

RESEARCH REPORT

Bonding versus bridging social capital and their associations with self rated health: a multilevel analysis of 40 US communities

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J Epidemiol Community Health 2006;**60**:116–122. doi: 10.1136/jech.2005.038281

Study objective: Few studies have distinguished between the effects of different forms of social capital on health. This study distinguished between the health effects of summary measures tapping into the constructs of community bonding and community bridging social capital.

Design: A multilevel logistic regression analysis of community bonding and community bridging social capital in relation to individual self rated fair/poor health.

Setting: 40 US communities.

Participants: Within community samples of adults (n=24 835), surveyed by telephone in 2000–2001.

Main results: Adjusting for community sociodemographic and socioeconomic composition and community level income and age, the odds ratio of reporting fair or poor health was lower for each 1-standard deviation (SD) higher community bonding social capital (OR=0.86; 95% CI=0.80 to 0.92) and each 1-SD higher community bridging social capital (OR=0.95; 95% CI=0.88 to 1.02). The addition of indicators for individual level bonding and bridging social capital and social trust slightly attenuated the associations for community bonding social capital (OR=0.90, 95% CI=0.84 to 0.97) and community bridging social capital (OR=0.96, 95% CI=0.89 to 1.03). Individual level high formal bonding social capital, trust in members of one's race/ethnicity, and generalised social trust were each significantly and inversely related to fair/poor health. Furthermore, significant cross level interactions of community social capital with individual race/ethnicity were seen, including weaker inverse associations between community bonding social capital and fair/poor health among black persons compared with white persons.

Conclusions: These results suggest modest protective effects of community bonding and community bridging social capital on health. Interventions and policies that leverage community bonding and bridging social capital might serve as means of population health improvement.

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Accepted for publication
18 October 2005

Social capital has been defined as the “resources embedded in a social structure which are accessed and/or mobilized in purposive actions”.¹ Other scholars have conceptualised social capital as the social networks themselves, or as both the network structures and the resources channelling through the networks.^{2–3}

Few empirical studies have distinguished between the effects of different forms of social capital on health.⁴ One distinction that has gained currency dichotomises social capital into “bonding” and “bridging” varieties. Bonding social capital is derived from relationships between similar persons (for example, those alike with respect to socio-demographic and socioeconomic characteristics), while bridging social capital is derived from dissimilar persons at the same level of hierarchy.^{2–5} “Linking” social capital is a more recently conceptualised form similar to bridging social capital, but is derived from relationships between persons across levels of hierarchy and power.³

In a recent study, Mitchell and LaGory⁶ examined the associations between measures of individual level bonding and bridging social capital with mental distress among 222 (80% African American) residents in a high poverty, racially segregated urban neighbourhood in a southern US city. No measures of social capital at the group level were analysed. While a modest inverse relation was seen between bridging social capital and mental distress, bonding social capital was significantly but positively associated with distress. This unexpected finding for bonding social capital was attributed to excessive obligations placed on individuals' time and resources through social participation, thereby contributing

to negative mental health consequences.⁶ Notably, the measure of bonding social capital used in the study was based upon overall levels of participation in formal community organisations, political activities, and volunteering, and was not restricted to organisations that shared the same characteristics such as race/ethnicity, sex, and education as the respondent (whereas for the measure of bridging social capital, these characteristics were incorporated).

Mechanisms by which social capital may be linked to health include the faster diffusion of knowledge about health related innovations, maintenance of healthy norms, promotion of access to local services and amenities, and contributions to psychosocial processes that provide affective support and mutual respect.^{1–8} Plausibly, bonding social capital may operate through any of these mechanisms, if characteristics shared between individuals act as motivators of behavioural change, solidarity, and/or social support. For example, persons may be more likely to conform with behavioural norms through modelling of others' behaviours, when the persons perceive similarities and can identify with the role models.^{9–10} Likewise, bridging social capital may yield health benefits through these mechanisms as a result of acquired assets and information stemming from dissimilarities between individuals. For instance, communities high in bridging social capital that aim to improve local services may conceivably access a wide range of informational resources,² and achieve strong political influence through the sociodemographic and socioeconomic diversity of its social networks.

