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Poverty, affluence, and income inequality: neighborhood economic structure and its implications for health

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Abstract

In this paper, we attempt to verify that neighborhood economic structure influences individual health over and above other individual characteristics, and to comparatively evaluate the effects of neighborhood concentrated affluence, concentrated poverty and income inequality in relation to individual health in the USA. We also explore physical environment, health-enhancing services, social hazards (crime) and social resources as mechanisms operating at the neighborhood level that may help to explain the influence of structural economic conditions on health. We use Hierarchical Ordinal Logit Models to examine a rich multi-level data set.

Results indicate that affluence exerts significant contextual effects on self-rated health while poverty and income inequality at the neighborhood level are not important structural factors. Moreover, we find that a composite measure of social resources distinguishes itself in both explaining the impact of concentrated affluence and exerting an independent contextual effect on individual health. Physical environment, or the level of physical disorder in the neighborhood, also mediates the effect of affluence on self-rated health, although to a lesser degree than social resources.

Our empirical findings suggest that different dimensions of economic structure do not in fact have unique and additive contributions to individual health; the presence of affluent residents is essential to sustain neighborhood social organization which in turn positively affect health.

Keywords: Neighborhood; Socioeconomic status; Social capital; Physical disorder; Health; USA

Introduction

Since the publication of Wilson's *The Truly Disadvantaged* (1987), there has been a resurgence of scholarly interest in neighborhood structural effects on residents' physical and mental well-being. This contextually oriented health research has been spurred by increasing interest in macro-social influences on individual health status, the availability of advanced statistical techniques for fitting multi-level regression models (Pickett & Pearl, 2001), and a more general concern with the limitations of exclusively individual-level research designs. In this area of research, economic conditions are the most frequently examined structural factors thought to be relevant for health status over and above individual characteristics. Three aspects of economic context have been discussed in the literature—the level of concentrated poverty, the prevalence of affluent families, and the degree of income inequality within the neighborhood.

Initially, health-related contextual effects research focused on the relationship between spatially concentrated deprivation and health. Findings from this research supported the hypothesis that residence in a poverty neighborhood area has negative effects for a range of health-related outcomes including all cause mortality (Haan, Kaplan, & Camacho, 1987), self-rated

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health and medical conditions (Luo & Wen, 2002), disease incidence (Barr, Diez-Roux, Knirsch, & Pablos-Méndez, 2001), incidence of severe childhood injury, (Durkin, Davidson, Kuhn, O'Connor, & Barlow, 1994), depression (Yen & Kaplan, 1999), intimate partner violence (Cunradi, Caetano, Clark, & Schafer, 2000), health behaviors such as physical activity level (Yen & Kaplan, 1998) and alcohol-related problems (Jones-Webb, Snowden, Herd, Short, & Hannan, 1997). On the other end of the scale, spatially concentrated affluence per se has seldom been directly examined in health research (but see Browning, Cagney, & Wen, forthcoming; Browning & Cagney, 2002a). The relative absence of research linking neighborhood affluence with health has persisted despite initial evidence that the presence of high- and low-income residents may exert unique effects on health. For instance, Browning and Cagney (2002a) found that affluence was positively associated with fair or poor self-rated health in a large urban sample. Cagney et al. (2002) found that this effect held for older adults as well. Affluence has also been demonstrated to affect neighborhood-level social conditions that may have implications for individual well-being, including health status (Brooks-Gunn, Duncan, Klebanov, & Sealand, 1993). Sampson and colleagues found that concentrated affluence was a more consistent predictor of intergenerational closure and reciprocal exchange than concentrated disadvantage (Sampson, Morenoff, & Earls, 1999). Some studies have used composite scores that combine indicators of neighborhood poverty and affluence (Ross & Mirowsky, 2001). Although composite indices are statistically efficient and parsimonious (Pickett & Pearl, 2001), they may mask the relative contributions of their component measures.

A more recent hypothesis focuses on the shape of the income distribution within a community or a society as a predictor of its overall health level, and presumably individual health status as well (Kaplan, Pamuk, Lynch, Cohen, & Balfour, 1996; Kennedy, Kawachi, & Prothrow-Stith, 1996; Lynch, Smith, Kaplan, & House, 2000; Marmot & Wilkinson, 2001; Wilkinson, 1996). This hypothesis suggests that what really matters to health is relative income; i.e., people's relative socioeconomic standing in relation to others. A substantial body of ecological evidence notwithstanding, this hypothesis remains largely untested for individual health, especially with respect to the impact of inequality within smaller spatial aggregations such as the neighborhood.

Implicit in the discussion of economic structure effects on health are two approaches: (1) an *additive* perspective on the link between neighborhood socioeconomic status (SES) and health that hypothesizes unique effects of poverty, affluence, and inequality ("poverty is bad, poverty and inequality are worse"); and (2) a perspective that places dimensions of economic structure in *competition*, arguing that effects of one dimension may be spurious due to association with another ("poverty isn't the problem, it's inequality"). Drawing on extant theory, we describe and test an additive approach to the effects of economic conditions on health placing particular emphasis on the impact of concentrated affluence on health. Our analyses examine the relative influence of the three measures of socioeconomic context on self-rated health after controlling for individual socio-demographic and socioeconomic characteristics as well as aggregated educational attainment in the neighborhood. We also explore the mechanisms linking neighborhood economic conditions and individual health. The results of our analyses call into question implicit reliance on an additive effects model and point to the need for more careful theoretical and empirical work identifying dimensions of neighborhood SES that are relevant to health, the pathways through which economic structure influences are channeled, and the appropriate level of analysis for the investigation of contextual effects. To our knowledge, no previous research has comparatively evaluated the effects of neighborhood concentrated affluence, concentrated poverty and income inequality in relation to individual health.

Previous studies

Both Wilson (1987) and Massey (1996) have documented the geographic concentration of poverty in large American cities. In *The Truly Disadvantaged* (1987), Wilson pointed out that the number of people living in poverty areas (defined as census tracts with poverty rates of at least 20 percent) rose by 40 percent in the five largest US cities between 1970 and 1980. Over the same period, the number of people living in high-poverty areas (those with poverty rates of at least 40 percent) grew by 69 percent. Similarly, Massey argued that over the next two decades, the concentration of poor people in poor places increased sharply, leading to the erosion of public order and alienation (Massey, 1996). Furthermore, Massey noted that affluence was even more highly concentrated spatially than poverty. He concluded that "the typical affluent person lived in a neighborhood where more than half the residents were also rich; the outcome was a social environment that was far more homogeneously privileged than at any time in the previous 20 years" (1996, p. 399). In light of these macro-structural changes, research on the consequences of economic concentration on health has grown markedly.

Concentrated poverty

An impressive number of studies have examined the direct effect of neighborhood poverty on health

outcomes. Haan et al. (1987) were among the first of a new wave to realize the importance of "place" as experienced by people and as a context for their health outcomes. Using data from the Alameda County Study, they examined the 9-year mortality experience of a random sample of residents aged 35 and over in Oakland, California. They found that residents of a federally designated poverty area experienced higher age-, race-, and sex-adjusted mortality over the follow-up period compared with residents of non-poverty areas. This increased risk of death persisted after multi-variate adjustment for a host of demographic, heath, and social indicators, including access to medical care. These results seem to support a "contextual" (as opposed to "compositional") explanation[1] for spatial variations in mortality. That is, living in a poverty area affects the life expectancy of its residents in addition to, or in interaction with, individual characteristics such as personal income level or race.

