State Social Capital and Individual Health Status

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Abstract

Recent studies have found that two state-level measures of social capital, average levels of civic participation and trust, are associated with improvements in individual health status. In this study we employ these measures, together with the Putnam (2000) index, to examine several key aspects of the relationship between state social capital and individual health. We find that for all three measures, the association with health status persists after carefully adjusting for household income, and that for two measures, mistrust and the Putnam index, the size of this association warrants further attention. Using the Putnam index, we find particular support for the hypothesis that social capital has a more pronounced salutary effect for the poor. Our findings generate both support for the social capital and health hypothesis and a number of implications for future research.

State Social Capital and Individual Health Status

1. Introduction

The concept of social capital and its potential importance for the human condition has captured the attention of both the academic and policy communities.[1] Because social capital is typically described as an attribute of organizations or communities that facilitates mutual cooperation (Coleman 1988 and Putnam 2000), several studies measure social capital in a particular place by the average level of civic participation or average measures of trust in others. Such measures have been shown to be associated with many different indicators of well-being,[2] including various measures of individual and population health.

In light of this mounting evidence, some public health scholars have posited that there may well be an important causal connection between social capital and public health. For example, in reviewing the social capital literature, Lomas (1998) states that:

> ... the way we organize our society, the extent to which we encourage interaction among the citizenry and the degree to which we trust and associate with each other in caring communities is probably the most important determinant of our health (p. 1181).

But others have sounded more cautionary notes regarding the social capital hypothesis (see especially, Pearce and Davey Smith 2003, and also Baum 1999, Edmondson 2003, Hawe and Sheill 2000, Henderson and Whiteford 2003, Macinko and Starfield 2001, Whitehead and

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[1]For example, see the World Bank website on social capital and development at http://www1.worldbank.org/prem/poverty/scapital/index.htm.

[2]Social capital has also been linked to such disparate phenomena as economic growth (Knack and Keefer 1997), the management techniques of state government (Knack 2002) and desertions form the Union Army (Costa and Kahn 2003).

Diderichsen 2001, and Woolcock 1998). Among these authors' concerns are the use of multiple constructs of social capital in different studies and the as yet underdeveloped theoretical basis for a connection between social capital and health. Beyond these conceptual problems lie questions about the application of research findings to public policy, since little is known about which specific policy levers may influence social capital, to what degree, and what effect social capital itself may have on the policy process. The purpose of the present paper is to identify and explore several additional concerns regarding the empirical analyses of social capital and health.

Our task is complicated by the broad spectrum of social capital constructs employed in previous studies of social capital and health. For this reason, we narrow our focus to one prominent strand of this burgeoning literature, the connection between state-level social capital and health status. In doing so, we follow several recent empirical analyses which use two common measures of social capital, specifically aggregate membership in voluntary groups and generalized trust.[3] Another reason for restricting our attention to state social capital is that this body of evidence has been most clearly and consistently supportive of the hypothesis that social capital is an important determinant of health.[4] In contrast, evidence regarding the efficacy of social capital at the level of communities or countries has been more mixed.[5]

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[3]Recent experimental work by Glaeser et al. (2000) calls into question the usefulness of survey-based measures of trust; however, Anderson et al. (2004) find that generalized trust is significantly associated with contributions in public goods experiments.

[4]Some studies compare social capital and health outcomes either across countries (McCulloch 2001) or geographic units within other countries, such as Russia (Kennedy, Kawachi and Brainerd 1998), Hungary (Skrabski et al. 2003), and Canada (Veenstra 2002).

[5]For example, across neighborhoods in Chicago, Lochner et al. (2003) report that social capital is associated with lower overall mortality rates among whites (and to a lesser extent among blacks), but is unrelated to cancer mortality; also see Subramanian et al. (2002 and 2003). Looking across countries, neither Lynch et al. (2001) nor Kennelly et al. (2003) find a consistent

Our review of existing empirical studies of the health consequences of state-level social capital reveals some of the same issues that we have previously identified in related public health research into two other state-level social determinants of health, income inequality and racial minority concentration (Mellor and Milyo 2002, 2003 and 2004). Specifically, many studies of state social capital and health are ecological in nature, while those that do use household data include only sparse measures of income to control for variations in material resources across individuals. Thus, one objective of this paper is to conduct new empirical work that addresses these limitations. In addition, we seek to address two other issues – the relative importance of social capital across the income distribution, and the relative size of the effects of social capital and material conditions in the state. Previous studies have not explicitly tested whether social capital matters more for the poor, nor has this literature devoted sufficient attention to whether the observed association between social capital and health is substantively important.

The remainder of this paper is as follows. In section 2, we summarize the theoretical model linking social capital to health status and the existing empirical literature on state social capital and health. In section 3 we describe our data. Section 4 covers our statistical method and results; here we also attempt to characterize the substantive importance of our findings. This represents an important contribution to this line of research, since previous work on state social capital and health has emphasized the statistical significance of social capital measures as determinants of health, with less concern for whether such estimates imply that state social capital is a substantively important determinant of health. In the conclusion, we discuss the

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association between social capital and mortality. Still others have examined the role of individual-level measures of social capital (e.g. Veenstra 2000 and Rose 2000).

future research directions suggested by our findings.