To investigate some of the existing gaps in the empirical literature on social capital and health, for this study, we

derived measures of bonding and bridging social capital from the 2000 Social Capital Community Benchmark Survey, both at the community and individual levels. Applying a multilevel approach, we sought to: (1) examine whether community bonding and community bridging social capital may exert beneficial contextual effects on health, after accounting for individual level compositional characteristics (including individual level social capital) and community level socio-economic status (SES) and age; (2) assess whether community bonding and community bridging social capital act independently, or interact with one another to produce their health effects; and (3) explore whether the estimated health returns of community bonding and community bridging social capital vary by individual level characteristics (sex, race/ethnicity, income, and social capital).

METHODS

Details of the 2000 Social Capital Community Benchmark Survey have previously been described.^{11, 12} In brief, this survey sampled 40 US communities to establish benchmark levels of community social capital. Of the foundations that attended an annual meeting of US community foundations in 1999 and that subsequently applied, 34 were selected that broadly represented the diversity of communities across the country. Most samples ranged from 500 to 1500 interviews. Random digit dialling telephone interviews were conducted in 2000–2001. Participation rates within community samples varied from 30.2% to 57.2%.¹¹ For most communities, the survey area was a single county or a cluster of contiguous counties. Four community samples corresponded to entire states (Montana, Indiana, New Hampshire, and Delaware).

Dependent variable

The dependent variable was based upon the self reported overall health status of individuals, in response to the question: “How would you describe your overall state of health these days? Would you say it is excellent, very good, good, fair, or poor?” The five response categories were collapsed into a dichotomous outcome: 0 for excellent, very good, or good health and 1 for fair or poor health. Previous longitudinal studies have shown global self rated health to be an independent strong predictor of overall mortality.¹³

Independent variables

Key individual level sociodemographic (age, sex, race/ethnicity, marital status), socioeconomic (educational attainment, income), and social capital characteristics were included as control variables in the multilevel regression models. To derive the community level measures of social capital, survey items were used on formal group involvement; the respondent’s stated most important formal group and how its composition was characterised in terms of race/ethnicity, sex, and education; the level of trust in members of one’s race/ethnicity; the diversity of friendship in one’s social network; and the number of times one had invited or been

invited to the home of a person of a different race/ethnicity over the previous year.

The measure of formal group involvement was derived from survey item responses to: one’s participation in 19 different types of formal groups, including neighbourhood associations, seniors’ groups, labour unions, and organisations affiliated with religion. The measure of diversity of friendships was a count of the number of different kinds of personal friends of the respondent, including having a friend who owns their own business, has been on welfare, is white, Hispanic, Asian, or African American, or has a different religious orientation.¹¹

Community bonding social capital was then calculated as the mean of (1) the standardised proportion of individuals in the community sample that was both at or above the national median on the number of formal group involvements and for whom most of the respondent’s stated most important formal group was similar to the respondent on race/ethnicity, sex, and education; and (2) the standardised community mean level of trust in members of one’s racial/ethnic group. Community bridging social capital was calculated as the mean of (1) the standardised proportion of people in the community sample that was both at or above the national median on the measure for formal group involvement and for whom the majority of the respondent’s most important formal group was dissimilar to the respondent on race/ethnicity, sex, and education; (2) the standardised community mean number of times one had invited or been invited to the home of a person of a different race/ethnicity; and (3) the standardised community mean level of diversity of friendships. To generate community level proportions and means, individual level measures were weighted according to previously assigned survey weights.¹¹ A prior study similarly aggregated survey responses (on individual level perceptions of trust) to construct a neighbourhood measure. Even after accounting for individual level sociodemographic and socioeconomic characteristics, significant neighbourhood differences in individual trust remained, substantiating the aggregate social capital measure as truly contextual.¹⁴

Table 1 shows the Pearson correlation coefficient matrix for the community bonding and bridging social capital indicators. A strong correlation was seen between the two indicators for community bonding social capital ($r = 0.60$), while fair to strong correlations were found between any pair of the three variables used to derive the measure of community bridging social capital (range: $r = 0.24–0.56$). The internal consistency reliability for the group of indicators comprising each measure of community social capital was relatively good (Cronbach’s $\alpha = 0.75$ for community bonding social capital, 0.67 for community bridging social capital).

