A Multilevel Analysis of Key Forms of Community- and Individual-Level Social Capital as Predictors of Self-Rated Health in the United States

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A Multilevel Analysis of Key Forms of Community- and Individual-Level Social Capital as Predictors of Self-Rated Health in the United States

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ABSTRACT *Communities may be rich or poor in a variety of stocks of social capital. Studies that have investigated relations among these forms and their simultaneous and combined health effects are sparse. Using data on a sample of 24,835 adults (more than half of whom resided in core urban areas) nested within 40 U.S. communities from the Social Capital Benchmark Survey, correlational and factor analyses were applied to determine appropriate groupings among eight key social capital indicators (social trust, informal social interactions, formal group involvement, religious group involvement, giving and volunteering, diversity of friendship networks, electoral political participation, and non-electoral political participation) at each of the community and individual levels. Multilevel logistic regression models were estimated to analyze the associations between the grouped social capital forms and individual self-rated health. Adjusting the three identified community-level social capital groupings/scales for one another and community- and individual-level sociodemographic and socioeconomic characteristics, each of the odds ratios of fair/poor health associated with living in a community one standard deviation higher in the respective social capital form was modestly below one. Being high on all three (vs. none of the) scales was significantly associated with 18% lower odds of fair/poor health (odds ratio = 0.82, 95% confidence interval = 0.69–0.98). Adding individual-level social capital variables to the model attenuated two of the three community-level social capital associations, with a few of the former characteristics appearing to be moderately significantly protective of health. We further observed several significant interactions between community-level social capital and one's proximity to core urban areas, individual-level race/ethnicity, gender, and social capital. Overall, our results suggest primarily beneficial yet modest health effects of key summary forms of community social capital, and heterogeneity in some of these effects by urban context and population subgroup.*

KEYWORDS *Civic engagement, Formal social capital, Informal social capital, Multilevel analysis, Political participation, Self-rated health, Social capital, Social trust, Volunteering*

INTRODUCTION

Social capital has been variably conceptualized, ranging from definitions focusing on the *resources* embedded within social networks that can be accessed or mobilized for purposeful actions,[1] to definitions encompassing *both social structures and*

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associated resources such as trust and reciprocity.[2] In addition to structural vs. cognitive/attitudinal distinctions, social capital has been dichotomized into *formal* vs. *informal* social capital (e.g., participation in neighborhood associations vs. visits with friends), *inward-* vs. *outward-looking* social capital (e.g., chambers of commerce vs. the Red Cross), and *bonding* vs. *bridging* social capital (e.g., social ties with individuals of like age and race/ethnicity vs. those with individuals of disparate social identities).[3] Civic engagement, as reflected in electoral/non-electoral activities to attempt to address public concerns, is considered another integral component of social capital. Cross-cutting all of these distinctions is debate as to whether social capital inheres at the individual level,[1] is a property of collectives,[4] or resides at both levels.[5]

Proposed mechanisms by which social capital may improve health include the diffusion of knowledge about health promotion, maintenance of healthy behavioral norms through informal social control, promotion of access to local services and amenities, and psychosocial processes that provide affective support and mutual respect.[6]

Recent years have witnessed a burgeoning empirical literature linking social capital at the collective and individual levels to better health outcomes.[5] The vast majority of these studies have applied indicators of interpersonal trust, norms of reciprocity, and associational memberships (at the individual, community, or state level), such that the operationalization of social capital has largely corresponded to a small subset of domains. Moreover, few studies have simultaneously investigated social capital at the community and individual levels.[5]

Using data from the Social Capital Benchmark Survey (SCBS), the most comprehensive U.S. survey of social capital to date among adults across 40 communities, Helliwell and Putnam[7] estimated the associations between two community social capital indicators (average levels of trust and associational memberships) and individual self-rated health, controlling for community-level median income and individual-level associational memberships, trust, importance of God/religion, frequency of religious service attendance, and sociodemographic and socioeconomic factors. At the community level, only social trust was significantly related to better health, while at the individual level, associational memberships, trust, and religious service attendance were all significantly associated with better health.

Data from the SCBS were also recently analyzed to explore the associations between community- and individual-level bonding and bridging forms of social capital with individual self-rated health.[8] Modest inverse associations between community bonding and community bridging social capital and fair/poor self-rated health were found, and were attenuated with the addition of individual-level measures of bonding and bridging social capital.