More recently, Yen and Kaplan (1999) examined the effect of residence in a poverty area on the risk of declining perceived health status and development of depressive symptoms, also using the Alameda County Study. Their results showed that age- and sex-adjusted risk for incidence of depressive symptoms was higher for poverty area residents. Those reporting excellent/good health at baseline were at higher risk for having fair/poor health if they lived in a poverty area. Independent of individual income, education, smoking status, body mass index, and alcohol consumption, poverty area residence remained associated with change in health status and depressive symptoms. The authors concluded that these results further supported the hypothesis that characteristics of residential place affect health conditions and health status. Ecological evidence is consistent with these findings. A recent study assessed the role of poverty in the resurgence of tuberculosis (TB) in New York City at the height of the epidemic and longitudinally from 1984 through 1992 (Barr et al., 2001). The authors found that neighborhood poverty was strongly associated with TB incidence. Based on this result, the authors concluded that public health interventions should target impoverished areas.

British evidence on neighborhood poverty effects is also abundant. For example, Humphreys and Carr-Hill (1991) applied a multi-level modeling framework to the Health and Lifestyle Survey data and found that the negative effects of living in a "poor" ward on several health outcomes was quite substantial, and remained after controlling for age, gender and several other socio-demographic variables. Jones and Duncan (1995) used the same technique to analyze data derived from a nationally representative sample of over 9000 United Kingdom individuals in nearly 400 places. They concluded that, independent of individual characteristics, places with aggregate low income or high deprivation suffered poorer health on a range of health measures.

Research on residential poverty and health has not reached consensus, however. Several studies have concluded that there were no contextual effects of poverty on health-related behaviors, psychiatric morbidity and adverse fertility events after adjustment for individual compositional effects (Reijneveld & Schene, 1998; Sloggett & Joshi, 1994). A more recent work investigating the relationship between collective efficacy and health also found no significant impact of neighborhood poverty on individual self-rated health after controlling for a rich set of individual socioeconomic, demographic and health characteristics (Browning & Cagney, 2002b). Meanwhile, some studies have found interactions between area poverty and individual characteristics such as age (Waitzman & Smith, 1998), race (Jones-Webb et al., 1997) and income level (Haan et al., 1987) and their effects on health. These findings suggest that there might be a more differentiated picture of the health effects of living in a poor area than previously believed.

Concentrated affluence

Few studies have directly examined the effect of neighborhood affluence on health. The relative contribution of concentrated poverty versus affluence to health outcomes has only recently received attention in health research. Cagney et al. (2002) and Browning and Cagney (2002a) found beneficial effects of a measure of the proportion of neighborhood residents with household incomes $50,000 or greater on self-rated health, while the proportion of residents below the poverty line was not a significant predictor of health. And, they found that affluence attenuated the association between race and self-rated health; although African American respondents, on average, rated their health at lower levels than their White counterparts, accounting for differences in the proportion of affluence residents in the neighborhood closed this gap considerably.

Although not specifically aimed at an examination of affluence, Robert (1998) simultaneously examined the effects of one positive neighborhood SES measure (the percentage of families with incomes $30,000 or greater) as well as two negative community SES measures (percentage of households receiving public assistance

[1] The compositional explanation refers to the notion that associations observed between places and health are spurious and stem from the population characteristics of residents in the areas, whereas in the contextual explanation the observed effects of place on health result from features of places that are not reducible to the individual level. Despite its popularity, this distinction has been criticized for lacking theoretical foundation, especially given that compositional and contextual factors are often intertwined (Macintyre, Ellaway, & Cummins, 2002).

income and percentage adult unemployment) on chronic conditions, functional limitations and self-rated health. Robert found that the percentage of families earning $30,000 or more and the percentage unemployed remained statistically significant predictors of chronic conditions independent of individual- and family-level SES, whereas percentage of households receiving public assistance did not. In contrast to the results for chronic conditions, none of the neighborhood-level SES variables remained statistically significant predictors of functional limitations. Only the percentage of households receiving public assistance remained a significant predictor of self-rated health after controlling for individual- and family-level SES. Robert concluded that the effects of neighborhood-level SES on health may not be stable across health measures and were less significant than those of individual- and family-level SES. On the other hand, her findings on the important contextual effects of neighborhood SES on different measures of health did suggest that there was something about contextual SES conditions per se that might matter to individual health outcomes.

Income inequality

Another important dimension of the contextual economic condition is the shape of the income distribution within a geographic or political area (e.g., community, state, or nation). Since the early 1990s, ecological work has emerged to suggest that the extent of income inequality in a society is negatively associated with its average population health (Wilkinson, 1992, 1996). In 1996, two studies found that state-level income inequality was significantly linked to health within the United States (Kaplan et al., 1996; Kennedy et al., 1996). Thereafter, several multi-level or ecological studies of income inequality and health have generated inconsistent results. For instance, Fiscella and Franks (1997) examined the relationship between income inequality and individual risk of mortality at the county level. They did not find evidence to support a contextual effect of income inequality on health after taking into account the relationship between individual-level income and health. Daly, Duncan, Kaplan, and Lynch (1998) examined this relationship at the state level and found that inequality had statistically significant detrimental effects on mortality risk in a specific subgroup (both non-elderly and middle-income). Kennedy, Kawachi, Glass, and Prothrow-Stith (1998) examined the relationship between state-level income inequality and individual self-rated health and found a modest but statistically significant deleterious effect of income inequality on self-rated health. Lochner, Pamuk, Makuc, Kennedy, and Kawachi (2001) revisited the link between state-level income inequality and individual mortality risk and found that, after adjusting for individual-level characteristics, those living in high-income-inequality states were at increased risk of mortality compared with individuals living in low-income-inequality states.

Recently, additional evidence disputing this link has emerged. Mellor and Milyo (2002) using data from the Current Population Survey found no consistent evidence of an association between state-level and metro-level income inequality and the health status of individuals, and no consistent evidence that inequality has its strongest impact on the health of the poor. Sturm and Gresenz (2002) analyzed the relation between geographical inequalities in income and the prevalence of common chronic medical conditions and mental health disorders. They found no significant correlation between income inequality and the prevalence of chronic medical problems or depressive and anxiety disorders even without controlling for individual income, either across the whole population or among poorer people. In an ecological study, Muller (2002) found that the income inequality effect disappeared when the percentage of people without a high school diploma was added to the regression models. In addition, little evidence has been found for such a relation outside the United States. Ecological data from Canada showed that there were no significant associations between income inequality and mortality at either the provincial or metropolitan area levels (Ross et al., 2000). Osler et al. (2002) reported the results of an analysis of the association between income inequality and mortality in a small area in Copenhagen, Denmark. After adjustment for individual income and other established risk factors, they found that parish income inequality was not associated with mortality, whereas individual household income was associated. Evidence from Japan also suggested that although income inequality at the level of prefectures was weakly associated with poor or fair self-rated health, this was no longer so when individual income was controlled in the analysis (Shibuya, Hashimoto, & Yano, 2002).