Meanwhile, the constituent indicators for individual level bonding social capital and bridging social capital were uncorrelated (table 2; range of absolute values: $r = 0.09$ for bonding social capital, $r = 0.11–0.12$ for bridging social capital), with the exception of the diversity of friendships

Table 1 Pearson correlation coefficient matrix for community level social capital indicators (n = 40 communities)†

	Formal bond	Trust own	Formal bridge	Informal bridge	Diversity
Formal bond	1.00	0.60*	-0.55*	-0.62*	-0.04
Trust own	-	1.00	-0.61*	-0.67*	-0.03
Formal bridge	-	-	1.00	0.56*	0.24
Informal bridge	-	-	-	1.00	0.42*
Diversity	-	-	-	-	1.00

*Significant at a level of 0.05. †All variables represent community level continuous measures aggregated from individual level data (see Methods for a detailed description). Formal bond, formal bonding social capital; trust own, trust in members of one’s racial/ethnic group; formal bridge, formal bridging social capital; informal bridge, informal bridging social capital; diversity, diversity of friendships.

Table 2 Pearson correlation coefficient matrix for individual level social capital indicators*

	Formal bond	Trust own	Formal bridge	Informal bridge	Diversity
Formal bond	1.00	0.09	-0.10	-0.03	0.07
Trust own	-	1.00	-0.01	-0.01	0.08
Formal bridge	-	-	1.00	0.12	0.11
Informal bridge	-	-	-	1.00	0.42
Diversity	-	-	-	-	1.00

*All variables represent individual level continuous measures. Formal bond, formal bonding social capital; trust own, trust in members of one's racial/ethnic group; formal bridge, formal bridging social capital; informal bridge, informal bridging social capital; diversity, diversity of friendships. The sample sizes for the calculation of each of the correlation coefficients varied from 19 033 to 24 835 persons.

measure and the measure for home invitations to/from a person of a different race/ethnicity ($r = 0.42$). The former indicators were therefore included in models individually (as dichotomous variables, categorised using the median value), rather than being combined. The measures for diversity of friendship and home invitations to/from a person of a different race/ethnicity were standardised and then averaged to create a measure of informal bridging social capital. High formal bonding social capital was deemed present if the person was both at or above the median on the measure for formal group involvement and if most of the respondent's stated most important formal group was similar to the respondent on race/ethnicity, sex, and education. High formal bridging social capital was designated if the person was at or above the median on the measure for formal group involvement and if the majority of the respondent's most important formal group was dissimilar to the respondent on all of these characteristics. A dichotomous variable for individual level social trust was also controlled for in the analysis that included the individual level social capital variables.

Indicators of low community level SES (education, income) were constructed by deleting missing individual level observations for educational attainment (after excluding individuals under age 25) and for annual household income, and then calculating the proportion of people within each community that fell below a given level (<high school education for educational attainment, <\$20 000 for income).

Statistical analyses

Multilevel statistical models appropriately allow for the estimation of contextual effects of community level factors by accounting for the spatial clustering of individuals within communities.^{15 16} We estimated multilevel logistic models using the predictive/penalised quasi-likelihood approximation of a second order Taylor linearisation procedure.^{17 18} All models applied the logit link function, with the logarithm of the odds of fair/poor health as the dependent variable. Model coefficient estimates were subsequently converted into odds ratios (OR) with 95% confidence intervals (CI). The following multilevel models were developed in sequence:

Model 1

A two level model of persons (level 1) nested within US communities (level 2), including individual level sociodemographic variables and socioeconomic variables, community level SES, community mean age, and a dichotomous variable indicating whether the community sampled corresponded to an entire state.

Model 2

The same as model 1, but with additional terms to estimate the fixed effects associated with the community bonding and community bridging social capital variables (both modelled as continuous). Models 2A and 2B estimated the effects of

the two social capital forms in separate models, while model 2C examined their effects upon coadjustment.