Along with the posited main effects of social capital on health, there are theoretical considerations and empirical evidence to suggest that community social capital may have differential health impacts according to population subgroup characteristics (e.g., individual-level social trust,[9] gender, and race/ethnicity[8]), and urban context. Regarding the latter, urban areas are likely to possess a higher density of public spaces and physical amenities (e.g., civic centers, museums, convention centers), that may facilitate both informal and formal social interactions, than rural areas. Conceivably, there may be synergistic health effects between residence in urban areas and informal and formal social interactions.

Utilizing data from the SCBS, for the present analysis, we aimed to extend investigations of social capital beyond social trust, associational memberships, and

bonding and bridging categorizations to more comprehensively encompass social capital domains through multiple indicators, including those for formal social capital, informal social capital, volunteering, and civic and political participation at the community and individual levels. Applying correlational and factor analyses, we sought to identify appropriate groupings of these indicators at each level. Furthermore, after collapsing the indicators into a smaller set, we aimed to estimate the simultaneous and combined health effects of summary community- and individual-level social capital forms, and to additionally test for potential heterogeneity in the health effects of community-level social capital according to one's proximity to core urban areas, individual-level race/ethnicity, gender, and social capital.

MATERIALS AND METHODS

The SCBS was conducted across 40 diverse U.S. communities to establish benchmark levels of social capital, and to better understand the correlates and consequences of social capital.[10] Within-community samples of 500 to 1,500 individuals were interviewed following random-digit dialing, with community-specific over-sampling of selected racial/ethnic groups. Participation rates ranged from 30.2% (Denver, Colorado) to 57.2% (Newaygo County, Michigan).[10] For most communities, the survey area consisted of a single county or cluster of contiguous counties. Four sampled communities comprised entire states: Montana, Indiana, New Hampshire, and Delaware. Survey respondents resided at varying proximities from core urban areas: within core urban areas (i.e., in the center city of a Metropolitan Statistical Area, MSA); non-core urban areas (outside the center city of an MSA but inside the county of the center city); suburban areas (inside a suburban county of an MSA); and rural areas (not in an MSA).

Outcome Measure

The primary outcome measure was self-reported general health status, 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?" These responses were collapsed into a dichotomous outcome: excellent/very good/good health and fair/poor health. Previous longitudinal studies conducted in the U.S. and internationally have consistently demonstrated global self-rated health to be an independent strong predictor of overall mortality.[11]

Individual-Level Predictor Variables

We controlled for key individual-level sociodemographic (age, gender, race/ethnicity, marital status), socioeconomic (educational attainment, income), and social capital characteristics to account for potential individual-level compositional explanations for between-community differences in health.[12]

Eight individual-level social capital indicators were analyzed, corresponding to measures of social trust, informal social interactions, formal group involvement, religious group involvement, giving and volunteering, diversity of friendship networks, electoral political participation, and non-electoral political participation. Each measure was itself calculated as the mean of standardized responses to multiple survey items; information corresponding to these items for each indicator is displayed in Table 1.[10]

TABLE 1. Key social capital indicators and information corresponding to constituent survey items*

Social trust
General interpersonal trust
Trust in neighbors
Trust in co-workers
Trust in fellow congregants
Trust in store employees where one shops
Trust in local police
Informal social interactions
Presence of visits to home from friends
Presence of visits with relatives
Socializing with co-workers outside of work
Hanging out with friends in public places
Playing cards and board games
Formal group involvement
Number of formal group involvements excluding church involvement (e.g., professional, trade, farm or business associations, neighborhood associations)
Having served as officer or on committee of local club/organization
Attendance at celebration, parade, or local sports or art event in one's community
Number of times attended club meeting within past year
Religious group involvement
Religious attendance
Participation in church activities besides services
Contributions to church or religious causes
Being church member
Volunteering for religious causes
Participation in religion-affiliated organization
Giving and volunteering
Volunteering for various organizations (e.g., art and religious organizations, and organizations helping poor or elderly)
Total number of times volunteered
Contributions to secular charities and religious causes
Diversity of friendships
Number of friends who: 1) owns own business; 2) is manual worker; 3) has been on welfare; 4) owns vacation home; 5) has different religious orientation; is 6) White; 7) Hispanic; 8) Asian ; 9) African-American; 10) gay or lesbian; or 11) could be described as community leader
Electoral political participation
Voting in 1996 presidential election
Being currently registered to vote
Having interest in politics and national affairs
Level of political knowledge
Days in past week respondent had read daily newspaper
Non-electoral political participation
Belonging to group that took local action for reform
Attendance at political meeting or rally in past year
Signing petition in past year
Participation in political group, demonstrations, boycotts, or marches in past year
Participation in ethnic, nationality, or civil rights organization
Participation in labor union

*These indicators were at each of the community and individual levels, with community-level measures derived by aggregating the corresponding individual-level measures.