2. State Social Capital and Individual Health Status

Several distinct mechanisms have been described as potential pathways from social capital to individual health. Social capital may counterbalance the stress of modern life and thereby reduce heart disease and unhealthy behaviors (e.g., Wilkinson 1996). Alternatively, social capital may lead to increased political support for social welfare programs and public health policies (e.g., Kawachi et al. 1997).[6] Finally, social capital may increase informational or material resources available to an individual.

Much of the evidence for a causal connection from state social capital to health is based on ecological analyses. For example, there is a well-documented statistical association between state-level measures of social capital and either mortality or violent crime (Galea et al. 2002, Kawachi and Kennedy 1997 and 1999, Kawachi et al. 1997, Kennedy et al. 1998, Kawachi, Kennedy and Wilkinson 1999, Putnam 2000, Wilkinson et al. 1998). There exists similar evidence of a link between state social capital and various risk factors or social indicators, including teen births (Gold et al. 2002), gun ownership (Hemenway et al. 2001), sexually transmitted diseases (Holtgrave and Crosby 2003) and food insecurity (Martin et al. 2004).[7]

While the variety of outcome variables examined in this literature is impressive, the

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[6]On this point, Anderson et al. (2003) find that group cohesion is associated with contributions in a public goods experiment.

[7]For additional evidence on pathways from social capital to health (but not necessarily *state* social capital), see Weitzman and Kawachi (2000) on binge drinking, Lindstrom et al. (2001) on physical activity, Hendryx et al. (2002) on access to care, Ahern and Hendryx (2003) on trust in providers and Beiseitov et al. (2003) on informational networks and health insurance coverage among the elderly.

studies cited above share common drawbacks. Aside from the well-known perils of ecological inference, these and similar studies typically examine only a single cross-section of state-level data, so by necessity include only sparse controls for other determinants of population health.[8]

Of particular interest, then, are studies which examine the relationship between state social capital and individual health outcomes, such as Kawachi et al. (1999) and Subramanian et al. (2001). Both studies use individual-level data to examine the effects of state social capital on individual health status. The former employs three measures of state social capital derived from the General Social Survey (average mistrust, reciprocity and membership). Subramanian et al. (2001) also use this same data, but they employ only the mistrust measure. These particular state social capital measures were first used in an ecological analysis by Kawachi et al. (1998); because the General Social Survey does not seek respondents from every state, Kawachi et al. constructed state social capital measures for only 39 states.[9] In contrast, Putnam (2000) creates an index of state social capital that is available for 48 states. In our subsequent empirical analysis, we will employ both sets of state social capital measures.

Kawachi et al. (1999) and Subramanian et al. (2001) analyze data from the 1993-1994 Behavioral Risk Factor Surveillance System (BRFSS), a large nationally representative survey. Because these studies seek to investigate the influence of state-level variables on individual-level health status, they employ multilevel estimation methods. In both cases, the researchers find a statistically significant association between state social capital and the risk of reporting poor or

[8]Also, see Milyo and Mellor (2003) on the sensitivity of such estimates to different methods of weighting and age-adjustment.

[9]See Milyo and Parnekar (2003) for a discussion of the procedures used by Kawachi et al. (1998) in constructing these variables.

fair health status. While these findings are intriguing, these studies also raise several methodological concerns.

First, while the BRFSS has the advantage of including several variables of interest to health researchers, it also has the decided disadvantage of providing only limited information on household income. For example, Kawachi et al. (1999) include controls for seven categories of income, but nearly half the sample observations are either top-coded (> $35,000) or missing. In a follow-up study, Subramanian et al. (2001) omit observations with missing income, and collapse the income controls into just three categories (low, medium or high income). The use of only sparse controls for income is a serious concern, as income is known to be an important determinant of both individual health status (e.g., Mellor and Milyo 2002) and common social capital measures (e.g., Alesina and La Ferrara 2000 and 2002). Therefore, in the analyses of Kawachi et al. (1999) and Subramanian et al. (2001), state social capital is expected to be correlated with unobserved individual variation in income, which should lead to an upward bias in the estimated effect of social capital on health status in these studies.[10]

In addition to this methodological concern, our study takes on two addition questions. First, we explore the effects of social capital across the income distribution. Regardless of the pathways through which social capital affects health, it is the well-being of the least well-off in society that is expected to be most influenced by the presence or absence of social capital, as the lack of material resources makes poorer individuals more vulnerable to the consequences of the

[10]On the other hand, both Kawachi et al. (1999) and Subramanian et al. (2001) control for whether an individual is a smoker, which may be along the causal pathway from social capital to health, and so should not be included in a reduced-from model. For this reason, the findings in these studies may instead *understate* the consequences of state social capital on health status.

breakdown of civil society, more susceptible to health problems, and less able to cope with these factors. Previous research on state social capital and health has not explicitly tested this implication of the social capital and health hypothesis. Second, we explore the substantive significance of state social capital as a determinant of health status. Previous work has emphasized the statistical significance of state social capital measures, and given less attention to the magnitude of their effects on health outcomes.