Model 3

The same as model 2, but also included a term to represent the interaction between the two social capital forms.

Model 4

The same as model 2, but with dichotomous variables to estimate the fixed effects of individual level social trust, and of constituent indicators for individual level bonding and bridging social capital.

Models 5–8

The same as model 2, but included terms to represent the interactions between each of the community bonding and bridging social capital variables with the variables corresponding to individual level social capital (model 5), race/ethnicity (model 6), sex (model 7), and income (model 8).

RESULTS

After excluding missing data on self rated health and the individual level independent variables (with the exception of income, for which there was a comparatively large number of missing values), the study sample was comprised of 24 835 persons within 40 US communities. A total of 3596 of these persons did not respond to the survey items assessing formal group participation, and the corresponding observations were assigned to "missing" categories in the model analyses that included individual level social capital.

In table 3, the Pearson correlation coefficient matrix for the community social capital variables and the two community level SES variables is shown. A strong inverse correlation was seen between the two community social capital variables ($r = -0.60$). Moderate to strong inverse correlations were found between the variable for community bridging but not community bonding social capital with each of the variables for low community level educational attainment ($r = -0.70$ for bridging, $r = 0.13$ for bonding) and low community level income ($r = -0.43$ for bridging, $r = -0.05$ for bonding).

Table 4 shows the descriptive statistics for the final sample. 12.0% of respondents across all US communities reported their health as fair or poor. Apart from age, all individual level characteristics were modelled as categorical variables. The community level variables for social capital, educational attainment, and income were all analysed as continuous.

Table 5 presents the regression coefficient estimates from the multilevel models. For the model that included the main effects except those for community social capital (model 1), the between community variation in fair/poor health was different from 0 at the 0.10 significance level although not the 0.05 level ($\sigma^2_{\mu 0} = 0.010$; $p = 0.096$). Controlling for individual level sociodemographic and socioeconomic characteristics, community level income, mean age, and the

Table 3 Pearson correlation coefficient matrix for indicators of community level socioeconomic status and bonding and bridging forms of social capital (n = 40 communities)†

	Bonding social capital	Bridging social capital	% Education ≤ high school	% Income < \$20000
Bonding social capital	1.00	-0.60*	0.13	-0.05
Bridging social capital	-	1.00	-0.70*	-0.43*
% Education ≤ high school‡	-	-	1.00	0.72†
% Income < \$20000	-	-	-	1.00

*Significant at a level of 0.05. †All variables represent community level measures. Each of the community social capital summary measures was calculated as the mean of the standardised values for the constituent indicators (see Methods for a detailed description of the indicators). ‡Among those age ≥25.

state community indicator variable, a 1-standard deviation (SD) higher level of community bonding social capital and a 1-SD higher level of community bridging social capital were associated with a significantly lower and a non-significantly higher odds of reporting fair or poor health, respectively (for bonding social capital, model 2A: OR = 0.88, 95% CI = 0.83 to 0.94; for bridging social capital, model 2B: OR = 1.02, 95% CI = 0.94 to 1.11). When the social capital forms were coadjusted (model 2C), the odds of reporting fair or poor health were significantly lower for people residing in communities with higher bonding social capital (OR = 0.86; 95% = 0.80 to 0.92), and lower for people in communities with higher bridging social capital (OR = 0.95; 95% CI = 0.88 to 1.02). The between community variation in self rated fair/poor health in this model was considerably smaller ($\sigma^2_{\mu_0} = 0.000$) relative to the model without these social capital variables.

No significant interaction was seen between the associations for residence in communities higher in each form of social capital and health (model 3). Furthermore, there were no significant interactions between the associations for either community bonding or bridging social capital and the association for community level income with health (data not shown).