The inconsistency among findings may lie in the heterogeneity of the study design and statistical methodology employed in these studies. At this time, and without further theoretical development, many design issues remain unsettled. Little work has been done to investigate the developmental history of this link and it is not clear what spatial level is appropriate to examine this relationship. To date, we have not accumulated adequate evidence either to confirm or to refute the hypothesis that income distribution per se has an impact on the population and/or individual variations in health.

Summary

The simultaneous examination of the relative effects of concentrated poverty, concentrated affluence and income inequality on health at the neighborhood level

has not been examined. The question of whether income inequality has a contextual effect on individual health is under-researched. Research on the mechanisms through which neighborhood economic conditions influence individual health remains in its infancy. The following section discusses a number of theoretical perspectives that offer potential explanations of the link between neighborhood economic conditions and health. In addition, we offer a heuristic conceptual model to help frame our empirical analyses.

Conceptual framework and hypotheses

Theoretical perspectives

Physical, service and social resources

A number of potential mechanisms underlying the impact of neighborhood-level economic context on health have been proposed. Macintyre, Maciver, and Sooman (1993), conceptualized socio-environmental influences on health as falling into five broad types: physical features of the environment shared by all residents in a locality (e.g., quality of air and water); the availability of healthy/unhealthy environments at home, work, and play (e.g., decent housing, secure and non-hazardous employment); services provided, privately or publicly, to support people in their daily lives (e.g., education, transportation, health and welfare services); socio-cultural features of a neighborhood (e.g., level of crime, networks of community support and community integration); and the reputation of a neighborhood (e.g., how areas are perceived). In a more recent work (Macintyre, Ellaway, & Cummins, 2002), the authors suggested that the first three of these organizing categories can best be seen as material or infrastructural resources, while the last two categories relate to collective social functioning and practices. Putatively, neighborhood economic conditions can affect every single aspect of this organizing framework.

Robert (1998) offered a comparably inclusive framework. She argued that the socioeconomic characteristics of communities affect the physical (e.g., quality of air and water, recreational options and exposures to toxins), service (e.g., social services such as mental health and family services), and social environments of communities (e.g., crime and health behavior), which in turn impact the health of all residents. Physical environment includes the first two dimensions of Macintyre et al.'s framework, and the social environment component resonates with what Macintyre et al. called "collective social functioning and practices."

As Lynch and Kaplan (2000, pp. 13–14) argued, "Measures of socioeconomic position indicate particular structural locations within society. These structural positions are powerful determinants of the likelihood of health damaging exposures and of possessing particular health-enhancing resources. This is perhaps the most basic principle in understanding how and why socioeconomic position is linked to health." Each dimension of neighborhood environment can be incorporated into this model. For example, residents of affluent neighborhoods may enjoy physical amenities such as spacious and easily accessible recreational areas (e.g., parks, playgrounds, or open spaces); adequate health services, services for children and adolescents and crime prevention; and supportive social resources in terms of dense local networks and strong collective efficacy (Browning & Cagney, 2002b; Sampson, Raudenbush, & Earls, 1997; Wilson, 1996). In addition, individuals in affluent neighborhoods may be less exposed to environmental health hazards such as victimization, fear, and accompanying stress.

Income inequality, aggregate education and social resources

Despite the debate over the validity of the link between income inequality and health, two plausible mechanisms operating at the contextual level have been proposed: (1) income inequality is linked to under-investment in health-promoting resources such as education, medical services, transportation and environmental controls (i.e., the neo-material interpretation); and (2) income inequality leads to the erosion of social capital and stressful social comparisons, which diminish health via painful individual psychosocial processes and ensuing detrimental physiological mechanisms (i.e., a psychosocial interpretation) (Kaplan et al., 1996; Kawachi & Kennedy, 1997; Kawachi, Kennedy, & Glass, 1999; Lynch et al., 2000).

The neo-material interpretation argues that income inequality is a result of, and also results in, other macro-structural forces that have direct effects on health. Under this formulation, the effect of income inequality on health reflects a combination of negative exposures and lack of resources held by individuals, along with systematic underinvestment across a wide range of human, physical, health, and social infrastructural dimensions (Lynch et al., 2000). This proposition has received limited yet positive empirical support. One study has demonstrated that in the United States, poor investment in education and low expenditures on medical care, observed in the states with the most unequal income distribution, lead to poor health outcomes (Kaplan et al., 1996). Muller's (2002) finding also supports this theory although he used the percentage of high school graduates to measure aggregate education. Potentially, high levels of income inequality may affect expenditures for public goods such as

education, which in the long run may affect educational attainment, and that, in turn, eventually affects health (Mackenbach, 2002). The longitudinal part of this whole process is essential, which implies that concurrently measured aggregate educational attainment is not likely to be an intermediary factor on the causal path from income inequality and health. In most static models of neighborhood contextual effects on health, aggregate educational attainment should be conceptualized as a contextual-level confounder.

Another suggested mechanism concerns the negative health effects of psychosocial disadvantage related to relative deprivation brought about by the unequal distribution of income. To investigate this pathway, we argue that the neighborhood or community level is a more appropriate unit of analysis than the state level. As long as within-state heterogeneity exists, people are most likely to be affected by social resources (e.g., reciprocity, collective efficacy, etc.) in their local living environment. Nevertheless, this mechanism has not been adequately examined for its relevance to individual health especially at smaller spatial settings.

Affluence and neighborhood resources

Recent research suggests that affluence might be a more telling indicator of health-enhancing resources than income inequality or poverty. Wilson's work (1996) emphasizes the benefits of economic heterogeneity for urban communities. In his model, the prevalence of middle/upper-class people positively correlates with the material and social resources necessary to sustain basic institutions in urban neighborhoods like the family, churches, schools, voluntary organizations, and informal service programs (Browning & Cagney, 2002a,b; Cagney et al., 2002). These institutions are pillars of local social organization that help to nurture neighborhood solidarity and mobilize informal social control. Recent work on collective efficacy parallels Wilson's conception. It stresses the critical role of neighborhood affluence in generating the social conditions that support community well-being (Sampson et al., 1999). In this view, the provision of health services, recreational spaces, and attention to potential hazards may be more responsive to the presence of socio-economically advantaged residents who have the resources to mobilize on behalf of a health-enhancing environment. Income inequality and poverty may not capture the health-enhancing resources that measures of neighborhood-level affluence might reflect.

