Neighborhood Social Processes, Physical Conditions, and Disaster-Related Mortality: The Case of the 1995 Chicago Heat Wave

Christopher R. Browning
Ohio State University

Danielle Wallace
University of Chicago

Seth L. Feinberg
Western Washington University

Kathleen A. Cagney
University of Chicago

The authors draw on Klinenberg's (2002) ethnography and recent neighborhood theory to explain community-level variation in mortality during the July 1995 Chicago heat wave. They examine the impact of neighborhood structural disadvantage on heat wave mortality and consider three possible intervening mechanisms: social network interaction, collective efficacy, and commercial conditions. Combining Census and mortality data with the 1995 Project on Human Development in Chicago Neighborhoods Community Survey and Systematic Social Observation, the authors estimate hierarchical Poisson models of death rates both during the 1995 heat wave and comparable, temporally proximate July weeks (1990–94, 1996). They find that neighborhood affluence was negatively associated with heat wave mortality. Consistent with Klinenberg's ethnographic study of the Chicago heat wave, commercial decline was positively associated with heat wave mortality and explains the affluence effect. Where commercial decline was low, neighborhoods were largely protected from heat-related mortality. Although social network interaction and collective efficacy did not influence heat wave mortality, collective efficacy was negatively associated with mortality during comparable July weeks (when no heat wave occurred). Unequal distribution of community-based resources had important implications for geographic differences in survival rates during the Chicago heat wave, and may be relevant for other disasters.

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Disaster makes visible the social distribution of vulnerability. Recent events in Europe suggest that this statement may be especially true of the lethal meteorological events known as heat waves. Estimates indicate that as many as 35,000 Europeans died as a result of the roughly two-week period of unusually high temperatures in August 2003, with evidence suggesting that the victims were largely elderly (Hémon and Jougla 2003). The United States experienced its own heat-related disaster during the mid-1990s. Affecting a swath of the upper Midwest, the July 1995 heat wave produced its most severe consequences in Chicago, where up to 739 residents died due to sustained high temperatures over a several-day period (Whitman et al. 1997).

Although the heat wave deaths were ostensibly weather related, Eric Klinenberg's (2002) "social autopsy" of the Chicago disaster suggests that the consequences of the heat wave cannot be considered exclusively "natural" and

Direct correspondence to Christopher R. Browning, Department of Sociology, Ohio State University, 300 Bricker Hall, 190 N. Oval Mall, Columbus, OH 43210. This research was supported by a grant from the National Institute on Aging and the Office of Behavioral and Social Science Research 1 R01 AG22488-01. The authors thank the *ASR* editor Jerry A. Jacobs and anonymous *ASR* reviewers for their helpful comments; and Paul Rathouz, Avery Guest, Richard Lundman, Mario Small, Sapna Swaroop, and Ming Wen for their helpful comments.

must be understood in the context of socially produced conditions of vulnerability that place some individuals at far greater risk than others. Indeed, the victims of Chicago's heat wave were primarily older, disproportionately poor and African American, and often isolated (Semenza et al. 1996). Beyond individual characteristics, however, evidence suggests that disadvantaged *neighborhoods* exhibited considerably higher rates of heat-related death, suggesting that an additional layer of ecological vulnerability contributed to the scope of the disaster.

To date, no quantitative study has explicitly linked features of neighborhood social context to differences in the rates at which older Chicagoans died during the 1995 heat wave. We combine data from the Illinois Department of Public Health on mortality in Chicago with the 1990 census, the 1995 Project on Human Development in Chicago Neighborhoods Community Survey (PHDCN-CS), and the 1995 PHDCN Systematic Social Observation (PHDCN-SSO) to examine various hypotheses about the social etiology of differential heat wave vulnerability at the community level. Specifically, we use hierarchical Poisson models to estimate the heat wave mortality rate for older Chicagoans (60 +). We address three key questions regarding variation in heat wave mortality across neighborhoods. First, what structural characteristics of neighborhoods (affluence, residential stability, population density, and age structure) were associated with mortality during the heat wave? Second, what social processes and commercial characteristics of communities (collective efficacy, social network interaction and exchange, commercial density, and commercial decline) were associated with heat wave mortality (and to what extent did variation in these conditions account for structural associations)? Finally, did differences in social or commercial conditions result in some communities largely escaping the lethal effects of the heat wave? By examining the conditions under which particular communities were effectively protected from the excessive heat, we seek to generate insight into neighborhood-level characteristics that buffer local populations from the impact of heat waves and, potentially, from other types of disasters.

This study brings quantitative evidence to bear on questions addressed principally with qualitative data in Klinenberg's (2002) analysis, harnessing the plural nature of sociological method to enrich our insights into neighborhood processes that may exacerbate heat-related disasters. We consider hypotheses rooted in an ecological model of the neighborhood-level factors that contributed to differential heat-related mortality. This approach allows us to cross-validate findings consistent with the ecological perspective presented in Klinenberg's account. Principally, we examine the role of commercial conditions (Jacobs 1961) within urban neighborhoods in producing circumstances that inhibited or facilitated help-seeking behavior during the heat wave. We move beyond Klinenberg's case study approach, however, to examine associations between neighborhood conditions and mortality both during the heat wave week as well as comparable, temporally proximate July weeks. The analytic strategy provides an opportunity to explore which neighborhood factors are more generally predictive of mortality and which were unique to the heat wave. By focusing only on the time period of the heat wave, Klinenberg is unable to disentangle typical and disaster-specific determinants of mortality. We also draw on emerging quantitative research linking neighborhood social organization with health outcomes by considering the potential role of social networks and collective efficacy (Browning and Cagney 2003; Sampson, Raudenbush, and Earls 1997) in explaining differential neighborhood-level vulnerability to the heat wave. The analysis contributes to the burgeoning literature on the health consequences of community context by considering the applicability of neighborhood theory to an extraordinary health event with lethal consequences.