Results in table 5 (model 4) show that the estimated fixed effects of the individual level measures of high formal bonding social capital (OR = 0.77; 95% CI = 0.66 to 0.88), high trust in members of one’s race/ethnicity (OR = 0.88; 95% CI = 0.79 to 0.98), and high generalised social trust (OR = 0.54; 95% CI = 0.49 to 0.59) were each significantly and inversely related to fair/poor health. With the addition of the individual level social capital variables, there was a slight attenuation of the associations for community bonding social capital (OR = 0.90; 95% CI = 0.84 to 0.97) and for community bridging social capital (OR = 0.96; 95% CI = 0.89 to 1.03). Meanwhile, significant cross level interactions were seen among persons with high (compared with low) trust in members of one’s race/ethnicity (ratio of associations with health for higher community bridging social capital: OR = 0.87; 95% CI = 0.77 to 0.97), and among people with high (compared with low) social trust (ratio of associations for higher community bonding social capital: OR = 0.89; 95% CI = 0.80 to 0.98; ratio of associations for higher community bridging social capital: OR = 1.13; 95% CI = 1.02 to 1.26) (from model 5; data not shown).

There was also evidence for significantly differential returns to community bonding social capital by race/ethnicity, although not by individual sex or income (data not shown in table 5 for the latter two factors). For the effect on health of living in communities 1-SD higher in community bonding social capital, relative to white persons, the odds

ratios of fair/poor health were significantly less inverse among black persons (ratio of associations with health for higher bonding social capital: OR = 1.34; 95% CI = 1.09 to 1.66), and among persons assigned to the “other” racial/ethnic category (OR = 1.28; 95% CI = 1.05 to 1.56).

DISCUSSION

This study assessed for the presence of contextual effects of community bonding and community bridging forms of social capital on self rated health across 40 US communities. Adjusting for individual level factors (except for social capital) and community level covariables, community bonding social capital and community bridging social capital were associated with 14% and 5% lower odds of self reported fair/poor health, respectively.

The addition of individual level social capital variables slightly attenuated the associations of both forms of community social capital with health (although the association for community bonding social capital remained statistically significant), suggesting that the contextual effects could be accounted for in part through community composition. At the same time, this finding could also potentially be explained by the mediation of community social capital effects by individual level social capital. We found no evidence that the two forms of community social capital interacted with one another, or with community level SES. Nor did the main effects differ significantly by individual sex or income. However, several significant cross level interactions were seen between community and individual level forms of social capital. Additionally, differential effects of social capital by race/ethnicity were found, with the inverse associations between higher community bonding social capital and fair/poor health significantly weaker among black persons and among those assigned to the “other” racial/ethnic category compared with white persons.

The validity of the study’s results was strengthened by our ability to control for a number of compositional characteristics as well as community level SES and age, thereby helping to minimise potential model misspecification. Furthermore, the survey sampling from multiple, diverse US communities favours the generalisability of the findings to other US communities.

Nevertheless, several study limitations should be noted. Based on the available survey items, a comparatively small number of indicators was used to derive the measures of community bonding and bridging social capital, potentially restricting the content and construct validity of these measures. Because we relied on the composition of one’s formal group to distinguish bonding and bridging social capital at the individual level and to then help derive community level measures, community bonding and bridging

Table 4 Descriptive statistics for the final sample analysed in multilevel models