Community-Level Predictor Variables

At the community level, eight social capital variables for the same indicator types as at the individual level were constructed as the survey-weighted mean of corresponding individual-level measures.[10]

Indicators of community-level socioeconomic status (SES) consisted of the within-community proportion of individuals with low educational attainment (<high school education, among those age 25 years and older) and proportion with low annual household income (<$20,000/year).

Statistical Analyses

To determine appropriate groupings of the eight individual-level social capital indicators, correlational and factor analyses were performed. Indicators within an identified grouping were combined by averaging their corresponding standardized values. This mean value was then dichotomized as high or low using its median value.

Table 2 shows the Pearson correlation matrix for the individual-level social capital indicators as continuous variables. Correlation coefficients ranged from −0.02 to 0.56. Cronbach's α across the eight indicators was 0.72. Both the scree plot and oblique rotation factor analysis suggested loading of the indicators onto four factors. However, internal consistency reliability was acceptably high (α > 0.70) for only one factor/subscale (comprised of the variables for formal group involvement, religious group involvement, and giving and volunteering). The other indicators were hence modeled as separate variables.

To combine the eight community-level social capital indicators, correlational and factor analyses were also applied. Table 3 shows the Pearson correlation matrix for the community-level social capital indicators. Absolute values of correlation coefficients ranged from 0.06 to 0.70. Across all indicators, Cronbach's α was 0.73. Examination of the scree plot suggested the presence of four factors. Following oblique rotation with specification of a four-factor solution, inspection of the structure and pattern matrices indicated three factors as the simplest solution, and these groupings were adopted. Three social capital subscales were created: 'SC1' (consisting of the indicators for social trust, informal social interactions, and electoral political participation; Cronbach's α = 0.80); 'SC2' (comprised of the indicators for formal group participation, religious group participation, and giving

TABLE 2. Pearson correlation coefficient matrix for individual-level social capital indicators (*n* = 24,501 individuals)*

	Itrust	Iinformal	Ielectoral	Iformal	Icharity	Ifaith	Idiverse	Iprotest
Itrust	1.00	0.02	0.34	0.17	0.25	0.17	0.16	0.08
Iinformal	–	1.00	−0.02	0.21	0.17	0.02	0.24	0.12
Ielectoral	–	–	1.00	0.31	0.36	0.20	0.23	0.32
Iformal	–	–	–	1.00	0.56	0.30	0.34	0.50
Icharity	–	–	–	–	1.00	0.48	0.37	0.36
Ifaith	–	–	–	–	–	1.00	0.14	0.12
Idiverse	–	–	–	–	–	–	1.00	0.34
Iprotest	–	–	–	–	–	–	–	1.00

Itrust Social trust, *Iinformal* informal social interactions, *Ielectoral* electoral participation, *Iformal* formal group involvement, *Icharity* giving and volunteering, *Ifaith* religious group involvement, *Idiverse* diversity of friendship networks, and *Iprotest* non-electoral political participation.

*All variables represent individual-level continuous measures.

TABLE 3. Pearson correlation coefficient matrix for community-level social capital indicators (n = 40 communities)*

	Trust	Informal	Electoral	Formal	Charity	Faith	Diverse	Protest
Trust	1.00	0.57†	0.62†	0.57†	0.48†	0.19	−0.07	−0.06
Informal	–	1.00	0.52†	0.29	0.23	−0.08	0.09	0.20
Electoral	–	–	1.00	0.66†	0.47†	0.16	0.15	0.31
Formal	–	–	–	1.00	0.64†	0.35†	0.20	0.22
Charity	–	–	–	–	1.00	0.65†	0.19	−0.13
Faith	–	–	–	–	–	1.00	−0.45†	−0.59†
Diverse	–	–	–	–	–	–	1.00	0.70†
Protest	–	–	–	–	–	–	–	1.00

Trust Social trust, *Informal* informal social interactions, *Electoral* electoral participation, *Formal* formal group involvement, *Charity* giving and volunteering, *Faith* religious group involvement, *Diverse* diversity of friendship networks, and *Protest* non-electoral political participation.