Conceptual model

Following these theoretical developments, we illustrate our conceptual framework in Fig. 1. This figure shows the relationship between neighborhood economic context and self-rated health and the mediating effects of physical environment, health-enhancing services, and

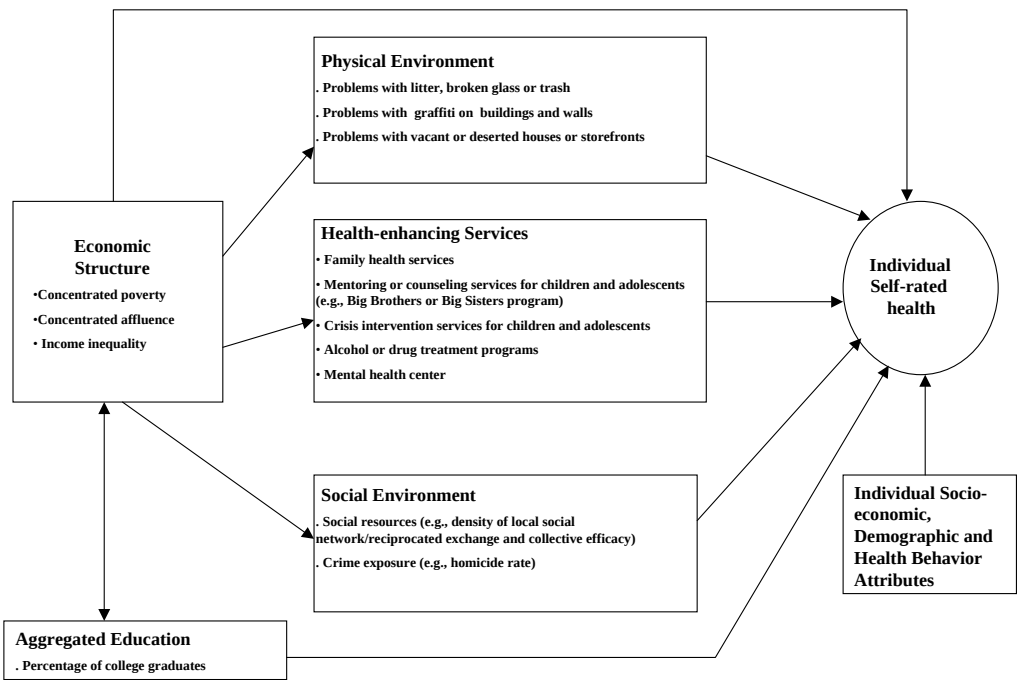

Fig. 1. Conceptual model.

Table 1
Data sources by years represented

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Decimal Census	*									
Homicides 65–95		*	*	*						
PHDCN-CS						*				
MCIC-CS							*	*		*

social environment. It acknowledges that individual-level socioeconomic, demographic and health behavior attributes also affect health, as does aggregated educational attainment (here in the form of the prevalence of college graduates).

Hypotheses

Based on this model, we hypothesize that (1) health correlates negatively with neighborhood poverty (1a) and income inequality (1b) and positively with neighborhood concentrated affluence (1c), (2) neighborhood affluence is the most powerful predictor of health among the three measures of neighborhood economic conditions, and (3) neighborhood affluence exerts a stronger effect on individual health due to its impact on the physical, social and service environment—key mediating features of neighborhoods relevant to individual health status.

Methods

Data

Four data sources were used to explore the above hypotheses. They were: (1) the 1990 Decennial Census; (2) the 1994–95 Project on Human Development in Chicago Neighborhoods-Community Survey (PHDCN-CS); (3) the 1991–2000 Metropolitan Chicago Information Center Metro Survey (MCIC-MS); and (4) Homicides in Chicago, 1965–1995 (Homicides 65–95). Both neighborhood and individual measures were derived from these data. A final multi-level sample was constructed linking these multi-level measures by neighborhood identifier. In order to allow a time sequence in our sample that matches the hypothesized causal process, we combined 1996, 1997 and 1999 data from the Metro survey (MCIC-MS). Table 1 reports data collection years for each of the samples used in the analyses. As is shown, the Census data and the homicide data were collected earlier than the PHDCN-CS data, followed by the selected Metro survey data.

Decennial Census—neighborhood-level measures of economic and education contexts

Measures of neighborhood[2] socioeconomic conditions were derived from the 1990 Census. We included measures of neighborhood affluence, poverty, income inequality, and aggregated educational attainment.

PHDCN-CS—neighborhood-level measures of physical, service and social resources

Measures of neighborhood physical, service and social resources were constructed from the PHDCN-CS. The PHDCN-CS asked questions about the neighborhood in which respondents lived. It is a probability sample of 8782 residents of Chicago, age 18 and older. The study combined 847 census tracts into 343 larger, ecologically meaningful "neighborhood clusters" (NC). The sampling strategy of the PHDCN-CS was intended to capture a within-NC sample size sufficient to estimate neighborhood characteristics based on aggregated individual-level data. The purpose of this strategy was to ensure the reliability of neighborhood-level measures of social processes. The response rate was 75 percent.

MCIC-MS—individual-level socio-demographic and health data

The dependent variable and individual-level predictors were drawn or constructed from the MCIC-MS. The MCIC-MS is a serial cross section of adults aged 18 and older who reside in the six counties of the metropolitan Chicago area (on average, 3000 respondents per wave). We confined our sample to the residents

[2] We used the "neighborhood clusters" provided by the PHDCN-CS as the spatial scale in the analysis. By neighborhood, the survey protocol stated: "we mean the area around where you live and around your house. It may include places you shop, religious or public institutions, or a local business district. It is the general area around your house where you might perform routine tasks, such as shopping, going to the park, or visiting with neighbors" (Morenoff, Sampson, & Raudenbush, 2001, footnote 3). As noted in Sampson et al.'s work (1997, p. 919), the overriding consideration in formation of neighborhoods was that they should be as ecologically meaningful as possible, composed of geographically contiguous census tracts, and internally homogeneous on key census indicators (i.e., SES and racial composition).

of the city of Chicago (about 1000–1200 subjects in Chicago per year).

The survey incorporated an array of individual-level measures of health and well-being including an assessment of self-rated health. The response rate for the MCIC-MS was approximately 55 percent across the 10 cross-sectional samples. Because the MCIC-MS did not achieve as high a response rate as the PHCDN-CS, we compared the latter with combined 1993–1996 MCIC-MS samples. The distributions across demographic characteristics such as gender, age and race in the MCIC-MS waves were similar, indicating that lower response rate in the MCIC-MS had not yielded a non-comparable sample.

Dependent measure

Our dependent variable is a measure of self-rated health, considered a valid and robust measure of general health status (Goldstein, Siegel, & Boyer, 1984; Wilson & Kaplan, 1995). A large body of evidence has demonstrated that the self-reported assessment of health has high predictive validity for mortality, physical disability, chronic disease status, health behaviors, and health care utilization (Idler & Benyamini, 1997; Idler & Kasl, 1995; Malmström, Sundquist, & Johansson, 1999; Wilcox, Kasl, & Idler, 1996). There is a persistent, positive congruence between self-rated health and physician ratings of health status (Maddox & Douglass, 1973). Furthermore, self-assessed health is a stronger predictor of mortality than is physician-assessed health (Mossey & Shapiro, 1982). As a subjective measure of general health status, it captures the problems of physical well-being as experienced by the respondent, some of which may not be diagnosable in medical terms (e.g., chronic pains with unknown etiology) yet may impair the quality of life.