Outcome	Yes (n = 2988, 12.0%)		No (n = 21847, 88.0%)	
Level 1, individuals, n = 24835: individual level independent variables, by outcome	Mean = 51.0; Range = 18, 96		Mean = 43.8; Range = 18, 99	
Age (in years)	Frequency (n)	Proportion (%)	Frequency (n)	Proportion (%)
Sex				
*Male	1112	37.2	9098	41.6
Female	1876	62.8	12749	58.4
Race/ethnicity				
*White	2162	72.4	17225	78.8
Black	469	15.7	2558	11.7
Asian	58	1.9	558	2.6
Native American	62	2.1	239	1.1
Other	237	7.9	1267	5.8
Marital status				
*Married	1265	42.3	11516	52.7
Single	651	21.8	5555	25.4
Widowed	445	14.9	1435	6.6
Divorced	472	15.8	2745	12.6
Separated	155	5.2	596	2.7
Educational attainment				
≤ High school	1577	52.8	6681	30.6
Some college	906	30.3	7157	32.8
*≥ College	505	16.9	8009	36.7
Annual household income (\$)				
<20000	892	29.9	2353	10.8
20000–29999	512	17.1	2708	12.4
30000–49999	562	18.8	5042	23.1
50000–74999	304	10.2	4119	18.9
75000–99999	147	4.9	2281	10.4
Unspecified/missing	450	15.1	2841	13.0
*≥100000	121	4.0	2503	11.5
Social capital				
Formal bonding				
*Low	2155	72.1	15749	72.1
High	254	8.5	3081	14.1
Missing	579	19.4	3017	13.8
Trust own race/ethnicity				
*Low	1923	64.4	13062	59.8
High	707	23.7	6383	29.2
Missing	358	12.0	2402	11.0
Formal bridging				
*Low	2286	76.5	17827	81.6
High	123	4.1	1003	4.6
Missing	579	19.4	3017	13.8
Informal bridging				
*Low	1752	58.6	10516	48.1
High	1192	39.9	11030	50.5
Missing	44	1.5	301	1.4
Social trust				
*Low	1682	56.3	8462	38.7
High	1306	43.7	13385	61.3
Level 2, communities, n = 40: community level independent variables				
Bonding social capital	Mean = 0	Range = -2.1, 2.6		
Bridging social capital	Mean = 0	Range = -2.6, 2.2		
% Income < \$20000	Mean = 15.1	Range = 6.8, 22.4		
% Education ≤ high school	Mean = 31.9	Range = 14.5, 47.8		
Mean age (in years)	Mean = 44.8	Range = 40.2, 53.4		
State community	*Non-state community (n = 36, 90.0%)			
	State community (n = 4, 10.0%)			

*Reference categories used for regression analyses.

social capital were strongly inversely correlated, although 6 of the 40 communities were still found to be above the median for both, and there was no evidence of multicollinearity upon coadjustment in the models. The incorporation of other relevant items (for example, those emphasising qualitative aspects of relations that foster bonding and bridging social capital, such as the degree and type of involvement in formal groups) could have led to more reliable and valid measurements of the two forms of social capital, and thereby resulted in less biased model estimates. Furthermore, non-respondent bias could have been present because of the comparatively low survey response rates within communities, and the additional non-response on survey items measuring formal group participation.

Because of the cross sectional design of the study, reverse causation (that is, worse health status causing lower individual and community level social capital) to explain part of the observed associations cannot be ruled out. Moreover, because of the study's observational design, bias due to selection into communities is possible. If unobserved factors codetermined the sorting of people of high social capital and of good health into the same communities, and were not fully adjusted for by the control variables (such as individual income), the estimated effects of community social capital on health would be biased.

The significant interactions seen between community social capital and some racial/ethnic groups are compatible with the individual level findings from the study by Mitchell

Table 5 Fixed and random part coefficient estimates from the multilevel logistic models (outcome of fair/poor health)