3. Data

In order to test the hypothesis that state social capital is a determinant of health status, we use individual-level data from the Current Population Survey (CPS) merged with three state-level social capital measures derived from other sources. In doing so, we depart from previous studies (Kawachi et al. 1999 and Subramanian et al. 2001) that use individual-level data from the Behavioral Risk Factor Surveillance System (BRFSS); the primary advantage of the CPS is in the quality of information on household income. This is crucial, because we wish to examine whether previous findings of a statistical association between social capital and health status are attributable to the inability of earlier studies to control for income in a sufficient manner. In contrast, in using two measures of state social capital from the General Social Survey (GSS), we follow earlier studies in the public health literature. However, in order to check whether previous findings are sensitive to the particular measures of state social capital, we also employ an index of state social capital developed by Putnam (2000).

A. Sample Size

The March CPS has included a question on respondents' health status since 1995.

However, the CPS rotates its sample so that 50% of respondents remain in the sample from one year to the next, making the CPS in effect a series of overlapping two-year panels. Unfortunately, individual identifiers are not publicly available, so in order to avoid double-counting the same individuals, we use alternating years of the CPS (1995, 1997 and 1999). In selecting data for our study, we follow several other published studies (Fiscella and Franks 1997 and 2000; Mellor and Milyo 2002, 2003 and 2004) and restrict the sample to include only white and black civilians, not living in group quarters, and between the ages of 25 and 74. We also limit our sample to heads of households, because only the head of household self-reports health status in the CPS.[11] Finally, we limit our analysis to either the 39 states for which we have measures of social capital from the GSS (see the appendix for a list of included states), or the 48 states for which we have measures of state social capital from Putnam (2000); this leaves us with about 68,000 or 76,000 observations, respectively. We provide descriptive statistics for all individual-level variables from the CPS in Tables 1 and 2.

B. Health Status

Self-reported health status is a common measure of individual health in both the public health and health economics literatures; beyond the advantage of expediency, self-reported health status has been shown to be significantly associated with mortality, even after controlling for several medical diagnoses (Hornbrook and Goodman 1996, Idler and Benyami 1997). Nevertheless, because it is a subjective measure, there is some possibility that health status will

[11]The head of household also reports health status for other members of the household, but those reports may not be valid or comparable to self-reported health status.

be spuriously correlated with other factors.[12] Therefore, to the extent state social capital influences the self-report of health status and not health status itself, our findings will overstate the importance of social capital.

The CPS, not unlike other large surveys, asks respondents to rate their health status on a five-point scale (poor, fair, good, very good, and excellent); several previous studies of health status collapse this measure into a binary indicator for fair\poor health or not (e.g., van Doorslaer et al. 1997, Marmot et al. 1998, Mellor and Milyo 2002, 2003 and 2004). We depart from past practice and employ the five-point scale as our dependent variable (ranging from 1 = poor to 5 = excellent); the fraction of respondents in each category is reported in Table 1. This use of the full range of health status categories also distinguishes our analysis from that Kawachi et al. (1999) and Subramanian et al. (2001), who employ a binary indicator for fair\poor health.[13]

C. Individual-Level Explanatory Variables

In order to gauge the independent effect of state social capital on health status, we control for a wide variety of individual covariates, including education, sex, race, Hispanic ethnicity, and residence in a central city (see Table 2). Because income is poorly measured in other surveys, and because other state-level social factors have been found to be spuriously correlated with household income,[14] we pay particular attention to this covariate. We model the effects of household income as a spline function with kinks at the quintiles for household income; this

[12]For example, self-reported health measures have been shown to be influenced by expectations about individual labor market outcomes (see Butler et al. 1987 and Waidmann, Schoenbaum, and Bound 1995).

[13]We discuss our findings using a binary indicator as part of our sensitivity analysis.

[14]See especially Mellor and Milyo (2002) on income inequality and health status.

allows income to have five different slope coefficients. The choice of quintiles is arbitrary, but it is a focal method for classifying individuals who are poor versus middle-income or rich. This will be particularly useful when we turn to the question of whether social capital has differential effects across income categories.

A major disadvantage of the CPS is that it does not include information on quality of health care, individual diet or lifestyle (e.g., smoking). The latter at least are choice variables that should not be included as controls in our reduced-form statistical specification. However, state policies or regional social norms may influence the choice of an individual to smoke. For this reason, as part of our sensitivity analysis, we check the robustness of our findings to the inclusion of state-level measures of the incidence of smoking, which we include as a proxy for state policies and social norms that may be exogenous determinants of an individual's tobacco usage. Likewise, we check the sensitivity of our findings to the inclusion of the state incidence of overweight and alcohol use as control variables. Similarly, there may be important regional variations in the quality of health care, as well as public health policies. Therefore, in our sensitivity analysis, we also report results obtained after including geographic fixed effects to control for this type of variation. However, because we have only one observation for social capital in each state, we are not able to control for state fixed effects; we instead use a set of census division indicators as a rough approximation for the influence of fixed geographic factors on health.

D. State-Level Social Capital

In constructing our first two measures of state social capital, we follow the previous literature as closely as possible in order to make our findings directly comparable to those of

Kawachi et al. (1999) and Subramanian et al. (2001). Specifically, we also use the General Social Survey (GSS) to construct two state-level measures of social capital from aggregated individual responses to separate questions on mutual trust and membership in voluntary associations.