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BACKGROUND

The 1995 Chicago heat wave brought several consecutive days of excessive heat, with temperatures reaching well over 100 degrees Fahrenheit (City of Chicago 1995). On Thursday, July 13, the second day of the heat wave, the temperature peaked at 106 degrees with a heat index of 126. These conditions led to widespread heat-related injury and hospitalization and a rapidly increasing mortality rate. Seventy-four and 82 people died on July 12 and 13, respectively, deviating only modestly from the July average of 72 deaths per day. On

July 14, however, three days into the heat wave, the per-day death count rose to an alarming 188 deaths and reached 365 on Saturday. Excessive death rates continued through the following week, resulting in an unprecedented number of heat-related mortalities and a disaster of rarely seen dimensions.

As the consequences of the disaster became apparent over the ensuing days and weeks, questions arose as to why the death toll resulting from the heat wave was so extreme. City representatives initially downplayed the extent of the disaster and subsequently attributed the increased death to residents who were already on the verge of death prior to the heat wave and would have likely died soon after July 1995 even in the absence of unusually high temperatures. Emerging evidence, however, suggests that the heat-related mortality was "real" (i.e., not an acceleration of imminent mortality)[1] and that it disproportionately affected the most socially vulnerable segments of the population: older, poor, socially isolated, and African American residents (Semenza et al. 1996). Moreover, preliminary evidence suggests that the distribution of heat-related mortality was concentrated in the most economically disadvantaged Chicago *neighborhoods.* Although age, race, socioeconomic status, and social isolation likely influenced the individual level capacity to cope with the excessive heat, the neighborhood-level absence of economic resources and other forms of structural disadvantage are associated with local conditions and collective dynamics that may have independently contributed to excess mortality during the heat wave. We next consider a range of neighborhood characteristics as potential explanations for why some spatially defined populations were more vulnerable during the heat wave crisis than others.

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[1] The notion that the heat wave mortality constituted "death displacement" would have been confirmed by evidence that mortality rates for months subsequent to July 1995 declined by comparison with the average rate. This hypothesis was debunked by a 1997 Illinois Department of Public Health study that found no evidence that mortality rates were stable when averaged over a longer period (Klinenberg 2002).

Neighborhood Structural Sources Of Heat Wave Vulnerability

The increasing concentration of poverty within urban neighborhoods has generated considerable research interest in the consequences of residing in economically disadvantaged environments (Jencks and Mayer 1990; Massey and Denton 1993; Wilson 1987, 1996). Clearly, the availability of individual-level socioeconomic resources will have implications for the ability of older residents to protect themselves from the consequences of intense heat, primarily through access to quality healthcare, air conditioning, and related amenities. Above and beyond individual factors, however, widespread macro-level economic disadvantage may compromise the effectiveness of neighborhood institutions, including local voluntary organizations, churches, businesses, social services, and more informal neighbor networks (Wilson 1987, 1996).

Wilson's insight into the process of neighborhood decline suggests a two-stage model in which middle-class flight (i.e., the declining prevalence of more *affluent* residents) destabilizes vital local institutions. In turn, the increasing concentration of poverty and the absence of middle-class resources and role models lead to the cultural transmission of behaviors that are maladaptive from the standpoint of mainstream society. With respect to the heat wave, the consequences of declines in the prevalence of middle-class residents and the accompanying institutional and infrastructural decay may be particularly important in understanding the vulnerability of elderly residents (Cagney, Browning, and Wen 2005).

The research literature on the detrimental consequences of neighborhood economic disadvantage offers strong evidence of a link between economic deprivation and mortality (Anderson et al. 1997; Cubbin and LeClere 2000; Haan, Kaplan, and Camacho 1987; LeClere, Rodgers, and Peters 1997; Lochner et al. 2003; Waitzman and Smith 1998; Yen and Kaplan 1999). Lochner et al. (2003), for instance, found powerful effects of a measure of neighborhood material deprivation on 1994–96 mortality rates for four race-sex groupings (African American and white men and women) of Chicago residents ages 45–64. These findings point to the possibility that economic disadvantage may also contribute to differential *excess* mortality due to exogenous disasters.

The level of residential stability characterizing a neighborhood may also independently contribute to health-relevant dimensions of social organization. High rates of turnover among local residents and limited homeownership tend to thwart emotional and social investments in neighborhoods, limiting the development of stable and viable social networks among neighbors (Kasarda and Janowitz 1974). Local institutions that are hampered in their ability to function due to limited social and economic resources combined with weak and unstable neighbor networks result in insufficient collective capacity to mobilize on behalf of shared local objectives including, potentially, the informal social support of neighborhood elderly.

Additional structural factors that may have contributed to neighborhood-level variation in heat-related death rates include population density and the proportion elderly. In an ethnographic account of the dramatic difference in excess heat-related death rates in North Lawndale (a primarily African American community in West Chicago) and "Little Village" (a primarily Latino community just to the south of North Lawndale), Klinenberg (2002) points to the population density of Little Village as a possible structural antecedent explaining its considerable advantage with respect to heat-related mortality. The increase in population due to the influx of Latino immigrants fostered the conditions under which commercial enterprises and street activity thrived during the mid-1990s. Klinenberg hypothesizes that these ecological dynamics were pivotal factors in the experience of Little Village during the heat wave. Indeed, contrary to the classic accounts of the downside of population density (Wirth 1938), recent research has found protective effects. Morenoff, Sampson, and Raudenbush (2001), for instance, found a negative effect of population density on homicide rates, consistent with the expectation that concentrated populations may be more effective at monitoring neighborhood space.

