Consumer Issues in Healthcare

Do Bonding, Bridging, and Linking Social Capital Affect Preventable Hospitalizations?

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Objective. To examine the relationship between social capital and preventable hospitalizations (PHs).

Data Sources. Administrative and secondary data for Florida (hospital discharge, U.S. Census, voting, nonprofits, faith-based congregations, uninsured, safety net and primary care providers, and hospital beds).

Study Design. Cross-sectional, zip code-level multivariate analyses to examine the associations among social capital, primary care resources, and adult PHs and pediatric asthma hospitalizations.

Data Extraction. Data were merged at the zip code-level ($n = 837$).

Principal Findings. Few of the social capital measures were independently associated with PHs: longer mean commute times (reduced bonding social capital) were related to higher adult rates; more racial and ethnic diversity (increased bridging social capital) was related to lower nonelderly adult rates but higher pediatric rates; more faith-based organizations (linking social capital) were associated with higher nonelderly adult rates. Having a safety net clinic within 20 miles was associated with lower adult rates, while general internists were associated with higher rates. More pediatricians per capita were related to higher pediatric rates.

Conclusions. The importance of social capital for health care access is unclear. Some bonding and bridging ties were related to PHs, but differentially across age groups; more work is needed to operationalize linking ties.

Key Words. Social capital, access to care, primary care, race and ethnicity, social environment

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Community-level factors have been associated with access to health care, above and beyond covariates such as individual health status, insurance coverage, and sociodemographics. For example, previous research has found that neighborhood is related to whether individuals report a usual source of care, physician use, receiving preventive care, and having unmet need for care (Kirby and Kaneda 2005; Litaker, Koroukian, and Love 2005). Social capital

has been suggested as a community-level characteristic and research exploring its link with health and health care has come “fast and furious” during the last decade (Veenstra 2002). The idea of social capital—defined generally as the institutions, relationships, and norms that shape the quality and quantity of a society’s social interactions—has engendered much enthusiasm among public health researchers and policy makers. However, criticisms are increasing, in particular regarding the widely varying and ambiguous definitions of social capital and the lack of clarity regarding its causal mechanisms with health (Labonte 1999; Leeder and Dominello 1999; Lynch et al. 2000; Macinko and Starfield 2001).

The overwhelming majority of empirical research on social capital has focused on health outcomes and much less on health care access and utilization. And the measures used to examine the relationship between social capital and access or utilization, as well as the findings and context, vary widely. Most studies have created one or more social capital scales by aggregating and combining a range of individual measures such as perceived interpersonal trust and social control/cohesion, community and voting participation, and sense of personal safety and efficacy (Hendryx et al. 2002; Greenberg and Rosenheck 2003; van der Linden et al. 2003; Wan and Lin 2003; Drukker et al. 2004; Lindström et al. 2006). Conceived of this way, social capital has been associated with individuals reporting fewer access problems across MSAs in the United States (Hendryx et al. 2002) and better access to a regular doctor in Scania, Sweden (Lindström et al. 2006); however, other studies found that the social capital scale was only related to access or utilization through its relationship to other factors like health status (Wan and Lin 2003) or neighborhood poverty (van der Linden et al. 2003; Drukker et al. 2004). When individual indicators of social capital (as opposed to a scale) have been used to examine health care access, the findings have also been largely inconclusive (Aye, Champagne, and Contandriopoulos 2002; Prentice 2006). Further, although community-level variables such as the number of nonprofit organizations or churches in a community have been identified as important types of social capital, these have not been examined in health studies.

In addition to having widely varying measures of social capital, previous literature on social capital and health care has been limited because there have been very few conceptual frameworks proposed. Furthermore, theoretical

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distinctions have been made in the broader literature on social capital and health between bonding, bridging, and linking ties, but only one previous article has distinguished empirically between bonding and bridging (Kim, Subramanian, and Kawachi 2006), and none have examined linking social capital. The objective of this paper is to test an original conceptual framework for social capital and health care access and utilization by operationalizing bonding, bridging, and linking social capital and examining their relationships with a validated measure of community access (Bindman et al. 1995), preventable hospitalizations (PHs).