*All variables represent community-level continuous measures, calculated as the survey-weighted mean of the corresponding individual-level measures.

†Statistically significant at the 0.05 level.

and volunteering; α = 0.78); and 'SC3' (based on the indicators for diversity of friendships and non-electoral political participation; α = 0.82). The value corresponding to each grouping/subscale was calculated as the mean of the standardized values for its constituent indicators. This mean value was then dichotomized as high or low using its median value. We also constructed dichotomous summary social capital variables to indicate whether a community was high on one or two, all three, or none of the scales.

We applied multilevel models to estimate the fixed effects of community- and individual-level social capital forms on self-rated health, controlling for one another, the contextual effects of community-level SES and community mean age, compositional effects of individual-level sociodemographic and socioeconomic characteristics, and for whether the sampled community was a state. The significance of terms corresponding to the interactions between the community-level social capital variables and variables for individual-level proximity to core urban areas, race/ethnicity, gender, and social capital were tested in subsequent models. Multilevel logistic models with random intercepts were estimated using *MLwiN* software (Version 1.10.0006),[13] based on the predictive/penalized quasi-likelihood approximation of a second-order Taylor linearization procedure.[14] All models utilized the logit function, with the logarithm of the odds of fair/poor health as the outcome. Model coefficient estimates of interest were subsequently converted into odds ratios (OR) with 95% confidence intervals (95% CI).

RESULTS

After excluding missing data on self-rated health and individual-level predictor variables for the main analyses (with the exception of household income, for which 3,291 values were assigned to a missing category), there were 24,835 individuals nested within 40 U.S. communities. An additional 334 individuals with missing values for individual-level social capital measures were excluded from the analyses that included these variables.

TABLE 4. Descriptive statistics for the final sample

Outcome		
Fair/poor health	Yes (n = 2,988, 12.0%)	No (n = 21,847, 88.0%)
Level 1, individuals, n = 24,835: individual-level predictor variables		
Age (in years)	Mean = 45	Range = 18–99
Gender	*Male (n = 10,210, 41.1%)	
	Female (n = 14,625, 58.9%)	
Race	*White (n = 19,387, 78.1%)	
	Black (n = 3,027, 12.2%)	
	Asian (n = 616, 2.5%)	
	Native American (n = 301, 1.2%)	
	Other (n = 1,504, 6.1%)	
Marital status	*Married (n = 12,781, 51.5%)	
	Single (n = 6,206, 25.0%)	
	Widowed (n = 1,880, 7.6%)	
	Divorced (n = 3,217, 13.0%)	
	Separated (n = 751, 3.0%)	
Educational attainment	<High school (n = 8,258, 33.3%)	
	Some college (n = 8,063, 32.5%)	
	*≥College (n = 8,514, 34.3%)	
Annual household income ($)	<20,000 (n = 3,245, 13.1%)	
	20,000–30,000 (n = 3,220, 13.0%)	
	30,000–50,000 (n = 5,604, 22.6%)	
	50,000–75,000 (n = 4,423, 17.8%)	
	75,000–100,000 (n = 2,428, 9.8%)	
	*≥100,000 (n = 2,624, 10.6%)	
	Unspecified/missing (n = 3,291, 13.3%)	
Proximity to core urban areas	*Core urban area (n = 13,028, 52.5%)	
	Non-core urban area (n = 5,319, 21.4%)	
	Suburban area (n = 3,175, 12.8%)	
	Rural area (n = 3,313, 13.3%)	
Social capital**		
'Formal/religious group involvement/ giving & volunteering'	*Low (n = 12,251, 50.0%)	
	High (n = 12,250, 50.0%)	
Social trust	*Low (n = 12,449, 50.8%)	
	High (n = 12,052, 49.2%)	
Informal social interactions	*Low (n = 12,250, 50.0%)	
	High (n = 12,251, 50.0%)	
Electoral participation	*Low (n = 12,393, 50.6%)	
	High (n = 12,108, 49.4%)	
Diversity of friendships	*Low (n = 12,339, 50.4%)	
	High (n = 12,162, 49.6%)	
Non-electoral participation	*Low (n = 17,290, 70.6%)	
	High (n = 7,211, 29.4%)	
Level 2, communities, n = 40: community-level predictor variables		
Social capital 'SC1'	Mean = 0	Range = −2.4, 2.2
Social capital 'SC2'	Mean = 0	Range = −1.6, 2.8
Social capital 'SC3'	Mean = 0	Range = −1.8, 3.3
Combined social capital indicators	*High on zero scales (n = 8, 20.0%)	
	High on one or two scales (n = 22, 55.0%)	
	High on all three scales (n = 10, 25.0%)	
% Income <$20,000	Mean = 14.7	Range = 6.8–22.4
% Education <high school	Mean = 32.2	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 subsequent regression analyses.
**n = 24,501 individuals at level 1.