We also consider the extent to which the proportion of the neighborhood population that is retirement age or older contributed to differential neighborhood mortality rates. Aging neighborhoods may be less effective at sustaining viable neighborhood institutions due to more limited resources and mobility. On the other hand, some research (e.g., Putnam 2001) indicates that retirees are more civically active and potentially more oriented toward neighborhood life. Retirees may have more discretionary time and an increasingly limited radius of daily activity, potentially resulting in more attention to, and action on behalf of, local neighborhood conditions. High concentrations of older residents potentially attract elder-relevant services and amenities, including businesses, which may promote a more supportive climate for older individuals. Such services may have benefited older residents during the heat wave.

In sum, neighborhood structural characteristics, including the prevalence of economic resources, residential stability, population density, and age structure, are likely to influence a number of *community-level mechanisms* that may have been consequential for the well-being of older residents during the heat wave.

Neighborhood Social Organization, Commercial Conditions, and Heat Wave Mortality

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We derive a number of key hypotheses regarding the central mechanisms linking neighborhood structural disadvantage with excess mortality during the heat wave. Drawing on the work of Sampson and colleagues, Jacobs (1961), and Klinenberg's (2002) ethnographic account, we consider (1) social organizational approaches to community self-regulatory capacity highlighting the potential benefits of both social network interaction and reciprocated exchange and the prevalence of collective efficacy, and (2) the role of physical and infrastructural resources—specifically commercial enterprises—in influencing elderly well-being during the heat wave.

First, the increasingly vast literature on the role of informal social support in promoting health (House, Robbins, and Metzner 1982) has generated interest in the effects of community-level social network characteristics on health. Structurally disadvantaged neighborhoods are less capable of sustaining viable social networks and may suffer from deficits in local social interaction and support (Berkman and Breslow 1983).

Research on aging suggests that the health benefits of social support are particularly relevant for older adults (Seeman et al. 1987).

Among elderly residents who live alone, the neighborhood context of network support may have important implications for the availability of health-enhancing and health-protective social capital (Thompson and Krause 2000). In the context of the heat wave, more extensive social ties, including non-kin exchange networks and kinship-based affiliations, are likely to have benefited elderly urban residents during the heat wave by providing a set of interested actors capable of intervening on behalf of a vulnerable older adult (Cannuscio, Block, and Kawachi 2003).

A second perspective highlights the capacity for action on behalf of community goals as the critical intervening mechanism linking community structure with health. Sampson et al. (1997) have encapsulated this process in the concept of collective efficacy, which emphasizes mutual trust and solidarity (social cohesion) and shared expectations for pro-social action (informal social control) in theorizing the impact of neighborhood social organization on local residents' well-being.

Neighborhood collective efficacy may have influenced heat-related mortality through a number of processes, including the social control of conditions that threaten health, access to services and amenities, and psychosocial processes (Browning and Cagney 2002; Kawachi and Berkman 2000). First, communities with high levels of collective efficacy are potentially more oriented toward the well-being of neighborhood residents in general. Normative orientations that encourage mutual support may benefit older residents during times of crisis, as neighbors are more likely to feel a sense of obligation to monitor and intervene on their behalf. Second, collective efficacy is likely to enhance the capacity of communities to attract and maintain high-quality health services and amenities such as community health clinics and safe recreational space. Third, widespread trust and neighborhood attachment may produce a sense of confidence among elderly residents that venturing out into the neighborhood for help during hot spells (e.g., to a breezy park space or an air-conditioned local commercial venue) is prudent (Kawachi and Berkman 2000).

Few studies have examined the association between either networks or collective efficacy and mortality rates at the neighborhood level. Lochner et al. (2003) found that social capital as measured by social trust, reciprocity, and civic participation negatively predicted mortality rates among Chicago adults ages 45–64. Though potentially consistent with both network and collective efficacy hypotheses, this finding points to the potential role of social organizational aspects of communities in limiting mortality—processes that may also be relevant in managing the consequences of heat-related disasters.

Finally, drawing on Klinenberg (2002) and Jacobs (1961), we focus on the state of commercial activity and infrastructure within urban neighborhoods and its possible associations both with the availability of aid during the heat wave and, in more degraded neighborhoods, conditions that fostered fear of victimization among the elderly. First, the prevalence of businesses within neighborhoods offers isolated older adults local, public destinations that serve as possible sources of assistance in the face of adversity. Klinenberg (2002) offers the example of one older Chicagoan who made use of the air conditioning provided by a local grocery store during the heat wave, potentially staving off a severe negative reaction. Options for support provided by local businesses during the heat wave may have encouraged help-seeking behavior.

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Dense commercial activity within neighborhoods also engenders a more dynamic social ecology, as residents more frequently traverse streets on their way to and from local businesses. As Jacobs (1961) argues, ecologically dynamic neighborhoods more effectively maintain control of public space. Active and diverse commercial life within neighborhoods, for instance, encourages "eyes on the street" (Jacobs 1961; Klinenberg 2002). During the heat wave, elderly residents may have felt more comfortable using streets with more vibrant social ecologies.

On the other hand, the ecological consequences of local commercial conditions in economically disadvantaged neighborhoods may have contributed to the prevalence of victimization fears among older adults. As Wilson (1996) argues, when middle-class and more affluent populations decline, the institutional and commercial foundations of neighborhoods are weakened. The abandonment of the inner-city by large-scale manufacturers is followed by the "demise or exodus of the smaller stores, the

banks, and other businesses" that depend on wages paid by the larger local employers to support them (Wilson 1996:35). In turn, economically disadvantaged inner-city neighborhoods are left with increasingly high concentrations of liquor stores and currency exchanges (Wilson 1996), but little else in the way of viable commercial activity. In a study of Chicago neighborhoods, Alwitt and Donley (1997) found that more affluent neighborhoods exhibited higher densities and greater diversity of commercial activity (e.g., large grocery establishments, drug stores, and banks). The exception—liquor stores—showed an inverse pattern of association, with higher concentrations observed in economically disadvantaged neighborhoods.

