, endogeneity may exist between self-reported health and self-reported chronic conditions. Since the magnitude of the coefficient for chronic conditions is not the major concern of this study, this type of endogeneity is problematic for our analysis only if chronic conditions relate to social capital. Specifically, if chronic conditions mediate the health effects of trust, the association between trust and health could be underestimated by overcontrolling chronic conditions in the model.

Lastly, selection bias due to non-response and proxy answers may exist in this study. A majority of the proxy answers gathered for people not at home during the interview would be for migrant workers in the cities. Analysis excluding this population provided consistent results with findings using the whole sample. However, direct responses

from this population are necessary for accurate results. Those excluded from this study because they did not answer all questions are more likely to be single, have chronic conditions, and have lower income, thus the study results may not be generalizable to all rural Chinese.

These limitations notwithstanding, this study provides empirical evidence for an important distinction between trust and mistrust and their particular effects on health. The results suggest that policies aimed at enhancing positive social norms collectively and reducing negative perception individually are promising in improving the health of the Chinese rural population.

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