TABLE 5. Estimated odds ratios from two-level logistic models (outcome of fair/poor self-rated health)

	Model 1	Model 2	Model 3	Model 4	Model 5
Fixed parameters					
Individual-level predictor variables*					
Social capital					
'Formal/religious group involvement/giving & volunteering'			0.68 (0.62–0.75)**		0.70 (0.64–0.77)**
Social trust			0.56 (0.52–0.62)**		0.56 (0.51–0.62)**
Informal social interactions			0.96 (0.88–1.05)		0.97 (0.89–1.06)
Electoral participation			0.78 (0.71–0.86)**		0.78 (0.71–0.86)**
Diversity of friendships			0.98 (0.90–1.07)		0.98 (0.90–1.08)
Non-electoral participation			1.18 (1.06–1.31)**		1.16 (1.04–1.29)**
Proximity to core urban areas					
Non-core urban area	0.85 (0.76–0.95)**	0.87 (0.78–0.97)**	0.87 (0.78–0.97)**	0.86 (0.75–0.97)**	0.87 (0.77–0.97)**
Suburban area	0.92 (0.81–1.06)	0.95 (0.83–1.10)	0.95 (0.83–1.09)	0.89 (0.75–1.05)	0.95 (0.83–1.09)
Rural area	0.96 (0.83–1.10)	0.99 (0.85–1.15)	0.98 (0.85–1.13)	1.13 (0.90–1.43)	0.99 (0.86–1.14)
Community-level predictor variables					
Mean age	1.03 (1.00–1.05)	1.00 (0.97–1.03)	1.03 (1.03–1.04)**	1.05 (1.02–1.08)**	1.03 (1.00–1.05)
% Income <$20,000	1.02 (1.00–1.03)	1.02 (0.99–1.04)	1.02 (1.00–1.03)	1.02 (1.01–1.04)**	1.02 (1.00–1.04)
% Education <high school	0.99 (0.98–1.00)	1.00 (0.99–1.01)	0.99 (0.98–1.00)	0.99 (0.98–0.99)**	0.99 (0.98–1.00)
State community	1.03 (0.91–1.17)	1.00 (0.84–1.18)	1.05 (0.93–1.19)	1.01 (0.89–1.14)	1.05 (0.93–1.19)
Social capital scale 'SC1'	0.96 (0.90–1.02)		1.00 (0.93–1.06)	1.02 (0.94–1.09)	0.96 (0.86–1.06)
Social capital scale 'SC2'	0.91 (0.87–0.96)**		0.94 (0.89–0.99)**	0.89 (0.83–0.95)**	1.00 (0.91–1.10))
Social capital scale 'SC3'	0.92 (0.85–0.99)**		0.91 (0.85–0.98)**	0.90 (0.84–0.98)**	0.90 (0.80–1.01)
Combined social capital indicators					
High on one or two scales		0.90 (0.79–1.04)			
High on all three scales		0.82 (0.69–0.98)**			
Interactions					
Social capital scale × proximity to core urban areas					
'SC1' × non-core urban area				0.87 (0.76–1.00)	
'SC2' × non-core urban area				1.16 (1.01–1.32)**	
'SC3' × non-core urban area				1.01 (0.85–1.20)	
'SC1' × suburban area				0.89 (0.75–1.05)	
'SC2' × suburban area				1.07 (0.89–1.29)	