METHODS

Conceptual Framework

Much of the early work on social capital (Kawachi et al. 1997; Kennedy et al. 1998; Kawachi, Kennedy, and Wilkinson 1999) referred to very general frameworks (e.g., income inequality leads to disinvestments in social capital which negatively affect health). More recently, James, Schulz, and van Olphen (2001) presented a framework for understanding social capital and health where social capital is defined as resources in social relationships and is seen as the direct result of social networks and societal-level inequalities. Social capital is also indirectly affected by: (1) community-level factors such as residential segregation that shape access to institutions and services and material living conditions, and limit social networks; and (2) organizations and organizational networks that provide opportunities to develop relationships, skills, common agendas and identities, enhance collective action, and provide access to resources.

To examine how community social capital may affect health care access and utilization, I incorporate components of the James et al. framework and a popular framework for studying access to health care, the Behavioral Model of Health Services Use (Andersen 1968, 1995; Andersen and Newman 1973). The left side of my framework (Figure 1) draws upon the Behavioral Model to explain health care seeking behavior as largely influenced by demographic and population characteristics related to care seeking. The center and right parts of Figure 1 draw upon the James et al. framework to emphasize the importance of community- and societal-level factors and social structure in potentially affecting both health care seeking behavior and community health care assets (primary care resources and outreach resources). Figure 1 emphasizes the social structural aspect of community social capital, as this provides

Figure 1: A Conceptual Framework for Studying Community Social Capital and Access to Health Care

more theoretical and methodological clarity than do more normative aspects such as “generalized social trust” (Foley and Edwards 1999; Woolcock 2001). Furthermore, it distinguishes, as recent theoretical work has emphasized,

between *bonding* social capital, e.g., intragroup social ties represented by family and household structure, neighborhood social structure, neighborhood participation, and homogeneous social networks, and *bridging and linking* social capital, e.g., intergroup social ties represented by civic participation, community organization and organizational networks, and cross-cutting ties (ties that cross racial-ethnic, social, and other barriers). Bridging social capital brings people together who might not otherwise associate; linking social capital enables groups to leverage resources, ideas and information from formal institutions beyond the community (Woolcock 2001).

Research Questions

The principal research question is, "Does community-level social capital decrease preventable hospitalizations?" Given the newness of social capital theory and research, empirical expectations should be modest (Lochner, Kawachi, and Kennedy 1999; Woolcock 2001), thus, these analyses are exploratory and examine the relationship between various types of social capital and PHs, while also considering their relationship to other variables like poverty and race and ethnicity.

Data Sources

To examine social capital in a more localized fashion than has been done previously, a zip code-level analysis was performed using data from one state. Florida was selected because its overall racial and ethnic composition is generally reflective of the United States' composition and because of the availability of zip code-level data on factors such as the uninsured and safety net providers. For the analyses, zip code-level data were developed and merged from nine data sources (see Table 1). These included data on hospital discharges, population characteristics, voting participation, faith-based congregations, nonprofit organizations, the uninsured, safety net providers, primary care physicians, and hospital bed availability.

Units of Analysis

Florida zip codes and zip code clusters were the units of analysis. All data were merged on 2000 Census zip codes (zip code tabulation areas or ZCTAs, $n = 927$). Unmatched zip codes were matched to the corresponding ZCTAs using *ArcGIS* 8.2 software (developed by Environmental Research Systems Institute) and the Census 2000 TIGER street file. Zip codes with zero population, no households, or consisting mainly of military bases ($n = 14$) were