The MCIC-MS asks "In general, would you say your health is: (1) excellent, (2) good, (3) fair or (4) poor?" We treat self-rated health as a four-level ordinal outcome.

Independent measures

Data measuring neighborhood structural features were obtained from the 1990 US Census Summary Tape File 3A. Neighborhood *affluence* was operationalized as the percentage of neighborhood residents with household annual income $50,000 and over. Aggregated educational attainment was represented by the percentage of college graduates. Neighborhood *poverty* was measured by the percentage of households in a neighborhood that were living below the Federal poverty threshold. In 1990, this represented a household income of less than US$13,359 for a household of four (Kawachi et al., 1999). A measure of aggregate income distribution was obtained from the 1990 US Census Population and Housing Summary Tape File 3A. This summary tape provided annual household income data for 25 income intervals. Counts of the number of households that fall into each income interval were obtained for each census tract and then aggregated to the neighborhood level in the city of Chicago. Income data reflected income prior to taxes and benefits. Our measure of income inequality, the Gini coefficient (Kennedy et al., 1996), was constructed from these grouped income data using a program developed in STATA 7.0 (Whitehouse, 1995).

Physical environment was represented by a three-item Likert-type scale in the PHDCN-CS. Residents were asked about the extent of problems stemming from litter, broken glass or trash on the sidewalks and streets; of graffiti on buildings and walls; of vacant or deserted houses or storefronts. Responses to the three-point Likert scales were aggregated to the neighborhood level as initial measures. The three scales were highly correlated across neighborhoods. We then combined them into a composite measure, with higher scores indicating lower levels of physical disorder.

The measurement of adequacy of local health-enhancing services was achieved in two steps. First, in the PHDCN-CS, respondents were asked about whether the neighborhood had family health services; mentoring or counseling services and crisis intervention services for children and adolescents; an alcohol or drug treatment program; and a mental health center in the neighborhood. Responses to these questions were aggregated to the neighborhood level. Second, we combined these scales into a summary measure labeled *health-enhancing services*, with higher scores denoting lower levels of resources.

Health-related *collective efficacy* was operationalized through combining measures of social cohesion and social control (Browning & Cagney, 2002b). Social cohesion was constructed from a cluster of conceptually related items from the PHDCN-CS measuring the respondent's level of agreement (on a five-point scale) with the following statements: (1) "people around here are willing to help their neighbors," (2) "this is a close-knit neighborhood," (3) "people in this neighborhood can be trusted," and (4) "people in this neighborhood generally do not get along with each other" (reverse coded). Health-related informal social control was tapped through respondent agreement with the following: (1) "If I were sick I could count on my neighbors to shop for groceries for me" and (2) "You can count on adults in this neighborhood to watch out that children are safe and don't get in trouble." An additional informal control item asked respondents how likely it is that people in their neighborhood would intervene if a fight broke out in front of their house. The informal control items tap expectations for action with respect to health-related social support as well as neighborhood

supervision of potentially hazardous conditions or violent situations. The seven items were combined to form a single scale of health-related collective efficacy.[3]

The *social network density/reciprocated exchange* scale encompassed a number of items measuring the extent of the respondent's neighborhood-based friendship networks (i.e., how many friends the respondent has in the neighborhood and the ratio of friends inside and outside the neighborhood), as well as the frequency of parties, visits, advice-giving, and favor exchange among neighbors. The latter four items were based on questions asking respondents (1) "how often do you and people in this neighborhood have parties or other get-togethers where other people in the neighborhood are invited?" (2) "How often do you and other people in this neighborhood visit in each other's homes or on the street?" (3) "How often do you and other people in the neighborhood ask each other advice about personal things such as child rearing or job openings?" and (4) "How often do you and people in your neighborhood do favors for each other?" Because we are primarily interested in a baseline comparison of social, physical, and service environment effects on health, we combine collective efficacy and social network density/reciprocated exchange in our empirical analyses.[4] Higher scores on this scale indicate greater social resources at the neighborhood level.

Homicide rate per 10,000 population between 1991 and 1993 was included to tap *crime exposure* within the neighborhood. Homicide is one of the most reliably measured crimes and signals the potential for victimization and environmental stress resulting from perceived threat to personal safety (Sampson et al., 1997).

We also included neighborhood-level measures of prior health. *Prior neighborhood health* was estimated from the 1992–1994 waves of the MCIC-CS by aggregating individual responses to the self-rated health item to the NC level. A prior health measure captures preexisting risk factors for poor health at the neighborhood level and ensures that the effects of poverty, for instance, are not simply due to a stable lower level of health in the neighborhood (that also reduces neighborhood-level resources). The higher the score for this variable, the lower the level of prior neighborhood self-rated health.

[3] The aggregation process employed a three-level item response model correcting for measurement error, missing data, and ressponse bias. This technique was also used to construct the social network density/reciprocated exchange and prior neighborhood health scale. See Browning and Cagney (2002b) for a detailed discussion of the aggregation procedure.

[4] See Browning and Cagney (2002a) for a more detailed consideration of the unique effects of distinct neighborhood level social and cultural factors on individual health status.

The correlations presented in Table 2 show the extent to which the neighborhood-level variables in our analyses are interrelated. As expected, affluence is strongly negatively correlated with poverty, income inequality and homicide rate, and positively associated with the availability of health-enhancing services, social resources, aggregated educational attainment and the absence of physical disorder in the environment. One interesting correlation is between income inequality and the percentage of college graduates. It appears that a neighborhood with higher income inequality is also richer in aggregated educational attainment. This may add complexity to the influence of income inequality on individual health.

Individual-level variables were taken from the 1996, 1997 and 1999 waves of the MCIC-MS. We chose data collected after 1995 to allow a temporal sequence from our neighborhood measures to the self-rated health measure. The information on high blood pressure was not collected in 1998 and self-rated health was not collected in the 2000 MCIC-MS. Therefore, our sample consists of data over the three waves of the MCIC-MS. Table 3 reports descriptive statistics for the key socioeconomic and demographic background variables used in the analyses. Included are measures of age, gender, race/ethnicity (Black, Latino, White/other), education level (measured in six categories), annual household income (measured in 10 categories), marital status (married/cohabiting, single), a dummy variable measuring smoking behavior, and a dummy variable indicating whether the respondent had reported high blood pressure. We also included a variable for interview year to capture any time trends in the dependent variable.

Analytic strategy

We use hierarchical non-linear modeling to account for within-neighborhood correlations that may compromise the efficiency of neighborhood-level parameter estimates (Raudenbush & Bryk, 2002). Tables 4 and 5 present the results of 10 two-level ordinal logit models of the likelihood of reporting reduced self-rated health. The analyses seek to (1) verify the impact of neighborhood economic conditions on health status after accounting for individual socioeconomic and demographic attributes, (2) assess the relative contribution to health of neighborhood affluence, poverty and income inequality, and (3) identify contextual resources that may mediate the relationship between neighborhood SES and health.