The decline of commercial life in some communities may have heightened vulnerability during the heat wave (Klinenberg 2002). An attenuated commercial base fosters conditions that may be particularly problematic for older residents. Decaying commercial infrastructure and the increasing dominance of businesses that draw a potentially fear-inducing clientele may make the elderly less likely to venture out into the neighborhood. Thompson and Krause (2000; see also Krause 1993), for instance, found that neighborhood deterioration—as measured by the condition of neighborhood buildings, roads, and the respondents' perceived level of safety from crime in the neighborhood—was positively associated with distrust and social isolation and negatively associated with physical health among older adults. Indeed, some elderly urban residents may experience such intense fear of victimization that they live in a state of "self-imposed house arrest" (Dowd, Sisson, and Kern 1981).

In the following sections, we present the results of analyses intended to address hypotheses drawn from Klinenberg's account of the heat wave and the extant literature on neighborhood structure, social organization, and health. We emphasize that the analyses we present are not intended to test the overall theoretical model advanced by Klinenberg. In contrast, we focus on the component of his approach that is consistent with an ecological perspective. Specifically, the hypothesized links among neighborhood social structure, commercial infrastructure, and conditions that support or impede the engagement of elderly residents with their communities.

Specifically, we (1) estimate the mortality rate for older adults (ages 60 and older) during the July 1995 heat wave, (2) investigate the relationship between structural characteristics of neighborhoods (affluence, residential stability, population density, and age structure) and variation in heat-related mortality, (3) examine whether neighborhood level collective efficacy, social networks, and commercial conditions are associated with heat wave mortality and account for neighborhood structural effects on this outcome, and (4) consider the extent to which some neighborhoods were effectively protected from heat-related mortality. Our analytic approach allows us to estimate the effect of key predictors of mortality both during the heat wave week and the same seven-day period in other proximate years, providing an opportunity to assess differences in the determinants of mortality during the crisis period of the heat wave by comparison with average conditions.

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DATA

We use four data sources to explore the association between neighborhood context and mortality—the 1990 Decennial Census, the 1994–95 Project on Human Development in Chicago Neighborhoods Community Survey (PHDCN-CS), the 1995 Project on Human Development in Chicago Neighborhoods Systematic Social Observation (PHDCN-SSO), and the 1990–96 Illinois Department of Public Health Vital Statistics data on mortality in Chicago. We construct measures of neighborhood structural disadvantage from 1990 census data, measures of neighborhood social processes from the PHDCN-CS, and measures of commercial conditions from the PHDCN-SSO. The PHDCN-CS is a probability sample of 8,782 residents of Chicago (age 18 and older) that focuses on respondent assessments of the communities in which they live (Sampson et al. 1997). The PHDCN-CS combined 847 census tracts into 343 "neighborhood clusters" (NCs) that maintained relative population homogeneity with respect to racial/ethnic, socioeconomic, housing, and family structure characteristics (NCs average roughly 8,000 people).

The PHDCN-SSO used a two-stage sampling procedure that included selecting a random

Table 1. Descriptive Statistics for Variables in the Analysis

Independent Variables	Mean	Standard Deviation
Social composition (60 and over population)		
Age		
60–69	.496	—
70–79	.342	—
80 and over	.162	—
Race/ethnicity		
White	.589	—
African American	.314	—
Latino	.069	—
Female	.599	—
Neighborhood characteristics (unstandardized)		
Population density	.800	.477
Proportion living alone	29.806	11.889
Proportion 65 and over	10.101	5.356
Commercial density	1.934	1.465

Note: Remaining neighborhood level variables are standardized (mean = 0; standard deviation = 1) and are not included in the table. Neighborhood level N = 77

sample of 80 of the 343 Chicago NCs stratified by racial/ethnic composition and SES. The SSO methodology was designed to observe various land-use, commercial, and other physical and social characteristics of Chicago communities directly through the use of videotape and observer logs (Raudenbush and Sampson 1999). The study was conducted between June and September of 1995, the period just prior to and after the July heat wave. Finally, we estimated mortality rates for Chicago NCs using the Illinois Department of Public Health mortality data (published in 1997 for years 1990–96).

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MEASURES

The outcome for the analysis is the log mortality rate for the population aged 60 and over in Chicago NCs during the week of July 14–20, 1990–96, disaggregated by the age, race, and sex composition of the neighborhood (see Analytic Strategy). Our principal concern is the week of July 14–20, 1995, a dummy variable for which captures the mortality rate associated with this period of time.

Age is a three-category variable representing adults ages 60 to 69, 70 to 79, and 80 and older. Dummy variable indicators reveal an approximately linear relationship between age categories and mortality rates, thus, we include age as a linear term in multivariate models presented in the following sections. Race/ethnicity is measured with dummy variables for African Americans and Latinos (white is the omitted category). Table 1 reports the 1990 age, race, and sex composition of Chicago for the population 60 and over and includes means and standard deviations for unstandardized neighborhood variables.

We hypothesize that community characteristics will influence heat wave mortality rates across neighborhoods above and beyond the compositional effects of age, race, and sex. A number of neighborhood-based structural characteristics are included in the analyses. A factor score capturing *concentrated affluence* was dominated by high loadings for the percentage of households with incomes above $75,000, college educated, and in professional or managerial occupations.[2] A second factor—*residential stability*—exhibited high loadings for measures of continuity of residence (percent living in the same house since at least 1985) and the percent of housing occupied by owners. *Population density* is the natural logarithm of the NC population per square mile divided by 10,000. The *proportion 65 and older* is the percentage of neighborhood residents who are 65 or older.

[2] The analysis employed alpha-scoring factor analysis with an oblique rotation. Scores from principal components analyses yielded the same pattern of results in multivariate analyses.