Table 1: Variables, Definitions, and Data Sources

<i>Variable</i>	<i>Data Source(s)</i>	<i>Year(s)</i>
Preventable hospitalizations (asthma, congestive heart failure, chronic obstructive pulmonary disease, diabetes, hypertension)	Florida Agency for Health Care Administration (AHCA)	1998–2000
Bonding social capital (horizontal associations)		
Intrahousehold social ties		
Households with married couples (percent)	U.S. Census (Short Form)	2000
Neighborhood participation		
Mean commute time to work	Census (Long Form)	2000
Bridging social capital (vertical associations)		
Neighborhood diversity		
Interaction (Simpson) index*	Calculated from Census (Short)	2000
Voting participation		
Voter participation in 2000 General election (percent) [†]	FL Dept. of State, Div. of Elections	2000
Residential segregation		
Relative diversity (zip compared with county) [‡]	Calculated from Census (Short)	2000
Linking social capital (vertical associations)		
Nonprofit organizations		
Number of nonprofit (NP) organizations per 10,000	National Center for Charitable Statistics	1999
Log program expenditures of NP organizations per capita	National Center for Charitable Statistics	1999
Faith-based congregations		
Churches, synagogues and mosques per 10,000	Electronic telephone directories	2000
Environment		
Urban (percent)	Census (Short Form)	2000
Population per square mile	Census (Short Form)	2000
Demographics		
Median age	Census (Short Form)	2000
Female (percent)	Census (Short Form)	2000
Black (percent)	Census (Short Form)	2000
Less than high school education (population > 25 years) (percent)	Census (Long Form)	2000
Limited English proficiency (percent)	Census (Long Form)	2000
Population characteristics related to care seeking		
Ability to pay		
Families/households $\leq$ federal poverty level (percent)	Census (Long Form)	1999
Uninsured (percent)	Florida Health Insurance Study (FHIS)	1999

continued

Table 1. *Continued*

<i>Variable</i>	<i>Data Source(s)</i>	<i>Year(s)</i>
Health care resources		
Safety net providers		
Safety net clinic within 20 miles (yes versus no)	FHIS Supplement, others	1999
Other health care resources		
Family practice/general practitioners per 10,000 (all ages)	AMA Masterfile	2000
General internal medicine MDs per 10,000 adults (18+ years)	AMA Masterfile	2000
Hospital beds per 1,000 population (county)	Area Resource File and U.S. Census	2000

*Interaction (Simpson) Index or S is the probability that two randomly selected people from the zip code cluster will be of different races or ethnicities. $S = 1 - \Sigma(N_k/\bar{N})^2$.

†Number of voters over those eligible; number of eligible voters was estimated using Census data: (number of people 18 years and older) $\times$ (percent citizens).

‡Relative diversity was measured using a χ^2 -statistic comparing the distribution of four race or ethnic groups (black, whites, non-Hispanic whites, and all other ethnicities) of the zip compared with the distribution at the county level. $[\chi^2(j) = \Sigma(T_{ij} - C_{ij})^2 / C_{ij}]$ The larger the statistic, the farther the zip distribution is from the county distribution.

eliminated and those with very small populations ($<1,000$ people, $n = 75$) were combined with nearby zip codes, giving preference to contiguous zip codes in the same city or county and with similar demographics.

Dependent Variables

The outcome of interest was the rate of hospitalizations that could have been prevented with timely and effective ambulatory care. These have been called “ambulatory care sensitive” (Billings et al. 1993), “avoidable” (Weissman, Gatsonis, and Epstein 1992; Begley et al. 1994; Parchman and Culler 1994; Pappas et al. 1997), and “preventable” (Bindman et al. 1995; Blustein, Hanson, and Shea 1998; Culler, Parchman, and Przybylski 1998) hospitalizations, and have been validated as a measure of community-level health care access (Bindman et al. 1995). The rates were defined as the number of nonmaternity and nonneonatal hospital discharges (averaged over 3 years for more stable estimates) in each zip code or zip cluster with a principal diagnosis of asthma, diabetes, hypertension, congestive heart failure, or chronic obstructive pulmonary disease (secondary diagnoses of asthma and COPD were also included if the principal diagnosis was either pneumonia or acute bronchitis) over the population at risk in the zip code. These five conditions are included in most lists of PHs, including the list of prevention quality indicators devel-

oped for the Agency for Healthcare Research and Quality through a structured literature review (Agency for Healthcare Research and Quality 2001), and are considered to represent the clearest examples of adult chronic conditions that could benefit from outpatient treatment (Bindman et al. 1995). The primary outcome was the summary PH rate for the adult population under 65. Because PHs may not apply in the same manner to pediatric and elderly populations, the rates of pediatric asthma-related hospitalizations and elderly PHs were explored as secondary outcomes.