The conceptual model illustrated in Fig. 1 guides our empirical analyses. We first attempt to adjudicate among the three different economic explanations for neighborhood structural effects on health. Specifically, we begin by examining a model with individual control variables (as a reference model). Next we add neighborhood

Table 2
Correlation matrix for neighborhood-level variables

	1	2	3	4	5	6	7	8	9
1. Concentrated affluence	1.000								
2. Concentrated poverty	−0.762 ***	1.000							
3. Income inequality	−0.146 *	0.452 ***	1.000						
4. Physical environment	0.355 ***	−0.278 ***	−0.064	1.000					
5. Health-enhancing services	−0.310 ***	0.409 ***	0.124 *	−0.079	1.000				
6. Social resources	0.428 ***	−0.270 ***	−0.026	0.275 ***	−0.055	1.000			
7. Crime exposure	−0.637 ***	0.693 ***	0.364 ***	−0.307 ***	0.319 ***	−0.390 ***	1.000		
8. Aggregated education	0.669 ***	−0.489 ***	0.336 ***	0.276 ***	−0.331 ***	0.271 ***	−0.382 ***	1.000	
9. Prior neighborhood health	−0.456 ***	0.342 ***	−0.196 ***	−0.155 *	0.201 ***	−0.088	0.206 ***	−0.555 ***	1.000

* $p<=0.05$; ** $p<=0.01$; *** $p<=0.001$ (two-tailed test).

a1. Concentrated affluence was measured by the percentage of households with annual family income over $50,000 and over.

a2. Concentrated poverty was measured by the percentage of households in poverty in a neighborhood.

a3. Income inequality was measured by the Gini coefficient.

a4. The higher the score in physical environment, the less of a problem from physical disorder.

a5. The higher the score in health-enhancing services, the smaller the number of services provided in the neighborhood.

a6. A higher score on this scale indicates greater social resources at the neighborhood level.

a7. Crime exposure was operationalized as the within-neighborhood homicide rate per 10,000 population.

a8. Aggregated education was represented by the percentage of college educated people.

a9. A higher score on this scale indicates a lower level of prior neighborhood self-rated health.

poverty, income inequality, and affluence, respectively. The full model simultaneously evaluates the effects of neighborhood poverty, income inequality and affluence on individual self-rated health. The final model assesses the relative contribution to health of different dimensions of neighborhood economic structure, controlling for aggregate educational attainment.

The second objective of the analysis is to test hypothesis 3 with respect to mediating mechanisms through which contextual economic conditions may impact individual health, controlling for other individual characteristics and a neighborhood-level confounder—aggregated educational attainment. The model with neighborhood affluence, poverty, income inequality, aggregated educational attainment and individual control variables is the baseline model. We then add measures of physical environment, health-enhancing services, and social environment (social resources and crime exposure) separately into the model. The final model includes all the hypothesized mechanisms that may link neighborhood economic conditions with individual self-rated health.

Results

Table 4 reports the results of a series of hierarchical ordinal logistic models, assessing the relative importance of affluence, poverty and income inequality at the neighborhood level to individual self-rated health. Model 1 reports the results of a model predicting self-rated health based on socioeconomic and demographic background factors. Consistent with expectations and previous research, age, African-American race, Latino ethnicity, cigarette smoking and high blood pressure are all associated with lower levels of self-rated health, whereas education and personal income are associated with higher levels of self-rated health. Model 2 adds measures of prior neighborhood health and poverty. The coefficient for African-American race and Latino ethnicity remain significant in Model 2 (now at the $p<0.05$ level). Not surprisingly, the poorer the prior aggregated self-rated health within the neighborhood, the lower the level of individual self-rated health. Contrary to what we hypothesized, neighborhood poverty is not a significant predictor for self-rated health after controlling for individual SES. Model 3 replaces poverty with income inequality. In this model, the coefficients for the individual-level variables and prior neighborhood health remain stable. Surprisingly, income inequality at the neighborhood level appears to exert a significant and positive effect on self-rated health net of individual factors, at odds with what we hypothesized and most previous findings in published work.

Model 4 replaces income inequality with affluence. The direction and magnitude of the effects of individual characteristics change nominally, although, consistent with prior research (Browning et al., forthcoming; Cagney et al., 2002), the coefficient for African-American race is reduced from the baseline model by over 40 percent—much higher than the proportional reduction in the size of the race coefficient achieved in models 2 and 3. Controlling for individual-level

Table 3
Descriptive statistics for variables in the analysis (MCIC-MS: 1996, 1997, 1999)

Variables	Proportions	St. dev.
Self-rated poor health		
Fair	0.04	0.19
Poor	0.18	0.39
Good	0.44	0.50
Excellent	0.34	0.47
Socio-demographic background		
Male	0.40	0.49
Age	45.22	16.75
Married/Cohabiting	0.38	0.48
Smoking	0.29	0.45
High blood pressure (self-reported)	0.26	0.46
Race		
White/Other	0.44	0.50
Black	0.40	0.49
Latino	0.16	0.37
Annual household income		
<$10,000	0.07	0.26
⩾$10,000<$15,000	0.07	0.26
⩾$15,000<$20,000	0.09	0.29
⩾$20,000<$25,000	0.08	0.27
⩾$25,000<$30,000	0.12	0.33
⩾$30,000<$40,000	0.17	0.38
⩾$40,000<$50,000	0.12	0.33
⩾$50,000<$70,000	0.12	0.32
⩾$70,000<$90,000	0.07	0.25
⩾$90,000	0.08	0.27
Education		
8th grade or less	0.05	0.22
9–12th grade, no diploma	0.10	0.30
High school graduate	0.17	0.37
Some college	0.34	0.47
College graduate	0.19	0.39
Graduate study or degree	0.16	0.36

Note: $N = 3459$.

predictors of health, neighborhood affluence has a significant effect on self-rated health.

Model 5 includes all three dimensions of neighborhood economic context along with all the control variables. The positive effect of affluence is robust in the presence of neighborhood poverty and income inequality. Controlling for individual SES and other personal attributes as well as neighborhood poverty and income inequality, a 10 percent increase in the percentage of households with annual family incomes of $50,000 and over leads to a 30 percent increase in the odds of reporting better self-rated health.[5]

Model 6 adds aggregated educational attainment to model 5. This model includes all major dimensions of neighborhood socioeconomic context. The results from this model show that the puzzling positive effect of income inequality appears spurious, evidently via the significant impact of aggregated educational attainment. Aggregated educational attainment is highly positively correlated with income inequality and is significantly correlated with better health. The magnitude of the affluence effect is reduced in the presence of aggregated educational attainment yet it remains significant at the $p<0.05$ level. In this model, controlling for individual characteristics and other major dimensions of neighborhood SES, a 10 percent increase in the percentage of households with annual family incomes of $50,000 and over leads to a 17 percent increase in the odds of reporting better self-rated health.

Moving to the second component of our analyses, Table 5 reports the results of a series of hierarchical ordinal logistic models exploring the mechanisms through which neighborhood affluence impacts individual self-rated health, independent of other individual-level health-related characteristics and other dimensions of neighborhood SES. Model 7 examines whether physical environment is a potential pathway linking spatially concentrated affluence to individual self-rated health.