'SC3' × suburban area				0.88 (0.63–1.25)	
'SC1' × rural area				0.72 (0.58–0.89)**	
'SC2' × rural area				1.01 (0.79–1.30)	
'SC3' × rural area				1.13 (0.76–1.67)	
Social capital scale × individual social capital					
'SC1' × 'formal/religious/giving' social capital					1.02 (0.91–1.15)
'SC2' × 'formal/religious/giving' social capital					0.95 (0.85–1.06)
'SC3' × 'formal/religious/giving' social capital					1.14 (1.01–1.28)**
'SC1' × social trust					0.88 (0.79–0.98)**
'SC2' × social trust					1.03 (0.92–1.14)
'SC3' × social trust					0.95 (0.85–1.06)
'SC1' × informal social interactions					1.07 (0.97–1.19)
'SC2' × informal social interactions					0.96 (0.87–1.06)
'SC3' × informal social interactions					1.04 (0.93–1.15)
'SC1' × electoral participation					1.05 (0.95–1.17)
'SC2' × electoral participation					0.91 (0.82–1.01)
'SC3' × electoral participation					0.98 (0.88–1.10)
'SC1' × diversity of friendships					1.03 (0.93–1.15)
'SC2' × diversity of friendships					1.06 (0.96–1.18)
'SC3' × diversity of friendships					0.97 (0.87–1.09)
'SC1' × non-electoral participation					1.05 (0.93–1.19)
'SC2' × non-electoral participation					0.91 (0.81–1.03)
'SC3' × non-electoral participation					0.95 (0.84–1.07)
Random parameters					
Between-community variation	0.001 (0.004)	0.010 (0.006)	0.000 (0.000)	0.000 (0.000)	0.000 (0.000)

Figures in parentheses are the 95% confidence intervals (except for between-community variation, for which each of the numbers corresponds to the standard error in the variance). All models were based on 24,835 individuals at level 1 nested within 40 communities at level 2, except for Models 3 and 5 (n = 24,501 individuals at level 1). Social capital scale 'SC1' was derived from the indicators for social trust, informal social interactions, and electoral participation; 'SC2' consisted of the indicators for formal group involvement, religious group involvement, and giving and volunteering; 'SC3' was based on the indicators for diversity of friendship networks and non-electoral political participation.

*All models are also adjusted for individual-level age, gender, race/ethnicity, marital status, educational attainment, and annual household income.

**Statistically significant at the 0.05 level.

Table 4 lists descriptive statistics for the final sample. 12.0% of respondents across all communities reported fair or poor health. Slightly greater than half of respondents (52.5%) resided in core urban areas. Approximately a fifth (21.4%) lived in non-core urban areas, whereas smaller proportions were located in suburban (12.8%) and rural areas (13.3%).

Controlling for community- and individual-level factors, residence in a community one standard deviation (1-SD) higher in each social capital indicator (analyzed in separate models) was primarily associated with modestly lower relative odds of fair/poor health (for social trust: OR = 0.92, 95% CI = 0.86–0.98; informal social interactions: OR = 0.97, 95% CI = 0.92–1.03; electoral political participation, OR = 0.94, 95% CI = 0.88–1.00; formal group involvement: OR = 0.90, 95% CI = 0.84–0.96; religious group involvement: OR = 0.99, 95% CI = 0.93–1.05; giving and volunteering: OR = 0.93, 95% CI = 0.88–1.00; diversity of friendships: OR = 0.99, 95% CI = 0.93–1.06; and non-electoral political participation: OR = 1.05, 95% CI = 0.98–1.11).

Residence in a community 1-SD higher on social capital scale 'SC1', on 'SC2', and on 'SC3' (co-adjusted for one another) was each associated with lower odds of fair/poor health (Model 1 in Table 5: for scale 'SC1', OR = 0.96, 95% CI = 0.90–1.02; 'SC2', OR = 0.91, 95% CI = 0.87–0.96; and 'SC3', OR = 0.92, 95% CI = 0.85–0.99). For communities high on one or two, and all three vs. none of the scales, inverse associations were found between community social capital and fair/poor health, with evidence of dose-response (Model 2: high on one or two scales vs. none: OR = 0.90, 95% CI = 0.79–1.04; high on all three scales vs. none: OR = 0.82, 95% CI = 0.69–0.98).