While these GSS questions are suitable for deriving social capital proxies, the survey does not cover every state in any given year and is not designed to be representative at the state level. Therefore, we follow Kawachi et al. (1998), as well as most subsequent studies of state social capital and health, and apply a post-stratification weighting procedure in order to construct more appropriate state-level measures of social capital (see the appendix for details). Finally, because the GSS contains a relatively small number of observations, we again follow the previous literature in pooling data from the 1986-1990 responses to the GSS. In this way, we are able to generate state social capital measures of average mistrust and memberships for 39 states (as in Kawachi et al. 1999 and Subramanian et al. 2001). Descriptive statistics and the exact definitions of these variables are shown in Table 3; the coefficient of correlation for these two variables is -0.60.

As an alternative measure of state social capital, we also employ the index developed by Putnam (2000), which is available for the 48 continental states; this measure has been more commonly employed outside the field of public health (e.g., Knack 2002). The Putnam index is a factor score derived from 14 different variables, including measures of average trust and membership in each state from the GSS, related measures from other national surveys, and state voter turnout rates in 1988 and 1992.[15] For ease of analysis, we normalize these factor scores so

[15]All of the survey data is from the period 1973-1998 (see Putnam 2000).

that they take values from 0 to 1 (see Table 3). This modified Putnam index is highly correlated with state mistrust (r = -0.82) in the 39 state sample, but less so for state average membership (r=0.49).

E. Preliminary Ecological Analyses

Before proceeding with the analysis of the multilevel data, we first demonstrate that our data also generate ecological associations of the sort found in previous work. This exercise establishes that any differences or similarities between our subsequent findings and those of the earlier literature are largely attributable to our statistical methodology and not to the choice of outcome variable (health status) or data set (CPS).

In Table 4, we present estimates from weighted least squares regressions where the dependent variable either is mortality (models 1-3) or average health status (models 4-6) and the key independent variable is one of our three measures of state social capital.[16] In every case, social capital is significantly related to population health; further, the signs on these estimates suggest that improvements in social capital are associated with substantial improvements in population health. For example, the estimates reported in Table 4 imply that a one standard deviation increase in state mistrust is associated with an increase in state mortality of 44 per 100,000 persons (or about a third of a standard deviation in state mortality). In contrast, that same increase in mistrust is associated with a decrease of 0.11 in state average health status (or roughly one full standard deviation in average health status).

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[16]We weight the regressions by state population, because the dependent variables are defined per capita. In addition, we adjust for different age-compositions of state population by including controls for fraction of state population that is less than 19 years old, or over 65 years old.

We obtain more modest but qualitatively similar results for the other two measures of social capital, memberships and the Putnam index. This exercise therefore yields findings that are broadly consistent with earlier ecological studies; in addition, this exercise demonstrates that health status is more sensitive than mortality to changes in state social capital (as might be expected). Having thus established that there is a significant association between state social capital and state-level average health status, we now proceed to our analysis of the contextual effects of state social capital on individual health status.

4. Methods and Results

In our mixed-level analyses, we estimate ordered probit models where the dependent variable is a five-point health status scale and the independent variable of interest is one of the three state social capital measures; because state social capital does not vary for individuals within a state, we adjust all reported standard errors for clustering of observations at the state level. In our first set of ordered probits, we test the hypothesis that there is a common effect of social capital on the health status of all individuals; the results of this analysis are reported in Table 5. Because the estimated coefficients from an ordered probit are not readily interpretable, we calculate the responsiveness of individual health status to changes in state social capital; these elasticity calculations are reported in Table 6. We then test the hypothesis that social capital is particularly important for the health of poor individuals by interacting state social capital with an indicator for the quintile of household income and, alternatively, an indicator for the lowest two quintiles (reported in Table 7 and Table 8, respectively). In each case, we estimate the ordered probit model separately for each state social capital measure.

A. Does State Social Capital Have an Independent Effect on Individual Health Status?

In this analysis, we assume that state social capital has the same effect on reported health status for all individuals; ordered probit estimates are listed in Table 5. In addition to one measure of state social capital, the independent variables in each model include the household income spline, size of household, age, race, Hispanic ethnicity, sex, marital status, education, and residence in a central city or metropolitan statistical area, as well as year and state median household income. The coefficients on household income are all statistically significant and exhibit diminishing returns; however, the coefficient on state median income is marginally significant in only one specification.

In the first column of Table 5, we report the estimated coefficient on the state membership variable (model A); the coefficient is positive, but not statistically significant at conventional levels. In contrast, the estimated coefficients for mistrust and the Putnam index (models B and C, respectively) have the predicted sign and are highly significant ($p<.001$). This exercise demonstrates that for two of three measures, the previously observed significant association between state social capital and health status is robust to the inclusion of controls for a rich set of individual attributes. However, it is worth noting that this association is much attenuated by adding our controls for household income (results without household income are not shown); therefore, as we conjectured, studies that include only sparse controls for income may exaggerate the association between state social capital and health status.