Social Capital Variables

Several different types of social capital were explored, including:

Bonding Social Capital. Intrahousehold social ties were defined as the proportion of households with married couples; neighborhood participation was defined using a proxy, the mean commute time to work. Marriage and family have been conceptualized as important indicators of social connections (Helliwell and Putnam 2004) and positional embeddedness (Lin 2001)—i.e., the idea that family ties provide supportive social relationships that help sustain health and well-being (Grimm and Brewster 2002). Marital status has been used as a social capital indicator to examine various health outcomes (Nakhaie, Smylie, and Arnold 2007) and health care utilization (Blankenau, Boye-Beaman, and Mueller 2000); related factors such as the percentage living alone (Siahpush and Singh 1999) and having two parents in the home (Runyan et al. 1998) have also been used. Commute time to work has been used as a measure of social capital for the Social Capital Benchmark Survey (Helliwell and Putnam 2004).

Bridging Social Capital. Voting participation was defined as the percent of eligible voters that voted in the 2000 general election; racial and ethnic diversity (absolute) was defined using the Interaction or Simpson Index (White 1986)—i.e., the probability that two randomly selected people from the same zip code or zip cluster will be of different races or ethnicities; relative diversity was defined as the deviation of the zip ethnic means (percentages) from the overall county means or percentages for each of four subgroups (black, non-Hispanic white, Hispanics, and other), i.e., how different the zip ethnic distribution is from the overall county distribution. Voting participation is a commonly used to measure social capital, and has been used to examine health care related outcomes either individually (Rosenheck et al.

2001; Lee, Chen, and Weiner 2004) or as part of a social capital scale (Hendryx et al. 2002; Veenstra 2002; Ahern and Hendryx 2003; Greenberg and Rosenheck 2003). Racial and ethnic diversity and segregation measures have been used infrequently in the social capital and health literature (Prentice 2006), although some qualitative work has suggested that cross-cutting ties among racial and ethnic groups are a key component of social capital (Campbell and McLean 2002; Campbell, Cornish, and McLean 2004). Further, James et al. (2001) identify racial residential segregation as a measure of social capital representing community disempowerment. Certainly, the relationship between racial residential segregation and racial disparities in health have been well documented, and the idea that segregation affects access to high-quality medical care, although less well studied, is compelling (Williams and Collins 2001).

Linking Social Capital. Nonprofit organization capacity was defined as the number of nonprofit organizations per capita and nonprofit program expenditures per capita; faith-based congregation capacity was defined as the number of churches, synagogues, and mosques per capita. Nonprofit organizations have been conceptualized as a measure of community volunteerism (Putnam 2000) and also as playing a central role in mobilizing resources (James et al. 2001), although to date they have not been used as measures of social capital in health studies. Similarly, faith-based congregations have been described as providing structured access to resources (e.g., information, space to gather, community service, and political participation), through extended social networks and broad social linkages (Foley et al. 2001); however, they have not been used empirically in social capital and health studies.

Table 2 contains a correlation matrix of social capital variables.

Health Care Resources

For safety net resources, community health centers and other safety net clinics identified through the Florida Health Insurance Study (FHIS) Supplement (Bilello and Albury 1999) and other lists (Florida Association of Community Health Centers, the Bureau of Primary Health Care, hospital district lists, and county health department lists) were geocoded using *ArcGIS* 8.2 software and the Census 2000 TIGER street file to calculate the distance from each zip code centroid to the closest community health center and create a dichotomous variable based on safety net clinic availability (yes versus no) within 20 miles. Other primary care resources were defined as the number of family practice or

Table 2: Correlations among Social Capital Variables

<i>Social Capital Variables</i>	<i>1</i>	<i>2</i>	<i>3</i>	<i>4</i>	<i>5</i>	<i>6</i>	<i>7</i>	<i>8</i>
1. Percent married								
2. Mean commute time	.312**							
3. Percent who voted in 2000 general election	.0288**	-.124*						
4. Interaction index (probability of racial/ethnic interaction)	-.397**	.024	-.396**					
5. Relative diversity (deviation from county)	-.346**	.039	-.158**	.336**				
6. Number of nonprofit organizations (NPO) per 10,000 population	-.510**	-.428**	.030	.138**	.148**			
7. NPO program expenditures per capita	-.520**	.421**	-.006	.225**	.179**	.785**		
8. Faith-based congregations per 10,000 population	-.218**	.014	-.191**	.179**	.108*	.109*	.010	