	Model 1	Model 2A	Model 2B	Model 2C	Model 3	Model 4	Model 6
Fixed parameters							
Constant	-3.398	-3.394	-3.397	-3.397	-3.382	-2.840	-3.401
Individual level independent variables							
Sociodemographic							
Age (centred around 45)	0.023 (0.001)*	0.023 (0.001)*	0.023 (0.001)*	0.023 (0.001)*	0.023 (0.001)*	0.027 (0.002)*	0.023 (0.001)*
Female	-0.011 (0.043)*	-0.011 (0.043)	-0.012 (0.043)	-0.010 (0.043)	-0.010 (0.043)	0.018 (0.043)	-0.009 (0.043)
Race/ethnicity							
Black	0.256 (0.061)*	0.249 (0.060)*	0.256 (0.061)*	0.248 (0.060)*	0.248 (0.060)*	0.048 (0.062)	0.296 (0.063)*
Asian	0.333 (0.148)*	0.299 (0.148)*	0.330 (0.149)*	0.304 (0.148)*	0.326 (0.149)*	0.225 (0.149)	0.267 (0.226)
Native	0.614 (0.153)*	0.611 (0.152)*	0.614 (0.152)*	0.610 (0.152)*	0.608 (0.152)*	0.434 (0.167)*	0.593 (0.164)*
Other	0.399 (0.081)*	0.376 (0.081)*	0.397 (0.081)*	0.375 (0.081)*	0.381 (0.081)*	0.219 (0.085)*	0.486 (0.088)*
Marital status							
Single	0.220 (0.060)*	0.217 (0.060)*	0.218 (0.060)*	0.222 (0.060)*	0.225 (0.060)*	0.199 (0.060)*	0.218 (0.060)*
Widowed	-0.021 (0.074)	-0.017 (0.074)	-0.021 (0.074)	-0.016 (0.074)	-0.016 (0.074)	-0.024 (0.074)	-0.013 (0.074)
Divorced	0.167 (0.062)*	0.163 (0.062)*	0.166 (0.062)*	0.166 (0.062)*	0.166 (0.062)*	0.123 (0.062)	0.160 (0.062)*
Separated	0.547 (0.102)*	0.533 (0.102)*	0.546 (0.102)*	0.534 (0.102)*	0.534 (0.101)*	0.476 (0.102)*	0.533 (0.102)*
Socioeconomic							
Educational attainment							
≥High school	0.879 (0.059)*	0.874 (0.059)*	0.880 (0.059)*	0.868 (0.059)*	0.867 (0.059)*	0.737 (0.061)*	0.866 (0.059)*
Some college	0.506 (0.060)*	0.504 (0.060)*	0.507 (0.060)*	0.501 (0.060)*	0.501 (0.060)*	0.418 (0.061)*	0.498 (0.060)*
Annual household income (\$)							
<20000	1.370 (0.109)*	1.378 (0.109)*	1.371 (0.109)*	1.379 (0.109)*	1.377 (0.109)*	1.277 (0.110)*	1.385 (0.109)*
20000–29999	0.833 (0.111)*	0.839 (0.111)*	0.833 (0.111)*	0.841 (0.111)*	0.841 (0.111)*	0.755 (0.111)*	0.850 (0.111)*
30000–49999	0.494 (0.107)*	0.501 (0.107)*	0.494 (0.107)*	0.501 (0.107)*	0.499 (0.107)*	0.447 (0.107)*	0.510 (0.107)*
50000–74999	0.233 (0.113)*	0.240 (0.112)*	0.234 (0.113)*	0.239 (0.112)*	0.237 (0.112)*	0.208 (0.113)	0.245 (0.112)*
75000–99999	0.212 (0.127)	0.213 (0.127)	0.213 (0.127)	0.213 (0.127)	0.211 (0.127)	0.187 (0.128)	0.217 (0.127)
Unspecified/missing	0.688 (0.110)*	0.695 (0.110)*	0.688 (0.110)*	0.694 (0.110)*	0.691 (0.110)*	0.605 (0.111)*	0.700 (0.110)*
Social capital							
Formal bonding							
High						-0.267 (0.073)*	
Missing						0.039 (0.055)	
Trust own race/ethnicity							
High						-0.128 (0.054)*	
Missing						0.020 (0.074)	
Formal bridging							
High						0.065 (0.103)	
Missing						0.000 (0.000)	
Informal bridging							
High						-0.009 (0.044)	
Missing						-0.170 (0.172)	
Social trust							
High						-0.615 (0.048)*	
Community level independent variables							
Bonding social capital		-0.127 (0.032)*		-0.151 (0.035)*	-0.139 (0.036)*	-0.101 (0.036)*	-0.196 (0.039)*
Bridging social capital			0.021 (0.041)	-0.053 (0.039)	-0.051 (0.039)	-0.043 (0.039)	-0.070 (0.043)
% Income<\$20000†	0.014 (0.007)	0.004 (0.006)*	0.015 (0.008)	-0.001 (0.007)	0.000 (0.007)	0.001 (0.007)	0.000 (0.007)
Mean age	-0.003 (0.013)	0.031 (0.013)*	0.002 (0.016)	0.025 (0.014)	0.023 (0.001)	0.028 (0.014)	0.022 (0.014)
State community	0.020 (0.082)	0.028 (0.062)	0.013 (0.083)	0.048 (0.062)	0.032 (0.063)	0.050 (0.063)	0.049 (0.062)
Interaction							
Bonding social capital × bridging social capital					0.027 (0.018)		
Bonding social capital × Black race							0.296 (0.107)*
Bonding social capital × Asian race							-0.190 (0.224)
Bonding social capital × Native race							-0.020 (0.216)
Bonding social capital × Other race							0.248 (0.101)*
Bridging social capital × Black race							0.153 (0.096)
Bridging social capital × Asian race							-0.179 (0.226)
Bridging social capital × Native race							-0.044 (0.241)
Bridging social capital × Other race							-0.035 (0.110)
Random parameters							
Level 2, between communities ($\sigma^2_{\mu_0}$)	0.010 (0.006)	0.001 (0.004)	0.009 (0.006)	0.000 (0.003)	0.000 (0.000)	0.000 (0.000)	0.000 (0.000)