B. Responsiveness of Individual Health Status to Changes in State Social Capital

The substantive importance of our ordered probit estimates are not transparent, so we next calculate the change in the probability that a given state of health is reported for a one percent increase in a given social capital measure (Table 6). For comparison, we calculate these

health status elasticities for state median household income, as well. The elasticities with respect to membership are all smaller in magnitude than those for state median income, but the opposite is true for mistrust and the Putnam index. All of these estimated elasticities are small in absolute magnitude, but this begs the question, compared to what?

For example, the largest response estimated is for mistrust; the elasticity of 0.69 in the first column means that a ten percent increase in state mistrust (nearly two-thirds of a standard deviation) will raise the mean probability of reporting poor health from 4.4% to 4.7% (i.e., a 6.9 percent increase in the probability of reporting poor health). This effect of a 10% increase in mistrust is relevant, because it is approximately equal to the average decade-by-decade decrease in generalized trust in the U.S. identified by Putnam (2000). The associated increase in the probability of reporting poor health may not seem large at first, but because social capital is an aggregate measure, this increase is applied to all individuals in the United States. To affect a similar change in health status for the entire U.S. population would require reducing income by at least $1,000 per household (calculated from the estimated elasticities on household income from Model B).

These elasticities are useful for considering the responsiveness of health status to small changes in state social capital. We consider these to be appropriate measures for thinking about the efficacy of social capital, since we are unaware of any policy treatments that would result in large shifts in state social capital. However, if instead we wish to consider the health consequences of large changes in social capital, for example a one-standard deviation "shock," then these elasticities may not be the most useful tools for making such comparisons. This is because the coefficients of variation (or the ratio of the standard deviation to the mean) differ

markedly across the three measures (see table 3). If instead of a one percent change, we consider a one-standard deviation change in each state social capital measure, then the elasticity measures in Table 6 imply that health status is most responsive to the Putnam index, with responsiveness to mistrust close behind. Consequently, the estimated effect of state membership is neither significant nor large by comparison to other common measures of state social capital.

Even so, it is difficult to comprehend the substantive importance of social capital for health status without some sense of the range of a social capital "treatment" that might be reasonably anticipated from changes in policy levers. We return to this issue in the conclusion.

C. Does State Social Capital Have a Greater Effect on the Health Status of the Poor?

We now turn to the question of whether social capital has a more pronounced effect on the health status of the poor, as implied by most of the discussion of potential causal pathways from social capital to individual health. In order to test this hypothesis, we interact state social capital with five indicator variables, one for each quintile of household income; the results of this exercise are reported in Table 7. The ordered probit models estimated are otherwise identical to those reported in Table 5.

For all three social capital measures, the interacted effects of social capital and income quintiles are jointly significant ($p<.001$) and not identical ($p<.01$). It is also worth noting that the estimated effects of state social capital do not change signs as we move from the lowest quintile to the highest. All of these findings support the social capital hypothesis; however, the gradient for the estimated coefficient of social capital by income quintile is relatively flat for both mistrust and the Putnam index. This gradient is steepest for membership, although only one of

these five coefficients is estimated with much precision.[17]

Because state social capital does not appear to have dramatically different effects across income quintiles, we provide another test of the hypothesis that social capital matters more for the poor. Rather than estimate a separate effect of state social capital for each quintile, we estimate a common effect for all individuals and a differential for individuals in the lowest two quintiles;[18] results are shown in Table 8. As before, the common effect of state social capital on all individuals has the predicted sign for each measure, but is significant for only mistrust and the Putnam index. However, the differential effect for the lowest two quintiles is significant only for the Putnam index.

D. Sensitivity of Results

In using an ordered probit model we depart from previous studies; therefore, we have replicated the analysis above using a probit model and a binary indicator for fair\poor status as the dependent variable. We observe a similar pattern of results using probits, and the effect of memberships has greater statistical significance compared to the ordered probit estimates. However, we prefer to present results obtained with the ordered probit since the CPS uses a five-point scale for health status.

In the models above, median income is the only other state-level control besides social capital. One concern is that state social capital may be spuriously correlated with omitted state

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[17]We do not provide separate estimates of the elasticities implied by the models in Table 7; however, comparison of the ordered probit coefficients in Tables 5 and 7 should convince the reader that the implied elasticities are similar to those reported in Table 6.

[18]This is a restricted version of the model reported in Table 7; the restriction imposed here can be rejected ($p<.05$) for membership and mistrust, but not for the Putnam index.

or regional determinants of health status. As a check on this possibility, we estimated the models above with the addition of measures of the state-level incidence of smoking, overweight and high alcohol consumption. In no case did these additional controls appreciably change the results that we report here. In addition, we also estimated our models with geographic fixed effects to control for unobserved heterogeneity. Because there is only one social capital observation for each state we cannot include state fixed effects; instead, we use fixed effects for census division. Not surprisingly, the addition of these controls attenuates the effects of state social capital, but for the most part we observe a similar pattern of results.

We also re-estimated our models with percent black in the state included as a control variable. Once again, the results are essentially unchanged by this addition. In addition we estimated our models separately for blacks and for non-blacks. In the non-black sample, we obtain results similar to the full sample analysis. In contrast, state social capital is not significantly associated with health status for blacks, in part because the standard errors of the estimates are larger, but also because the coefficients are a small fraction of their size in the full sample. These findings suggest that future work should explore racial differences in social capital itself.