** $p < .001$.

* $p < .01$.

general practice physicians (FPs/GPs) per 10,000 population, the number of internal medicine physicians per 10,000 adult population, and the number of pediatricians per 10,000 pediatric population (0–17). Although all these physician groups provide primary care, they were kept separate because earlier work suggested that only the availability of FPs/GPs is related to lower rates of PHs (Parchman and Culler 1994). Other related supply factors were defined as the number of short-term, general hospital beds per 1,000 population at the county level.

Ability to Pay

Ability to pay was defined as the percentage of families (or households for the elderly analysis) under the 1999 federal poverty level and the percentage of uninsured persons under 65 estimated from the FHIS (Lazarus, Foust, and Hitt 2000). Missing data on the uninsured (percent uninsured) were imputed using a two-step procedure: (1) predictive mean matching of nearest or most similar zip codes; and (2) hotdecking of an observed value of “percent uninsured” to replace missing ones.

Demographic Variables

Demographic variables included: median age (or percent <18 years for pediatric and percent 65+ years for elderly analyses); percent female; percent black, percent with less than a high school education; and percent with limited English proficiency (LEP)(percent Latino was dropped because of its correlation with LEP). Finally, for environmental variables, urbanization was defined as the percent of the population defined as “urban” by the Census, and population density was defined as total population per square mile.

Analysis

STATA 10.0 (College Station, Texas) was used for all analyses, which included bivariate and multivariate linear regression to explore the relationships between community social capital and other variables and PHs. Interaction terms were explored to determine if the associations between diversity and/or faith-based congregations and the outcomes varied across zip codes that with a larger proportion of black, Latino, or poor populations. Given the wide variation in population size among zip codes, each observation was weighted by the square root of the age-appropriate population. Finally, since one of the covariates (hospital beds per 1,000 population) was measured at the county level, analyses were also adjusted for clustering at the county level using the Huber–White sandwich variance estimator. A significance level of $p < .05$ was considered significant for all tests.

RESULTS

Bivariate Analyses

Bivariate associations between study variables and each of the three outcomes ($n = 837$) were examined for overall trends (shown in Supplementary material Appendix SA1). Briefly, community social capital variables had similar associations with the outcomes across the three age groups: percent married and voter participation had consistently negative associations, while mean commute time for workers, the probability of racial or ethnic interaction, relative diversity (or racial segregation), nonprofit organizations and their expenditures, and faith-based congregations all had positive associations. The bivariate associations between primary care resources and the outcomes were less consistent: the number of FPs/GPs per 10,000 was negatively associated with nonelderly adult PHs and pediatric asthma hospitalizations, and the number of general internists per 10,000 was also negatively associated with nonelderly

adult PHs; and the availability of a safety net clinic within 20 miles was negatively associated with elderly PHs. The number of hospital beds per 1,000 in the county was not associated with PH rates.

Multivariate Analyses

Table 3 provides multivariate regression results for each of the three outcomes examined.

Nonelderly Adult PH Rate. All the demographic and environmental variables except percent black and population per square mile were significantly related to nonelderly PHs. Median age, percent female, percent with less than a high school education, and percent urban all positively predicted rates, while percent with LEP negatively predicted rates.

Of the bonding social capital variables, mean commute time to work ($p = .012$) positively predicted PHs. For bridging social capital, the probability of racial or ethnic interaction ($p = .014$) negatively predicted PHs. Finally, among linking social capital, the number of faith-based congregations was positively associated with PHs ($p = .008$). However, there appeared to be a significant interaction between the number of faith communities and percent black, discussed below. Having a safety net clinic within 20 miles of the zip code centroid was negatively related to nonelderly PHs ($p = .027$). Among primary care resources, the availability of general internists was the most strongly and positively related to hospitalization rates ($p = .014$). The amount of variance explained by the final model for nonelderly adult PHs was 77.48 percent.

Pediatric Asthma Hospitalization Rate. Only some of the demographic and environmental variables were related to pediatric asthma hospitalization rates—percent with less than a high school education and percent urban were positively associated (both $p = .002$), while percent with LEP was negatively associated ($p = .051$).