Social isolation among urban elderly is also a central focus of Klinenberg's analysis and a potentially important structural factor relevant to heat wave–related mortality. Consequently, we include a control for the proportion of the population who live alone.

Collective efficacy is operationalized through combining measures of social cohesion and informal social control. Social cohesion is 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 don't get along with each other" (reverse coded). Health-related informal social control is tapped through items measuring the respondent's level of 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, (3) "If there was a fight in front of your house and someone was being beaten or threatened, how likely is it that your neighbors would break it up?" Responses were given on a five-point scale. 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 are combined to form a single scale of health-related collective efficacy. The reliability of the collective efficacy scale is .73.[3]

The *social network interaction/reciprocated exchange* scale encompasses a number of items measuring respondent's assessments of the frequency of parties, visits, advice giving, and favor exchange among neighbors. The scale is constructed from 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?" These items are intended to tap aspects of community-level instrumental, informational, and appraisal support as well as the level of sociability characterizing the neighborhood (House, Landis, and Umberson 1988). The reliability of the social network interaction/reciprocated exchange scale is .61.[4]

Two measures of commercial conditions are included in the analysis, based on data from the PHDCN-SSO. A measure of *commercial density* is the log of the total count of local businesses (representing 20 different categories of commercial activity) divided by the total number of face blocks sampled within the NC. The level of *commercial decline* in the neighborhood is measured with six items tapping declining commercial conditions and the clustering of alcohol and youth-oriented businesses. Dichotomous indicators of the presence of commercial buildings in fair or poor condition; burned-out, abandoned, or boarded-up commercial buildings; liquor stores; bars and alcoholic beverage services; pool halls or videogame parlors; and signs advertising beer, whiskey or other alcoholic beverages are combined into a single scale (reliability = .91). The aggregation procedures for neighborhood-level measures drawn from the PHDCN-CS and SSO follow those of Sampson and colleagues (Sampson et al. 1997; Raudenbush and Sampson 1999).

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[3] Distinct from individual-level reliability (e.g, Cronbach's alpha), the reliability of neighborhood-level scale scores is dependent upon both the sample size within the neighborhood as well as the proportion of the total variance that is between (vs. within) neighborhoods. The reliability estimates of neighborhood scales are comparable to reliabilities reported in other recent neighborhood research (see Sampson, Morenoff, and Earls 1999).

[4] The aggregation of the scale used in the analyses excludes PHDCN-CS respondents below age 40 to capture the networks of relatively older adults. Although we cannot employ a scale based only on the networks of older (60+) PHDCN-CS adults due to sample size limitations, a scale that excludes the reports of significantly younger adults (those less likely to be integrated with local elderly), enhances the validity of the measure.

Correlations among neighborhood-level independent variables are reported in the Online Supplement (*ASR* Web site: http://www2.asanet.org/journals/asr/2006/toc052.html).

ANALYTIC STRATEGY

Despite the dramatic increase in mortality during the 1995 heat wave, death nevertheless remained a rare event among older Chicagoans. We view the mortality count for the 60 and older population within each NC as sampled from an over-dispersed Poisson distribution. Thus, we employ a hierarchical generalized linear model (HGLM) with a log link function to model mortality during the week of July 14–20, 1990–96. We then estimate mortality for the relevant 1995 heat wave week and model variation in heat wave mortality across neighborhoods based on measures of neighborhood structure, social processes, and commercial conditions. An advantage of the multilevel HGLM is the ability to assign each NC a unique "exposure," represented by the number of individuals who reside in the neighborhood within the relevant subgroup, based on the cross-classification of age, race, and sex categories (Lochner et al. 2003; Raudenbush and Bryk 2002). Incorporating the exposure variable allows us to interpret the left-hand side of the following level-one equation as the log mortality rate per 1000 population. The data are multilevel in structure: subgroup death rates are nested within time points (years), and time points, in turn, are nested within neighborhoods.[5] The three-level HGLM takes the following form:

Level 1 model:

$$\ln(Y_{itj}) = \pi_{0tj} + \pi_1(AGE_{itj}) + \pi_2(SEX_{itj}) + \pi_3(BLACK_{itj}) + \pi_4(LATINO_{itj}) \quad (1)$$

Level 2 model:

$$\pi_{0tj} = \beta_{1j}(AVERAGE_{tj}) + \beta_{2j}(HEATWAVE_{tj}) + u_{tj} \quad (2)$$

Level 3 model:

$$\beta_{1j} = \gamma_{10} + \sum_{q=1}^{Q} \gamma_{1q} Z_{qj} + \delta_{1j}$$
$$\beta_{2j} = \gamma_{20} + \sum_{q=1}^{Q} \gamma_{2q} Z_{qj} + \delta_{2j} \quad (3)$$

At level 1, Y_{itj} is the count of deaths for each subgroup i at time period t (the one-week July period relevant for the heat wave assessed each year from 1990 to 1996) in neighborhood j; π_{0tj} is the intercept; and π_1–π_4 represent the within-neighborhood coefficients for age, sex, and race/ethnicity. At level 2, π_{0tj} is modeled as a function of a dummy variable β_{1j} for the non–heat wave ("average") July weeks (1990–94, and 1996), a dummy variable for the week of the heat wave (1995) β_{2j}, and an error term u_{tj}. At level 3, the βs are allowed to vary randomly and are modeled as a function of Q neighborhood predictors, along with error terms $\delta_{1,2}$. By omitting the intercept at level 2, the coefficients represent the effects of neighborhood predictors on variation in mortality across neighborhoods during the two time periods considered (i.e., their interpretation is comparable). We also estimated a level-two model in which an intercept, a linear time trend, and a dummy variable for 1995 are included. We included the linear time trend at level 2 to capture any changes in mortality rates over time. We found no evidence of a significant time trend across the period considered.