Adding individual-level social capital variables slightly attenuated the associations for 'SC1' and 'SC2', while the association for 'SC3' was relatively unchanged (Model 3: OR = 1.00, 95% CI = 0.93–1.06; OR = 0.94, 95% CI = 0.89–0.99; and OR = 0.91, 95% CI = 0.85–0.98, for the respective scales). In this model, individuals high on the scale derived from the individual-level indicators of formal group involvement, religious group involvement, and giving and volunteering were less likely to report fair/poor health (OR = 0.68, 95% CI = 0.62–0.75). Those who were high in social trust and high in electoral political participation were each at significantly lower odds of fair/poor health (OR = 0.56, 95% CI = 0.52–0.62; and OR = 0.78, 95% CI = 0.71–0.86, respectively), while those high in informal social interactions and high in diversity of friendships were each non-significantly less likely to report fair/poor health (Table 5). By contrast, individuals high in non-electoral political participation were significantly more likely to be in fair/poor health (OR = 1.18, 95% CI = 1.06–1.31).

We also found evidence that one's proximity to core urban areas was related to self-rated health. Compared to residence in core urban areas, living in non-core urban areas, suburban areas, and rural areas was each inversely associated with fair/poor health, with non-core urban areas followed by suburban areas showing the greatest health advantage (Model 1: OR = 0.85, 95% CI = 0.76–0.95 and OR = 0.92, 95% CI = 0.81–1.06 for residence in non-core urban areas and suburban areas vs. core urban areas, respectively). In the model that tested for interactions between community social capital and proximity to core urban areas, the associations between the community-level scale comprised of trust, informal social interactions, and electoral participation ('SC1') and health were more strongly inverse outside of core urban areas than in core urban areas (ratio of associations for each of non-core urban areas and rural areas vs. core urban areas, respectively:

Model 4: OR = 0.87, 95% CI = 0.76–1.00; and OR = 0.72, 95% CI = 0.58–0.89). Meanwhile, formal and religious group involvement and giving and volunteering ('SC2') appeared to be less beneficial to health outside of core urban areas, particularly in non-core urban areas (ratio of associations for non-core urban areas vs. core urban areas: OR = 1.16, 95% CI = 1.01–1.32).

The majority of cross-level interactions between community- and individual-level social capital were statistically non-significant. However, we did observe a significant positive interaction between 'SC1' and individual-level social trust, and a significant negative interaction between 'SC3' and the individual-level scale corresponding to formal and religious group involvement and giving and volunteering (Model 5).

We further determined a significantly weaker inverse association for 'SC1' among Blacks compared to Whites (ratio of associations with health: OR = 1.22, 95% CI = 1.02–1.47), and for 'SC2' among those of 'Other races' compared to Whites (ratio of associations: OR = 1.28, 95% CI = 1.04–1.57). Meanwhile, the association for 'SC1' was significantly more strongly inverse among women vs. men (ratio of associations: OR = 0.88, 95% CI = 0.80–0.97).

DISCUSSION

This paper investigated the simultaneous and combined effects of key summary forms of community- and individual-level social capital on self-rated health across 40 U.S. communities. Adjusting for community- and individual-level sociodemographic and socioeconomic characteristics, we found a modest relation between each of three community social capital scales and self-rated health, with 4–9% lower odds of fair/poor health associated with a 1-SD higher level on the respective scale. Being high on all three (vs. none of the) scales was significantly associated with 18% lower odds of fair/poor health. Furthermore, adding individual-level social capital variables to the model attenuated two of the three community social capital associations, with several of the former variables appearing to be significantly protective of health (although plausibly, individual-level social capital may have been shaped by and mediated the effects of community-level social capital).

By contrast to the analysis by Helliwell and Putnam,[7] we did not observe a significant association between the community-level scale that included trust ('SC1') and health, controlling for individual-level social capital. Additionally, we determined a significant relation between the community-level scale that included formal group involvement ('SC3') and health. These discrepancies could be partly attributed to the slightly different social capital variables constructed (with each of our eight community-level indicators utilizing additional survey items compared to the two community-level indicators in the Helliwell and Putnam analysis) and the indicators/control variables incorporated into the respective analyses (with six other community-level social capital indicators, mean age, and proximity to core urban areas being integrated into our analysis).

As anticipated, the majority of individual-level social capital measures were inversely associated with fair/poor health. The relations were particularly strongly protective for being high in formal and religious group involvement and giving and volunteering, and for being high in social trust and in electoral participation. The findings for formal and religious group involvement and for social trust were generally in keeping with those by Helliwell and Putnam.[7] Contrary to expected, we

observed 18% significantly higher odds of fair/poor health with high non-electoral political participation. Plausibly, the act of protesting and organizing political activities may affect one's work productivity, or related interpersonal conflicts may potentially contribute to negative psychological sequelae, such that a toll is taken on individual health.