Similar to the model for nonelderly adults, the interaction index was consistently and significantly related to pediatric asthma hospitalizations ($p = .002$), but in the opposite direction (positively predicting hospitalizations). None of the other social capital variables were independently related to pediatric asthma hospitalizations, except there was a significant interaction between the relative diversity (segregation) variable and percent black (discussed below). The number of FPs/GPs per 10,000 was negatively

Table 3: Multivariate Regression Results for Nonelderly Adult, Pediatric, and Elderly Preventable Hospitalization Rates ($n = 837$)

Variable	Adult (18–64) Rate		Pediatric (0–17) Rate		Elderly (65+) Rate	
	β	p	β	p	β	p
R^2	.7748		.5581		.6429	
Demographics						
Age*	.29	.020	–.19	.165	–2.78	<.001
Female (percent)	1.44	<.001	.18	.457	7.46	<.001
Black (percent)	.19	.153	.11	.096	–.58	.140
< High school education (percent)	2.25	<.001	.44	.002	6.78	<.001
Limited Eng. proficiency (percent)	–1.81	<.001	–.32	.051	–4.30	.002
Environment						
Urban (percent)	.16	.003	.08	.002	–.10	.670
Population per square mile	<.001	.124	> –.001	.653	.01	<.001
Bonding social capital						
Married, percent	–.11	.432	–.07	.614	–.31	.660
Mean commute time (minute)	.59	.012	–.01	.943	3.25	.004
Bridging social capital						
Voting participation (percent)	.009	.928	.10	.107	.51	.418
Interaction (Simpson) index [†]	–.18	.014	.14	.002	.22	.418
Relative diversity (square root) [‡]	1.77	.682	4.06	.061	–.21	.198
Linking social capital						
Nonprofit organizations per 10,000 (square root)	1.44	.225	.97	.227	5.94	.218
Nonprofit program expenditures per capita (log), \$	–.13	.768	.13	.674	2.59	.211
Faith-based congregations per 10,000 (square root)	3.94	.008	–.49	.382	3.72	.567
Ability to pay						
Poverty (percent) [§]	.73	.091	.13	.405	4.50	.001
Uninsured (percent)	–.06	.820	.24	.278		
Health care resources						
Safety net clinic within 20 miles (yes versus no)	–11.00	.027	1.57	.548	–89.30	.015
Family and general practitioners per 10,000	.19	.567	–.42	.013	1.22	.410
General internists/pediatricians per 10,000	.46	.014	.03	.270	2.26	.015
Hospital beds per 1,000 population	–1.05	0.297	–.07	.878	–1.97	.704

*For nonelderly adult rate, this is median age; and for pediatric and elderly rates, this is percent of population 0–17 and 65 and older, respectively.

[†]Interaction (Simpson) Index, or S , is the probability that two randomly selected people from the zip code cluster will be of different races or ethnicities. $S = 1 - \sum (N_k/N)^2$.

[‡]Relative diversity was measured using a χ^2 -statistic comparing the distribution of four race or ethnic groups (black, whites, non-Hispanic whites, and all other ethnicities) of the zip compared with the distribution at the county level [$\chi^2(j) = \sum (T_{ij} - C_{ij})^2 / C_{ij}$].

[§]For the nonelderly adult and pediatric rates, this is the proportion of families below the federal poverty level; for the elderly rates, this is the proportion of households below the federal poverty level.

associated with pediatric asthma hospitalizations ($p = .013$). The amount of variation explained by the final model for pediatric asthma hospitalizations was 55.81 percent.

Elderly PH Rate. Demographic and environmental variables were consistently related to elderly PHs. Percent female had the largest association (positive, $p < .001$), followed by the proportions of the population with less than a high school education (positive, $p < .001$), percent with LEP (negative, $p = .002$), the proportion of the zip population that is over age 65 (negative, $p < .001$), and population density (positive, $p < .001$).