Finally, the Putnam index yields somewhat more favorable results for the social capital hypothesis in our analysis above, but at the same time this measure is also available for more states than either memberships or mistrust. In order to check whether it is the sample of states that is driving this difference in results, we re-estimated models using the Putnam index, but restricted the sample to the set of 39 states used in the other models (rather than the full 48 states for which the Putnam index is available). This does not cause any appreciable change in our

reported results for the Putnam index using the 48 state sample.

5. Conclusion

A burgeoning literature suggests that social capital may be an important determinant of health. In this paper, we focus on one facet of this literature: the connection between state social capital and health. Much of the prior empirical support for such a connection comes from ecological analyses that employ few control variables, while two recent mixed level studies include sparse controls for individual income. These empirical studies raise concerns that the frequently-observed association between state social capital and measures of population or individual health may be spurious, due to omitted or poorly measured determinants of health. This same methodological problem has been noted in our earlier work on income inequality and racial minority concentration. However, in contrast to those other social determinants, we find in this study that the association between state social capital and health status is robust to the inclusion of a rich set of control variables and various model specifications. Nevertheless, some caution is in order.

First, because our state social capital measures are available for only a single cross-section, we are not able to control for unobserved state-specific heterogeneity. Nor are we able to ascertain whether exposure to higher levels of social capital is positively associated with health over time. This would require panel data, or at least more detailed information on the past residential locations of survey respondents. This is a serious limitation of the existing data sets that are employed in social capital research; new survey instruments need to be developed that will allow researchers to test whether lifetime exposure to social capital is more important than the contemporaneous social capital measures. In addition, it is conceivable that the timing of

exposure to higher social capital may matter; for example, contemporaneous social capital may have more influence over the health-related behaviors of young adults than for the elderly.

Second, because the CPS does not contain information on health habits or access to care, we are unable to control for other determinants of individual health, or to test whether these are the pathways by which social capital influences health. Similarly, because the CPS does not contain information on individual trust or membership, we cannot be sure whether state social capital is itself a determinant of health status, or is serving as a proxy for omitted individual-level social connections.[19] Future empirical investigations of the health consequences of social capital should address these issues through the use of more comprehensive survey data and structural modeling techniques.

Like previous studies of state social capital and health, we measure state social capital with aggregate levels of mistrust and memberships, but we depart from most previous work in this area by also employing the Putnam index. We find relatively weak associations between memberships and health status, and much stronger effects from both the mistrust measure and the Putnam index in terms of the size and statistical significance of their effects. When we explicitly test whether social capital has a more pronounced salutary effect on the poor, we observe significant interaction effects across income quintiles for all three state social capital measures. Notably, however, it is only for the Putnam index that we observe a significant differential effect on the poorer two quintiles of household income. For this reason, of our three

[19]Two studies attempt to address this issue (Subramanian 2002 and 2003); each includes measures of both community level social capital and individual trust or memberships. These authors find that the latter the estimated effect of community social capital becomes insignificant once individual measures of social capital are included in their model.

measures, the Putnam index yields results which are most favorable to the social capital hypothesis.

The pattern in the statistical significance of our results raises important questions about the interpretation of social capital effects on health. For example, the membership measure is in some sense the most narrow and readily-defined of the three measures, yet it produces the weakest associations. The variable that produces the strongest result, the Putnam index, is a compilation of 14 different variables, including levels of trust and memberships, but also the number of charitable organizations, and the frequency of volunteering, and various other measures of civic participation. Because the index also incorporates voter turnout, one might caution that the significance of this variable in our models may be driven by underlying political preferences for redistributive policies. Investigating this possibility is beyond the scope of this paper, but clearly our findings speak to the need for a closer examination of this index. Future research is needed to identify whether certain components of the Putnam index are more closely associated with health status than others. In addition, since none of our social capital measures are significant determinants of health status for blacks, future work should explore whether social capital should be measured differently by race.

This study also brings new focus to the size or substantive significance of social capital's effect on health, an issue not previously examined in the literature to date. To this end we calculate the elasticities of health status with respect to social capital and state median income. In percentage terms, we find that health status is more responsive to changes in two social capital measures than to changes in state median income. Our results suggest that the average decade-by-decade decline in state social capital would be associated with an almost 7% increase in the

base probability of any individual reporting poor health (ie, an increase from 4.4% to about 4.7%). While this may seem like a small increase, it must be remembered that this increase would be applied to every individual in the U.S. (with a slightly larger increase for the poor).

However, our analysis of the substantive importance of state social capital is vexed by the absence of knowledge about the efficacy of policy levers to affect social capital. Several recent studies have examined some of the factors associated with individual trust and membership, and the existence of spillover effects from residing in areas with high levels of trust and membership (e.g., Alesina and Ferrara 2000 and 2002). This research repeatedly identifies population heterogeneity in income, race, ethnicity, occupation or birth cohort as determinants of these social capital measures. In addition, novel evidence of the importance of heterogeneity for social cohesion comes form a recent experimental study by Anderson et al. (2003), who show that inequality in payments to experimental subjects reduces voluntary contributions by all participants in a canonical public goods game. We do not expect such findings to lead to calls for ethnic or occupational segregation, but these findings may help target geographic areas for which it would be desirable to try to increase social capital through other means.