Physical environment significantly affects self-rated health. The affluence coefficient was rendered non-significant after including physical environment in the model. The magnitude of the coefficient for affluence is reduced by 20 percent. This suggests that physical environment contributes to the effect of affluence on individual health. Model 8 tests the hypothesis that health-enhancing services mediate the affluence effect. The results of this model do not provide any evidence for this hypothesis. The coefficient for services is not significant and the effect of affluence remains similar to that in model 6. Model 9 adds measures of social resources and crime exposure simultaneously since both are important indicators of neighborhood social environment. The stock of social resources is a positive predictor of better health while the effect of crime exposure is not significant. The effect of affluence is not significant in this model and is reduced by 57 percent as compared to model 6. Finally, model 10 offers an

[5] The log odds ratio of reporting one level better self-rated health corresponding to 100 percent increase in affluence was 2.604 (Table 4). Since we are interested in presenting the odds ratio for a 10 percent increase in affluence, we divided 2.604 by 10, and then exponentiated 0.2604 to get the odds ratio 1.3 that is corresponding to a 10 percent increase in neighborhood affluence.

Table 4
Hierarchical ordinal logit models of self-rated health (assessing the relative impact of affluence, poverty and income inequality on individual health)

	Models											
	1		2		3		4		5		6	
Independent variables												
Individual-level variables												
Age	−0.021	***	−0.021	***	−0.021	***	−0.021	***	−0.021	***	−0.021	***
Interview year	−0.039		−0.040		−0.040		−0.041		−0.042		−0.042	
Male	0.015		0.007		0.010		0.016		0.018		0.019	
Latino	−0.369	**	−0.286	*	−0.304	*	−0.207		−0.178		−0.140	
Black	−0.410	***	−0.262	*	−0.353	**	−0.214		−0.224		−0.148	
Married/Cohabitating	−0.109		−0.128		−0.095		−0.149		−0.130		−0.118	
Smoking	−0.462	***	−0.432	***	−0.445	**	−0.421	***	−0.423	***	−0.419	***
High blood pressure	−1.086	***	−1.085	***	−1.081	***	−1.088	***	−1.087	***	−1.069	***
Education	0.205	***	0.210	***	0.209	***	0.214	***	0.216	***	0.219	***
Income	0.146	***	0.149	***	0.146	***	0.151	***	0.150	***	0.150	***
Neighborhood-level variables												
Prior neighborhood health			−0.210	***	−0.215	**	−0.134	**	−0.073		−0.029	
Concentrated poverty			−0.704						−0.170		0.399	
Income inequality (Gini)					2.471	*			3.962	**	0.380	
Concentrated affluence							2.396	***	2.604	***	1.612	*
Aggregated education											4.122	***

a Neighborhood level $N = 275$; Individual level = 3459.
* $p <= 0.05$, ** $p <= 0.01$, *** $p <= 0.001$ (two-tailed tests).
∼ The range of poverty, income inequality, affluence and aggregated education is between 0 and 1.
ˆ The estimates presented in this table are log odds ratio.

opportunity to evaluate the relative importance of these hypothesized pathways linking neighborhood affluence with individual self-rated health. The introduction of variables measuring physical environment, health-enhancing services, crime exposure and social resources simultaneously results in little additional impact on the affluence coefficient as compared to model 9. Thus, the social resources indicator showed a stronger impact on the affluence effect than the other proposed mediators. Physical environment is also important, although its impact is not as great as that of social resources.

Concerned with the potential problem of multi-collinearity in model 6 and model 10, we examined the variance inflation factors (VIF) in two OLS linear regression models containing the same set of covariates (data not shown). In model 6, the average VIF is 2.03, and the largest VIF is 5.01 for aggregated educational attainment. In model 9, the average VIF is 2.04, and the largest VIF is 5.23 for aggregated educational attainment. According to one rule of thumb, there is evidence of multi-collinearity if the largest VIF is greater than 10 or the mean of all the VIFs is considerably larger than 1 (Chatterjee, Hadi, & Price, 2000). Although the neighborhood predictors in these two models are highly correlated, it seems that multi-collinearity is not a serious concern in our analyses.

Table 5
Hierarchical ordinal logit models of self-rated health (exploring the mechanisms through which affluence impacts on health)

	Models									
	6		7		8		9		10	
Independent variables										
Individual-level variables										
Age	−0.021	***	−0.021	***	−0.020	***	−0.020	***	−0.020	***
Interview year	−0.042		−0.042		−0.042		−0.041		−0.041	
Male	0.019		0.017		0.020		0.022		0.021	
Latino	−0.140		−0.129		−0.127		−0.112		−0.091	
Black	−0.148		−0.123		−0.143		−0.126		−0.103	
Married/Cohabitating	−0.118		−0.121		−0.119		−0.122		−0.126	
Smoking	−0.419	***	−0.418	***	−0.419	***	−0.420	***	−0.418	***
High blood pressure	−1.069	***	−1.068	***	−1.071	***	−1.079	***	−1.080	***
Education	0.219	***	0.220	***	0.220	***	0.221	***	0.222	***
Income	0.150	***	0.150	***	0.150	***	0.150	***	0.151	***
Neighborhood-level variables										
Prior neighborhood health	−0.029		−0.034		−0.028		−0.054		−0.054	
Concentrated poverty	0.399		0.350		0.562		0.579		0.664	
Income inequality (Gini)	0.380		0.596		0.636		0.496		0.909	
Concentrated affluence	1.612	*	1.297		1.752	*	0.694		0.676	
Aggregated education	4.122	***	3.916	***	3.750	***	4.121	***	3.542	**
Physical environment			0.144	*					0.127	*
Health-enhancing services					−0.103				−0.114	
Crime exposure							−0.121		−0.091	
Social resources							0.183	**	0.171	*

a Neighborhood level $N = 275$; Individual level = 3459.
* $p <= 0.05$, ** $p <= 0.01$, *** $p <= 0.001$ (two-tailed tests).
$\sim$ The range of poverty, income inequality, affluence and aggregated education is between 0 and 1.
$\hat{}$ The estimates presented in this table are log odds ratio.

Discussion

The purpose of this work was two-fold. First, we attempted to verify that contextual economic conditions exerted influence on individual self-rated health independent of individual SES, and to assess the relative importance of three contextual measures, affluence, poverty and income inequality, for individual self-reported health. Second, we explored mechanisms operating at the neighborhood level that may help to explain the influence of structural economic conditions on health. Responding to the criticism that "much less energy has been devoted to investigating possible explanations for any observed contextual effects"

(Macintyre & Ellaway, 2000, p. 342), we explicated an exploratory model of the links between neighborhood SES and health and systematically tested it.

At odds with hypothesis 1a (i.e., heath negatively correlates with poverty) and some previous research, we did not find evidence for contextual effects of neighborhood poverty with or without the presence of other neighborhood socioeconomic measures. Consistent with our expectations described in hypotheses 1c (neighborhood concentrated affluence positively correlates with health) and 2 (at the neighborhood level, affluence is more powerful than poverty and income inequality in affecting health), we found that neighborhood affluence exerted a significant positive effect on health, even after controlling for individual-level socioeconomic, demographic and health-related background factors. And, it remained significant after the introduction of neighborhood-level poverty, income inequality, aggregated educational attainment and prior neighborhood health. We also found that aggregated educational attainment was a significant socioeconomic factor influencing individual health. Controlling for this factor, and contrary to hypothesis 1b (neighborhood income inequality negatively correlates with health), income inequality appeared not to be an important factor influencing health, beyond individual characteristics.