Coefficient estimates from models 5, 7, and 8 are not shown. Figures in parentheses are the estimated standard errors. All models were based on 24835 persons at level 1 nested within 40 communities at level 2. *Significant at a level of 0.05. †% Education ≤ high school (among those age ≥ 25) was also entered into model 2C in lieu of the variable % Income < \$20000, with similar coefficient estimates being observed for community bonding and community bridging social capital (data not shown).

and LaGory,⁶ although as earlier noted, the bonding social capital measure used in that study does not correspond to the conceptualisation drawn upon for this study. Our study's weaker estimated protective associations of higher community bonding social capital with poor health, for black persons and for those assigned to the "other" racial/ethnic category compared with white persons, could plausibly be attributable to the perception/occurrence in black persons and those of "other" racial/ethnic groups of excessive demands, ostracism, or discriminatory practices by others in the community, in the presence of high community social participation and

trust. Such perceptions/circumstances could generate adverse effects on the health of individuals within these minority groups—that is, negative externalities of community social capital. In addition, two of the three significant cross level interactions that were seen (between each of higher individual level trust in members of one's race/ethnicity and generalised social trust with community bridging and community bonding social capital, respectively) are consistent with previous findings of interactions between community and individual level social trust.¹² Our results extend the evidence for such negative externalities to both bonding and

What this paper adds

- Few studies have distinguished between the effects of different forms of social capital on health. In particular, the potential contextual effects of community bonding and community bridging forms of social capital on health have not yet been examined.
- The results of this study suggest modest protective effects of community bonding and community bridging social capital on the health of individuals, with apparent differential returns by race/ethnicity and by individual levels of social capital. Interventions and policies that leverage community bonding and bridging social capital might serve as means of population health improvement.

bridging social capital—with one's incongruence with the values of the community majority leading to worse health among low social capital individuals resident in high social capital communities (and congruence leading to positive externalities for high social capital individuals). These findings are further in keeping with other studies that have shown that one's "cultural consonance in lifestyle", the degree to which people succeed in achieving the normative lifestyle as defined by their culture, predicts better health outcomes.^{19, 20}

Meanwhile, the moderate to strong correlations between community bridging social capital (but weak correlations between community bonding social capital) and higher community level SES are consistent with the concept that bridging social capital (but not bonding social capital) enables individuals/communities to "get ahead". According to Lin's social resources theory, access to and use of social resources can lead to improved socioeconomic status.¹ It is conceivable that through high community bridging social capital, members of disadvantaged social groups (for example, women and racial/ethnic minorities) may advance their SES through social interactions with those of more advantaged groups, with an overall effect of raising the average SES of their communities.

In summary, the key findings of this study provide novel empirical evidence for modest protective effects of community bonding and community bridging social capital on the health of individuals. The evidence on differential returns to health of community social capital among persons by race/ethnicity and by levels of individual social capital highlight the importance of considering heterogeneous groups and

underlying complexities for average population associations. Ultimately, from building upon these results, interventions and policies that leverage community bonding and bridging social capital might be designed for population health improvement.

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Funding: DK is supported by a Postdoctoral Fellowship through the Canadian Institutes of Health Research.

Competing interests: none declared.

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