Among the community social capital variables, only mean commute time for workers had a significant association with elderly PHs ($p < .001$)—a higher mean commute time was associated with a higher elderly rate. Similar to the nonelderly rates, the number of general internists per 10,000 positively predicted elderly PHs and having a safety net clinic within 20 miles of the zip code centroid negatively predicted elderly rates (both $p = .015$). Percent poverty also had a strong, positive relationship to elderly PHs ($p = .001$). The total amount of variance explained by the final model of elderly PHs was 64.29 percent.

Exploring Interactions. Exploring whether racial segregation affected zips with larger minority populations differently as compared with zips with larger white populations resulted in two significant findings. First, for nonelderly PHs, a significant positive relationship was found for racial segregation when interacted with percent black and a significant negative relationship was found when racial segregation was interacted with percent Hispanic. Thus, although racial segregation is not related to nonelderly adults hospitalization rate overall, it becomes important for those living in areas with larger proportions of African Americans and Latinos. Second, for pediatric asthma hospitalizations, racial segregation was also significant when interacted with percent black but not percent Hispanic. Therefore, for children's access, bridging ties seemed to be particularly important for communities with larger proportions of African American residents. Finally, a significant negative relationship was found when racial and ethnic diversity was interacted with having a safety net clinic among adults. Thus, adult PHs were lower in communities with both the potential for racial and ethnic interaction and a safety net clinic within 20 miles.

DISCUSSION

Few of the social capital measures were significantly related to PHs once demographic and environmental variables, primary care resources, and ability to pay factors were controlled for. Under bonding social capital, shorter mean commute times for workers were associated with fewer adult PHs. An increase of 7 minutes in average commute time was associated with 4.1 additional nonelderly adult PHs and 22.8 additional elderly PHs. Shorter commute times for working adults could facilitate attending health care appointments, or assisting a family member or neighbor in attending theirs, as well as greater neighborhood participation for workers and more diverse interaction among all residents, facilitating the diffusion of information. Interestingly, the proportion of the population that was elderly was associated with fewer elderly PHs. More “elderly” communities may have more social support and community resources oriented to seniors’ particular needs (e.g., transportation assistance, senior activities, and housing).

Also under the bonding social capital category, less ethnic diversity was associated with fewer pediatric asthma hospitalizations. An increase of 30 percent in the probability of racial or ethnic interaction was associated with 4.2 additional pediatric asthma hospitalizations. It may be that intra-ethnic ties and interactions are particularly important for children, given the strong cultural and social influences and close contacts relied upon for child rearing.

Bridging social capital appeared to be important for nonelderly adults, as greater potential for interracial and interethnic interaction at the zip code-level was associated with fewer PHs. An increase of 30 percent in the probability of racial and ethnic interaction was associated with 5.6 fewer PHs among adults. It has been shown that “weak ties” (cross-cutting ties) are important for diffusion of information about employment opportunities among working-age adults (Granovetter 1973); such ties may also facilitate diffusion of health care information.

Racial and ethnic segregation (relatively diversity) was also positively associated with the nonelderly adult PH rate and pediatric asthma rate in zip codes with higher percentages of black residents as well the nonelderly adult rate in zips with higher percentages of residents in poverty. This finding is corroborated by research that has found black-white segregation associated with deteriorated physical environments and economic opportunities, and fewer public resources in predominantly black areas (Massey and Denton 1989; Williams 1999), as well as higher black infant mortality rates, indepen-

dent of income and poverty differences between blacks and whites (Polednak 1991, 1996).

In contrast, racial and ethnic segregation (relatively diversity) was negatively associated with nonelderly adult PHs in zip codes with higher percentages of Latinos. This may seem counterintuitive, as did the finding that percent with LEP was negatively associated with PH rates among all three age groups. Having a concentration of immigrants speaking other languages could facilitate access for certain subgroups through shared communication networks and culturally competent providers (Angel and Angel 1992; Komaromy et al. 1996).

In terms of linking social capital, the multivariate analyses did not support the hypotheses. However, the positive relationship between faith-based congregations and PHs among nonelderly adults is not completely unexpected. Faith-based congregations are often the last to leave distressed, marginalized neighborhoods and the first to return (Foley et al. 2001). The needs created by societal inequalities could overwhelm any "protective" effect of faith-based congregations. Indeed, some of faith-based congregations' association with increased PHs in the nonelderly adult model was due to its interactions with the percentage of black residents (at higher percentages, this represented racial segregation) and percent poverty. Given the larger trends that affect these areas (e.g., capital flight, urban and rural deterioration) and shape the well-being of congregants and their communities (Foley et al. 2001), our expectations for linking social capital, as exemplified by these institutions, may be unrealistic.