We observed notable variations in individual health according to one's proximity to core urban areas. This pattern, with non-core urban areas followed by suburban areas showing the strongest health advantage, has been previously identified in U.S. metropolitan settings.[15] In addition, we found evidence consistent with significantly differential community social capital effects based on urban area proximity. Outside and relative to residence in core urban areas, the effects of community trust, informal social interactions, and electoral participation on one's health were more beneficial, especially within non-core urban areas and rural areas (by contrast to our hypothesis of stronger associations for informal social interactions in urban vs. rural areas). On the other hand, community formal and religious group involvements and giving and volunteering appeared to be more salutary within core urban areas, compared to non-core urban areas. Future investigations would be beneficial in confirming the presence of these interactions, and in delineating their underlying pathways and mechanisms.

Our finding of a significant positive interaction between individual-level trust and the community-level scale that included trust is consistent with prior empirical evidence,[9] and compatible with the notion that social capital may produce benefits for some individuals while engendering "downsides" among others.[16] Such negative externalities might result from low-trust individuals feeling alienated by community members who are high in trust within a high-trust community. Likewise, the relatively worse health reported by those involved in formal and religious groups and charitable activities in communities high on average in diverse friendships and political activities, and worse health seen among Blacks and among those in the category of other races/ethnicities compared to Whites in the presence of high community social capital, might each reflect selectively harmful effects of incongruence with the norms and values of the community majority.

The stronger inverse association for the group of community-level indicators that included social trust and informal social interactions with fair/poor health among women compared to men might be attributed to a greater responsiveness in women to the presence (or absence) of psychosocial/cognitive resources within community social networks. Some evidence suggests that women may be more vulnerable to negative impacts of relationships, due to their greater emotional involvement in relationships than men.[17,18]

Several important strengths were inherent to our study. First, by using multiple indicators of community- and individual-level social capital, we were able to perform a detailed assessment of the effects of various summary forms of social capital at each level on individual health. Second, by adjusting these summary social capital measures for one another and for key community- and individual-level characteristics, we reduced potential model misspecification bias. Estimating a separate model for each social capital indicator would have posed a threat to validity through potential confounding by omitted social capital indicators—a limitation of most analyses on this topic to date. By grouping the indicators into a smaller set of factors at each level, we avoided possible threats to validity stemming from confounding bias and multi-collinearity. Third, our specification of a multilevel model enabled estimation of

standard errors that accounted for clustering of individual characteristics within communities, and thereby permitted us to derive more robust statistical inferences.

Key limitations to our study should also be noted. First, because of its cross-sectional design, reverse causality could potentially account to some degree for the observed associations i.e., worse health status contributing to lower individual and community social capital. Second, in light of the study's observational design, we cannot fully exclude the presence of selection effects (e.g., if trusting, socially active, and healthy individuals had chosen to live side-by-side with neighbors sharing similar social and health characteristics) or residual confounding, although our control for community- and individual-level factors should have restricted such potential biases. Third, the relatively low survey response rates within some communities may have contributed to non-respondent bias (with item non-response particularly for household income also possibly contributing to residual confounding). Moreover, while we observed several statistically significant interactions between community-level social capital and other factors, many of the non-significant associations were modest in magnitude (e.g., 5–10% decreases/increases in the relative odds), such that statistical power may have been insufficient to detect true significant associations. Finally, some of the interactions investigated may have been significant due to chance alone i.e., multiple comparisons. Additional studies would aid in determining the consistency of these interactions.

In summary, this study provides empirical evidence for social capital as a multidimensional construct at both the community and individual levels, and demonstrates key summary social capital forms at each level as having predominantly favorable health returns. Notably, our results underscore the similar yet not uniformly beneficial effects of different forms of community- and individual-level social capital, and suggest heterogeneity in some of the effects of community social capital according to urban context as well as individual race/ethnicity, gender, and social capital. Future longitudinal studies would advance the social capital evidence base by investigating individual-level social capital forms as potential mediators of community-level social capital in their effects on health. Through estimating the simultaneous and combined health effects of major summary forms of community- and individual-level social capital and better understanding their underlying mechanisms, more effective interventions and policies may eventually be conceived to promote the health of populations.

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