Table 2 reports the results of a model including controls for age, race/ethnic, and sex composition along with additional interactions (Model 1) and a model including neighborhood structural predictors of β_{1j}, the adjusted mortality rate during average July 14–20 weeks (across 1990–94 and 1996), and β_{2j}, the adjusted mortality rate during1995 (Model 2). Table 3 reports the results of models including additional neighborhood predictors of variation in β_{1j} and β_{2j}. The modeling strategy provides an

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[5] At level one, we represent subgroups based on age, race, and sex. An individual record at this level, then, is the count of deaths among, for example, 60- to 69-year-old African American women—*not* the record of an *individual* decedent. The total population (e.g., of 60- to 69-year-old African American women) in the neighborhood for a given subgroup is considered an "exposure" variable in the estimation of the multilevel count model. Coefficients for the effect of independent variables can be interpreted in terms of the impact of a unit change on the log mortality rate per 1,000 population.

Table 2. Three-level Hierarchical Generalized Linear Models of Mortality: Neighborhood Social Composition and Structure

Independent Variables	Model 1		Model 2	
Social Composition				
Female	–1.896***	(.544)	–1.878***	(.543)
African American	1.109**	(.369)	1.005**	(.370)
Latino	.168	(.564)	.029	(.558)
Age	.546***	(.045)	.551***	(.044)
Female × Age	.255*	(.110)	.248*	(.109)
African American × Age	–.141*	(.072)	–.131	(.074)
Latino × Age	–.279	(.196)	–.293	(.196)
Female × Latino	1.550**	(.488)	1.514**	(.493)
1990–94, '96 Mortality				
Intercept	–9.290***	(.226)	–9.243***	(.220)
Concentrated affluence	—		.001	(.073)
Residential stability	—		.187	(.138)
Population density	—		–.421*	(.161)
Proportion living alone	—		.030**	(.011)
Proportion 65 and over	—		–.068***	(.017)
1995 Mortality				
Intercept	–8.232***	(.235)	–8.139***	(.225)
Concentrated affluence	—		–.176*	(.088)
Residential stability	—		–.064	(.153)
Population density	—		–.261	(.204)
Proportion living alone	—		.012	(.013)
Proportion 65 and over	—		–.041*	(.019)

Note: Data show population-average models (with robust standard errors in parentheses). Level one covariates omitted. Neighborhood level N = 77; Year level N = 539; Count Level N = 11,179.
* $p < .05$; ** $p < .01$; *** $p < .001$ (two-tailed tests).

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opportunity to examine whether predictors of mortality during the heat wave diverged from those that predict mortality under average conditions.

RESULTS

We begin by examining models for the total population aged 60 and older conditional on within neighborhood social compositional characteristics at level 1 and year variables at level 2.

Of central interest is the substantially higher magnitude of the intercept for the heat wave week (–8.23), by comparison with the intercept for non–heat wave weeks (–9.29). The mortality rate for 1995 was 2.9 times the average rate for the entire period ($e^{1.06}$).

Model 1 of Table 2 also demonstrates the powerful effects of social composition on mortality rates. Age, African American race, and male sex increase the log mortality rate substantially. As age increases, the heightened vulnerability of African Americans declines by comparison to whites. The relative advantage of women over men also declines with age. Latino women do not experience a decreased risk of death by comparison to men.

Data from the City of Chicago Coroner's office cited in Klinenberg's *Heat Wave* (2002) indicate that men and African Americans were more vulnerable to heat-related mortality. It is not clear from these data, however, whether the relative vulnerability of these groups differed from their average levels. To address this question, we included dummy variables for the heat wave and average periods, and a random effect in equations for each of the social compositional effects at level 2 (π_{1-8}, including social composition interaction terms) to test the hypothesis that these effects varied across time. We found no evidence of variation in the effects of social composition during the heat wave. An additional issue raised in *Heat Wave* is the apparent relative immunity of Latinos to heat-related death (according to Coroner's data) by comparison to both African Americans and whites. Our analyses do not reveal a Latino

Table 3. Three-level Hierarchical Generalized Linear Models of Mortality: Neighborhood Structure, Social Process, and Commercial Condition Measures

Independent Variables	Model 1		Model 2		Model 3		Model 4	
1990–94, '96 Mortality								
Intercept	–9.247***	(.220)	–9.276***	(.220)	–9.249***	(.220)	–9.278***	(.219)
Concentrated affluence	.001	(.070)	.057	(.070)	–.086	(.076)	–.041	(.076)
Residential stability	.264	(.138)	.307*	(.139)	.125	(.128)	.280*	(.134)
Population density (logged)	–.502**	(.163)	–.639***	(.155)	–.458**	(.164)	–.659***	(.144)
Proportion living alone	.037**	(.011)	.033**	(.011)	.031**	(.011)	.037**	(.012)
Proportion 65 and over	–.067***	(.016)	–.061***	(.015)	–.072***	(.017)	–.065***	(.015)
Network density	–.149*	(.059)	—	—	—	—	–.110	(.066)
Collective efficacy	—	—	–.263**	(.086)	—	—	–.197*	(.092)
Commercial density	—	—	—	—	.020	(.051)	.008	(.038)
Commercial decline	—	—	—	—	–.142	(.085)	–.127	(.081)
1995 Mortality								
Intercept	–8.122***	(.226)	–8.127***	(.226)	–8.150***	(.225)	–8.133***	(.230)
Concentrated affluence	–.175*	(.086)	–.192*	(.091)	.005	(.099)	.006	(.104)
Residential stability	–.101	(.168)	–.090	(.162)	.067	(.163)	.024	(.177)
Population density (logged)	–.222	(.198)	–.203	(.220)	–.333	(.205)	–.277	(.200)
Proportion living alone	.009	(.014)	.011	(.014)	.009	(.014)	.005	(.015)
Proportion 65 and over	–.041*	(.019)	–.043*	(.020)	–.035	(.020)	–.034	(.020)
Network density	.060	(.089)	—	—	—	—	.078	(.096)
Collective efficacy	—	—	.062	(.102)	—	—	.010	(.123)
Commercial density	—	—	—	—	.092	(.048)	.098	(.053)
Commercial decline	—	—	—	—	.239*	(.108)	.245*	(.114)

Note: Population-average models (with robust standard errors in parentheses). Level one covariates omitted. Neighborhood level N = 77; Year level N = 539; Count Level N = 11,179.
* $p < .10$ ** $p < .05$ *** $p < .01$ (two-tailed tests)

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advantage with respect to mortality rates during the heat wave by comparison to whites.