The finding that having a safety net clinic within 20 miles was related to lower adult PH rates confirms findings from a previous study in Virginia, where the availability of public ambulatory clinics was associated with lower PHs among low-income and elderly populations (Epstein 2001). The positive relationship between the supply of general internists and adult PHs is not surprising, because internists are likely to take care of patients with the conditions studied and might be more likely to have offices in areas where more of these patients reside. Further, general internists and pediatricians tend to cluster more in urban areas than FPs/GPs and are thus less able to have a significant impact on PHs across all zip codes in the state (Parchman and Culler 1994), like FPs/GPs appear to have had on pediatric asthma hospitalization rates in this study.

Limitations

These analyses had a number of limitations. First, zip codes are at best a proxy for neighborhoods, although they do provide a way to examine variation

across geographic areas in a more localized fashion than previously done in social capital and health studies. Second, many of the social capital measures were also only proxies for the different types of social capital identified in the conceptual framework. For example, to estimate the level of social capital associated with community organizations, one should know something about their level of activity or reach. Third, the design of the study (cross-sectional, ecological analyses) limits our ability to make causal inferences about how area social capital affects an individual's probability of having a PH. Fourth, as the data come from only one state, they have limited generalizability. Future research that attempts to replicate the findings of this study over time and across states would be valuable. Finally, although PHs have been validated as a community-level measure of poor access to care for nonelderly adults (Bindman et al. 1995), it is still an indirect measure and may not correlate perfectly with actual access. Moreover, although timely primary care for chronic conditions is preferable to PHs, the latter could be preferable to not getting hospitalized when needed.

CONCLUSION

Much of the empirical research on social capital has been under-developed theoretically and has not explored factors such as racial and ethnic interaction and segregation. More qualitative research on social capital is needed to build theory and generate better hypotheses that can be tested quantitatively. Empirical work should also distinguish among different types of social capital, clearly identifying what are bonding, bridging, and linking ties, as well as what constitute strong and weak ties within each of these (Ferlander 2007). This study, although far from conclusive, suggests that aspects of community social relations, such as racial diversity and segregation and cross-cutting ties, heretofore conceptualized as a type of social capital but not considered in empirical analyses, are related to PHs, but in different ways across different age groups. Linking social capital is an important theoretical distinction, but further work is needed to fully operationalize this concept.

Research on social capital needs to consider the larger macrolevel economic policies that structure the types of relationships within any community. For example, multilevel models have been suggested as important for understanding the effects of residential segregation and the relative contributions of individual, neighborhood, and metropolitan area factors on health outcomes (Acevedo-Garcia et al. 2003). Social capital research needs to be similarly

sophisticated, teasing out the relative contribution of different factors in affecting health care access and outcomes.

ACKNOWLEDGEMENTS

I gratefully acknowledge Thomas Rice, Ph.D., of the University of California, Los Angeles, committee chair for my dissertation (upon which this article is based), for his guidance and encouragement and for feedback on this manuscript. Many thanks to other members of my dissertation committee at UCLA, Emily K. Abel, Ph.D., E. Richard Brown, Ph.D., Naihua Duan, Ph.D., and Leobardo Estrada, Ph.D., and to Carol Edwards and Adrian Overton, M.S., of the RAND Corporation for programming and geocoding assistance. Beth Ann Griffin, Ph.D., also from RAND, provided statistical advice on a revision of the manuscript. Partial funding for this study was provided by RAND.

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SUPPLEMENTARY MATERIAL

The following material is available for this article online:

Appendix SA1: Author Matrix

Table S1: Weighted Bivariate Associations between Study Variables and Preventable Hospitalization Rates ($n = 837$).

This material is available as part of the online article from: <http://www.blackwell-synergy.com/doi/abs/10.1111/j.1475-6773.2008.00856.x> (this link will take you to the article abstract).

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