Beyond these studies, future work on social capital needs to address the ability of citizens and governments to influence social capital levels. Unfortunately, to date there have been no systematic studies of the efficacy of income redistribution, zoning laws, or community events, etc. as tools for increasing social capital. Without some knowledge of the costs of manipulating social capital, it is impossible to discern whether this is a promising tool for increasing population health. We consider our results a call for more serious empirical investigation of the pathways by which social capital may influence health, and the policies that influence social

capital.

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Appendix

A1. Weighting Procedure:

The General Social Survey responses were weighted to make the data representative at the state level. The weighting procedure used in this paper attempts to best replicate the one used by Kawachi et al. (1998) to develop post stratification weights based on the distribution of age, race, and educational attainment of survey respondents. In the following equation, $\boldsymbol{W_{i,j,k,l}}$ refers to the weight for a survey respondent in state *i*, age group *j,* race *k* and with level of education *l*. This is calculated by dividing the proportion (***C***) of respondents in the actual population (U.S. Census 1990) in that stratum by the corresponding proportion of respondents in the survey data (***S***). Individual responses to the social capital items in the General Social Survey were adjusted using these post stratification weights.

$$\boldsymbol{W_{i,j,k,l} = C_{i,j,k,l} / S_{i,j,k,l}}$$

Age was divided into 7 strata, education into 5 strata and race into 3 strata. The statistical package Stata 7.0 was used to conduct the weighting procedure. The 5% Public Use Micro Data Sample (PUMS) from the US census data (1990) was used to calculate census proportions. MicroAnalyst, a CD-ROM based application, was used to extract the sample. Further details about the weighting procedure will be made available on request.

A2. States in the GSS

The following states are not included in the calculation of the GSS-based state social capital measures (membership and mistrust):

Alaska
Delaware
Hawaii
Idaho
Maine
Montana
Nebraska
Nevada
New Mexico
South Dakota
Vermont

Table 1: Descriptive Statistics for Health Status
(Fraction of individuals reporting each category)

Individual-Level Variables	39 State Sample	48 State Sample
Poor	0.044	0.043
Fair	0.091	0.090
Good	0.247	0.245
Very Good	0.323	0.326
Excellent	0.295	0.296
Sample Size	68,076	75,784

Table notes: Sample observations are household heads from the 1995, 1997 and 1999 March CPS.

Table 2: Descriptive Statistics for Individual-Level Explanatory Variables
(Mean and Standard Deviation)

Continuous Variables	39 State Sample	48 State Sample
Household Income (in 000s)	53.365 (47.58)	52.646 (46.69)
Age (in years)	46.07 (12.87)	46.09 (12.87)
Indicator Variables	**39 State Sample**	**48 State Sample**
Black race	0.111	0.102
Hispanic ethnicity	0.146	0.143
Female	0.333	0.329
Married	0.787	0.792
Divorced or separated	0.123	0.121
Widowed	0.032	0.031
Health insurance coverage	0.872	0.872
Central city status	0.263	0.250
Metropolitan area status	0.765	0.715
Less than high school	0.174	0.171
Some college	0.255	0.257
College degree	0.159	0.157
Advanced degree	0.090	0.089
Sample Size	68,076	75,784

Table notes: Sample observations are household heads from the 1995, 1997 and 1999 March CPS.

Table 3: Description of State-Level Social Capital Measures

Variable Name	Definition	Source	Number of Observations	Mean (Standard Deviation)	Minimum	Maximum
Memberships	Average number of types of voluntary group memberships	General Social Survey	39	1.49 (0.43)	0.68	3.31
Mistrust	Percent *not* responding, "Most people can be trusted"	General Social Survey	39	65.83 (10.61)	42.52	84.60
Putnam Index	Normalized factor score derived from 14 different state-level variables (Putnam 2000)	www.bowlingalone.com	48	0.462 (0.249)	0	1

Table notes: Membership and Mistrust are derived from weighted individual responses to the General Social Survey for 1986 through 1990, following the procedure described in Kawachi et al. 1998 (see the Appendix for details).

Table 4: Ecological Association Between State Social Capital and Population Health, 1999
(Estimated Coefficients from Weighted Least Squares Regression Model)

	Mortality per 100,000		
Explanatory Variable	(1)	(2)	(3)
Memberships	-131.0 (3.05)		
Mistrust		4.11 (3.11)	
Putnam Index			-48.6 (2.70)
Mean of the dependent variable (standard deviation)	878.5 (129.5)	878.5 (129.5)	878.2 (127.4)
Number of observations	39	39	48
R^2	.775	.777	.759
	Average Health Status		
Explanatory Variable	(4)	(5)	(6)
Memberships	.173 (2.37)		
Mistrust		-.010 (4.99)	
Putnam Index			.155 (7.26)
Mean of the dependent variable (standard deviation)	3.705 (.113)	3.705 (.113)	3.707 (.119)
Number of observations	39	39	48
R^2	.144	.477	.549

Table notes: Absolute values of t-statistics reported in parentheses; weight is state population. All regressions control for share of state population that is under 19 years of age, or over 65 years of age.