Model 2 adds measures of neighborhood structure to the equations for average (β_{1j}) and heat wave (β_{2j}) periods. Parameter estimates indicate, contrary to expectations, that concentrated affluence and residential stability are not significantly associated with average mortality rates. Log population density and the proportion of the population aged 65 and over are negatively associated with mortality while the proportion living alone is positively associated with this outcome. These findings suggest that Klinenberg's expectations regarding the effects of population density and social isolation hold under average conditions. The effect of the proportion elderly on average mortality suggests that the concentration of older adults has health benefits. We now ask whether these factors are comparably relevant for mortality during the heat wave.

We include the same set of structural predictors in the equation for β_{2j} (adjusted neighborhood mortality rates during the heat wave). In contrast to findings for average mortality, only the coefficients for affluence and the proportion elderly achieve significance during the heat wave. Affluence exhibits a negative association with mortality during the heat wave. More affluent communities were less vulnerable to the effects of the heat wave, even after controlling for age, race/ethnic, and sex composition as well as other neighborhood structural predictors. The estimate from Model 2 of Table 2 suggests that a standard deviation increase in neighborhood concentrated affluence decreased the heat wave mortality rate by 16 percent.[6]

Table 3 reports the results of models including additional neighborhood characteristics tapping key social processes and commercial conditions. Measures are added to the equations for both average and heat wave death. Model 1 adds a measure of social network interaction/reciprocated exchange. Although the

[6] Tests of coefficient equality indicate that the difference in magnitude of coefficients for heat wave and average periods is significant only for concentrated affluence.

coefficient for the effect on baseline mortality is significant and negative, indicating a protective effect under average conditions, the coefficient for the heat wave period does not achieve significance. The coefficient for concentrated affluence remains significant and unchanged from its magnitude in Model 2 of Table 2. Thus the protective effect of social network interaction/reciprocated exchange observed for average mortality does not appear to carry over to the heat wave. The coefficient for the effect of social network interaction/ reciprocated exchange on heat wave mortality is both insignificantly different from zero and significantly different from the comparable coefficient for average mortality.

Model 2 considers the effect of collective efficacy in the absence of measures of social network interaction/reciprocated exchange and commercial conditions. Reproducing the pattern observed for our network measure, the coefficient for collective efficacy is negative and significant in its association with average mortality. No effect of collective efficacy, however, emerges in the model for heat wave mortality, indicating that the protective effect that collective efficacy exerts under average conditions was not relevant for heat-related mortality. This pattern is similar to that observed for the social network effect. Again, the coefficient for the effect of collective efficacy is not significantly different from zero and significantly different from the comparable coefficient for average mortality. The negative effect of concentrated affluence on 1995 death in Model 2 increases modestly over Model 1.

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Model 3 of Table 3 adds measures of commercial density and decline, again considered in isolation from other mechanisms. Although no evidence emerges of a commercial density effect on either average or heat wave mortality, commercial decline exerts a significant positive effect on heat wave mortality. A one–standard deviation increase in commercial decline leads to a 27 percent increase in the mortality rate ($e^{.24}$). Commercial decline does not significantly impact baseline mortality, however, suggesting that its effect is specific to the heat wave (the coefficients for the two periods are significantly different in magnitude). Of central interest is the decrease in the effect of concentrated affluence with the introduction of commercial decline. The coefficient for affluence is no longer significant and is reduced, effectively, to zero, suggesting that the protective effect of affluence on heat wave mortality works through commercial conditions. In addition, the beneficial effect of the proportion elderly within the neighborhood is reduced in magnitude by nearly 20 percent and is no longer significant with the introduction of commercial decline. The presence of older residents may be important to heat wave mortality, in part, through the availability of viable and higher-quality commercial enterprises.

Model 4 adds measures of social network interaction/reciprocated exchange and collective efficacy to Model 3 in order to assess the robustness of the commercial decline effect in the context of this fully specified model. The effect of commercial decline in Model 4 remains comparable in magnitude and significance. The protective effect of collective efficacy remains for baseline mortality. The effect of social network interaction/reciprocated exchange, however, is rendered insignificant, suggesting that the protective effect of networks on baseline mortality is confounded with, or works through, collective efficacy. Nevertheless, as noted, the positive effect of commercial decline on heat wave mortality is robust to the inclusion of additional social process measures. The positive effect of commercial decline on heat wave mortality remains comparable in magnitude when included in all model specifications presented in Tables 2 and 3, offering further evidence of the robustness of the commercial decline effect.[7]

Commercial decline exerts a substantial impact on vulnerability to excess death during the heat wave. Figure 1 shows the proportionate increase in the adjusted heat wave mortality rate, by comparison with average mortality, when the commercial decline scale is set at values ranging from –2 to 2 standard deviations (with other neighborhood predictors remaining at their means). In neighborhoods with very high levels of commercial decline (+2 standard deviations), mortality rates during the heat wave were over six

[7] We also extracted neighborhood-level residuals adjusted for social composition (see Model 1 of Table 2) for average and heat wave mortality and regressed these residuals on all neighborhood level predictors. To assess possible collinearity among the predictors, we examined variance inflation factors (VIF). The VIF exceeded 3 only for the proportion living alone and residential stability (4.8). The average VIF was 2.7.