This empirical evidence suggests that different dimensions of economic structure do not in fact have unique or additive contributions to individual health. Our finding that neighborhood concentrated affluence is more important than concentrated poverty and income inequality supports Wilson's theory regarding the extent to which neighborhood context influences individuals' well-being. Wilson's conceptualization indicates that socioeconomic heterogeneity is not necessarily bad because the prevalence of middle- and upper-class people correlates with the resources necessary to sustain basic institutions like the family, churches, schools, and even health facilities or programs that are health protective. On the other hand, it is important to note that individual-level income has a considerably greater effect on individual self-rated health than neighborhood affluence. This suggests that individual-level poverty is persistently detrimental to health even with the potential benefits attached to residence in affluent neighborhoods.

Turning to the second set of analyses, we found that a composite measure of social resources distinguished itself in both explaining the impact of concentrated affluence and exerting an independent contextual effect on individual health. Our social resource measure has four key components: reciprocity, density of local networking, social cohesion and informal social control. All are important aspects of social capital according to a diverse set of social capital theorists (Baron, Field, & Schuller, 2000; Coleman, 1990; Putnam, 2000). Since the early 1990s, there has been considerable research interest in the conceptualization of social capital and its impact on individual and societal outcomes. Even though studies are emerging to directly test the effect of contextual social capital on health (Browning & Cagney, 2002b; Kawachi, Kennedy, Lochner, & Prothrow-Stith, 1997), macro-to-micro research on this issue is far from adequate. Our findings contribute to this literature by suggesting that social resources at the neighborhood level are more powerful determinants of individual self-rated health than the availability of health-enhancing services, and even homicide exposure. Moreover, the prevalence of social resources mediates the impact of neighborhood affluence, indicating that neighborhood economic context might work through social resources to influence health status.

Physical environment, or the level of physical disorder in the neighborhood, also mediates the effect of affluence on self-rated health, although to a lesser extent than social resources. This is consistent with the recent work of Ross and Mirowsky (2001), who found that the association between neighborhood disadvantage and health is mediated by perceived neighborhood physical and social disorder.

Conversely, the positive effect of the prevalence of college-educated people cannot be explained by physical disorder, social environment or health-enhancing services. It is possible that aggregated educational attainment relates more to psycho-cultural environmental factors such as self-esteem and morale of the residents. Evidence shows that human capital obtained in school increases a person's real and perceived control over life; and positively correlates with a person's cognitive flexibility and ability (Mirowsky & Ross, 1989; Spaeth, 1976). These psycho-cognitive resources when aggregated at the neighborhood level may encourage the spread of health-enhancing behaviors, self-reliance and positive perspectives toward life. On the other hand, the significant effect of aggregated educational attainment may partially reflect the residual effects of college selectivity net of the college credential and years of schooling.[6] Empirical investigations of whether this effect is causal are beyond the scope of this paper. Future research is warranted to explore the underlying mechanisms and attempt to explain why aggregated educational attainment is good for individual health net of individual educational attainment and other neighborhood social and structural contexts.

[6] In our models, individual education was measured by six ordinal levels of years of schooling. Educational credentials were implied in this measure. We did not control for the prestige of the educational institution (selectivity) as a separate dimension of individual education status, which to some extent may explain the unique effect of aggregated educational attainment on self-rated health.

Our non-significant finding of the association between income inequality and health is particularly thought-provoking. Recent scholarship has argued for the importance of income inequality to the health of larger spatial or political units as well as individual health outcomes. The abundant ecological evidence suggests that income inequality may correlate with aggregate health status (Kaplan et al., 1996; Kennedy et al., 1996; Wilkinson, 1996). Yet the evidence for the relevance of income inequality as a predictor of *individual* health is sparse. Our study potentially contributes to this knowledge in two ways. First, our result implies that the observed relationship between income inequality and population health is not necessarily manifest at the individual level,[7] which is consistent with Mellor and Milyo's (2002) finding (although the aggregation level differed). Second, to the extent that local social resources are more influential to our psychological processes than general social features of a large city or a state, our finding that structural income inequality at the *neighborhood* level is not detrimental to individual health may indirectly refute the psychosocial interpretation and may suggest that the neighborhood is not an appropriate unit of analysis to test and explain the structural effect of income inequality on individual health.

The debate about whether economic inequality has a real impact on the health of individuals has just begun. It is possible that at larger spatial aggregation (e.g., state or nation), income inequality negatively affects our health, whereas for smaller areas (e.g., neighborhood, community, municipality) the effect is not strong or may even work in the opposite direction (e.g., Lorant, Thomas, Deliége, & Tonglet, 2001). Moreover, the longitudinal feature of this relationship has not been examined, it is particularly important to test whether income inequality affects our health via public expenditures on health-enhancing resources. Further theoretical construction and empirical investigations are merited to elucidate this relationship.

This work is not without limitations. Our study is restricted to a single metropolitan area, limiting the applicability of our findings to other urban centers. The cross-sectional design hampers our ability to capture neighborhood dynamics and determine causation. Lacking a measure for individual stock of social capital, our study is unable to disentangle the effects of aggregate social capital from those of the individual. In addition, our measure of neighborhood health-enhancing services is not based on utilization, but is an aggregate self-report of the availability of services in the neighborhood. Although data on actual utilization would be preferable, the availability of health services, and the knowledge of it, is an important component of "potential" or probable access to care (Andersen & Aday, 1978; Andersen, McCutcheon, Aday, Chiu, & Bell, 1983). Ideally, future research will incorporate measures of both quantity and quality of health-enhancing services, potentially more reliable, from self-reports of utilization or sources such as Medicare claims (which could address the "realized" or actual access portion of the Andersen and Aday model).

One possible elaboration is to incorporate micro-to-macro and macro-to-macro interactions into the analyses. Based on previous evidence of these interactions, we believe that contextual effects operate in more complex ways than can be represented in exclusively main effects models. In addition, different aspects of economic context may have different effects on health for different populations. Further exploration of variations in the empirical evidence for neighborhood effects across populations and areas will not only advance our knowledge of macro-structural effects on health but also improve the effectiveness of our community health-intervention programs.

[7] It may be argued that the neighborhood is such a small unit that the relationship between income inequality and health may be masked by within-neighborhood homogeneity (Lynch & Kaplan, 1997; Veenstra, 2002). However, our data showed that within-neighborhood income inequality was not small: the mean Gini coefficient across 275 neighborhoods in the city of Chicago is 0.41 with a minimum value of 0.33 and maximum value of 0.54. This level of economic heterogeneity is largely comparable to that of metropolitan areas in the United States as presented in Sturm and Grensenz's work (2002). Even with a non-trivial degree of economic heterogeneity at the neighborhood level, we found no significant relationship between structural income inequality and self-rated health.

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