Table 5: Effects of State Social Capital on Individual Health Status

Explanatory Variables	Social Capital Measure Used in Model:		
	Memberships	Mistrust	Putnam Index
	Model A	Model B	Model C
State Median Household Income (in 000s)	.0061 (1.92)	.0027 (1.07)	.0024 (1.10)
State Social Capital	.0361 (1.51)	-.0045 (4.47)	.2595 (5.96)
Household Income Spline:			
Lowest Quintile	.0212 (14.93)	.0211 (14.93)	.0211 (14.78)
Second Quintile	.0143 (8.89)	.0143 (8.92)	.0146 (9.31)
Middle Quintile	.0057 (4.82)	.0057 (4.84)	.0057 (5.04)
Fourth Quintile	.0059 (7.16)	.0059 (7.18)	.0061 (7.76)
Highest Quintile	.0009 (6.10)	.0009 (6.19)	.0009 (6.48)

Table notes: Each column reports coefficients from an ordered probit model in which the dependent variable is health status, where 1= poor, 2 = fair, 3 = good, 4 = very good, 5 = excellent). Absolute values of t-statistics reported in parentheses (adjusted for clustering of observations at the state level). All models include controls for size of household, year of survey, individual characteristics such as age, age squared, black race, Hispanic ethnicity, sex, marital status, education indicator variables, and dummies for central city residence and residence in an MSA.

Table 6: Estimated Social Capital Elasticities

	Probability that health status is reported to be:				
	Poor	Fair	Good	Very Good	Excellent
Model A					
Memberships	-0.127	-0.084	-0.040	0.007	0.067
State Median Income	-0.455	-0.301	-0.143	0.026	0.239
Model B					
Mistrust	0.690	0.456	0.217	-0.040	-0.362
State Median Income	-0.202	-0.134	-0.064	0.012	0.106
Model C					
Putnam Index	-0.250	-0.166	-0.079	0.014	0.131
State Median Income	-0.182	0.121	-0.058	0.010	0.095

Table notes: Each cell reports the percent change in the probability that a given state of health is reported for a 1 percent increase in a given explanatory variable. Models A, B, and C also included controls for size of household, year of survey, individual characteristics such as age, age squared, black race, Hispanic ethnicity, sex, marital status, education indicator variables, and dummies for central city residence and residence in an MSA . Elasticities were calculated at the means of the independent variables.

Table 7: Effect of State Social Capital on Individual Health Status, By Household Income Quintile

	Social Capital Measure Used in Model:		
	Memberships	Mistrust	Putnam Index
Explanatory Variable	Model A	Model B	Model C
State Social Capital Household Income Indicator*			
Lowest Quintile	.0336 (1.03)	-.0053 (4.34)	.2448 (4.00)
Second Quintile	.0642 (2.56)	-.0039 (3.86)	.3397 (6.21)
Middle Quintile	.0428 (1.59)	-.0041 (4.14)	.2431 (4.71)
Fourth Quintile	.0080 (0.33)	-.0047 (4.43)	.2135 (4.62)
Highest Quintile	.0117 (0.48)	-.0046 (4.23)	.2419 (4.03)
State Median Household Income (in 000s)	.0061 (1.93)	.0027 (1.06)	.0025 (1.11)
H_0: All coefficients on social capital are the equal	p<.01	p<.01	p<.01
H_0: All coefficients on social capital are equal to zero	p<.001	p<.001	p<.001

Table notes: Each column reports coefficients from an ordered probit model in which the dependent variable is health status, where 1= poor, 2 = fair, 3 = good, 4 = very good, 5 = excellent). Absolute values of t-statistics reported in parentheses (adjusted for clustering of observations at the state level). Other individual characteristics include: household income entered as a spline, size of household, year of survey, age, age squared, black race, Hispanic ethnicity, sex, marital status, education indicator variables, and dummies for central city residence and residence in an MSA.

Table 8: Effect of State Social Capital on Individual Health Status, Among Low Income Households

	Social Capital Measure Used in Model:		
	Memberships	Mistrust	Putnam Index
Explanatory Variable	Model A	Model B	Model C
State Median Household Income (in 000s)	.0061 (1.92)	.0027 (1.07)	.0024 (1.10)
State Social Capital Measure	.0262 (1.05)	-.0046 (4.61)	.2254 (5.10)
*State Social Capital Measure * Indicator Variable equal to 1 if Household Income in first or second quintile, 0 otherwise*	.0213 (1.50)	.0003 (0.84)	.0807 (2.09)
H_0: Both coefficients on social capital measures are equal to zero	p<.10	p<.001	p<.001

Table notes: Each column reports coefficients from an ordered probit model in which the dependent variable is health status, where 1= poor, 2 = fair, 3 = good, 4 = very good, 5 = excellent). Absolute values of t-statistics reported in parentheses (adjusted for clustering of observations at the state level). Other individual characteristics include: household income entered as a spline, size of household, year of survey, age, age squared, black race, Hispanic ethnicity, sex, marital status, education indicator variables, and dummies for central city residence and residence in an MSA.