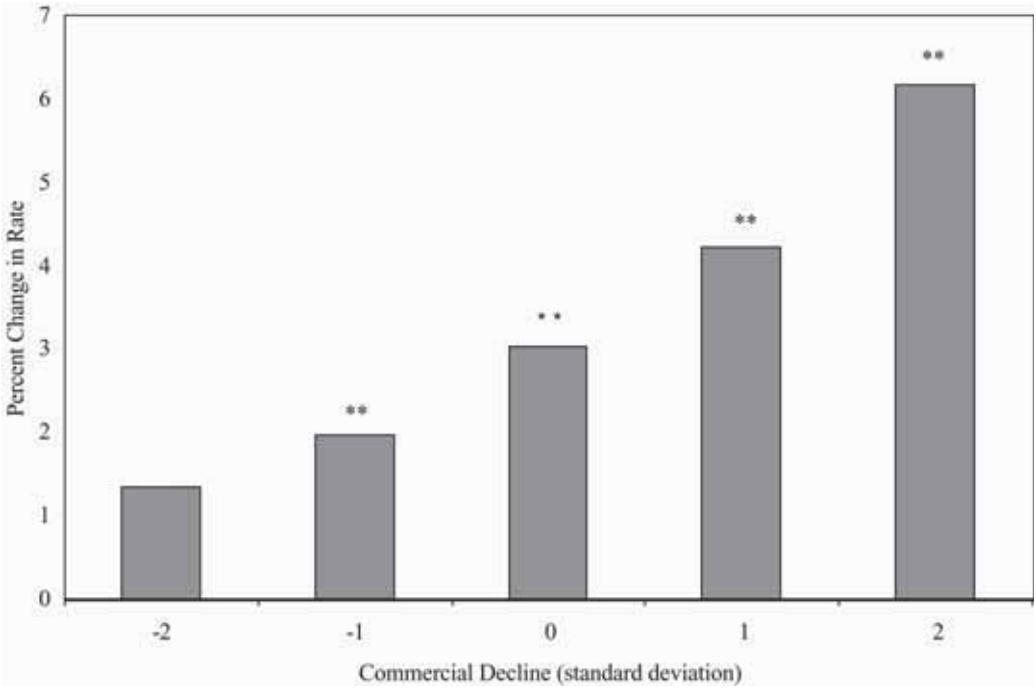

Figure 1. Adjusted Proportionate Change in Mortality Rate for July 14–20, 1995 by Level of Commercial Decline

Note: ** $p < .01$ (two-tailed tests).\

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times as high as those experienced under average conditions. In contrast, neighborhoods with very low levels of commercial decline (-2 standard deviations), experienced statistically insignificant increases in mortality during the heat wave. Thus, the presence of viable and healthy commercial enterprises largely buffered neighborhoods from heat-related mortality.

An important question concerns the extent to which access to medical care was differentially distributed across Chicago communities. We could not address this question directly, but did examine data on the distribution of physicians across neighborhoods to assess the protective effects of physician availability. Although relatively highly correlated with affluence (.40), the log of the physician availability rate by neighborhood does not exert a significant effect on heat-related mortality nor does it alter the impact of other variables on the outcome. [8]

We also examined a number of other structural predictors, including a measure of the percent African American in models of average and heat wave mortality (with other structural measures and the three mechanisms considered in the analysis also controlled). These analyses revealed no evidence of an association with mortality and did not alter the results of our final models. A measure of the percent Latino resulted in a similar pattern. Moreover, we included a measure of concentrated poverty simultaneously with concentrated affluence to test our assumption that affluence was a more robust predictor of mortality. Concentrated affluence remained significant and negative in its association with heat wave mortality; no evidence of a poverty effect emerged.

[8] It should be noted, however, that the physician data were collected from post-1995 licensure data. Medical care facilities, particularly hospitals (which are represented through clustering of physicians), are relatively stable. Physician practices, however, may be more fluid with respect to geographic location across time. Consequently, the results regarding physician availability should be considered with caution.

DISCUSSION

The 1995 heat wave was a catastrophic event the aftermath of which brought widespread concern about the causes of the massive death toll and its concentration within certain populations. Indeed, the heat wave exposed the differential vulnerability of both particular *individuals*—older, African American, and male residents—as well as *collectivities*—specifically, economically and socially disadvantaged neighborhoods. This study offers the first detailed quantitative investigation of the factors that contributed to variation in heat-related mortality across neighborhoods.

Based on Klinenberg's (2002) ethnographic account and recent theoretical developments in neighborhood research, we examined a number of hypotheses regarding the social sources of neighborhood-level vulnerability to heat wave mortality. Our findings support one aspect of Klinenberg's theoretical approach: specifically, his contention that declining commercial conditions contributed to differential heat wave vulnerability across neighborhoods. Although neighborhood social organization—represented by measures of social interaction/exchange and collective efficacy—was not a protective factor during the heat wave, we did find evidence of its beneficial effect under average conditions. Thus, the analysis points to the relevance of both sets of factors.

We focused our effort to understand the origins of differential heat-related mortality, across space, on three key questions: *First, did neighborhood structural characteristics contribute to excess heat-related mortality, above and beyond the race, age, and sex composition of neighborhoods?* Consistent with expectations, concentrated affluence exerted a significant effect on July, 1995 deaths. The effect of affluence on 1995 death, moreover, remained significant within the context of models including other potentially relevant structural factors. The proportion of older adults in the neighborhood also exerted a protective effect during the heat wave. In contrast, we did not find evidence that heat wave mortality was influenced by residential stability, population density, and the proportion living alone.

The effect of affluence on heat-related deaths is consistent with initial evidence regarding the economic correlates of heat wave mortality (Klinenberg 2002) and prompts the second question that we address. *What neighborhood level social processes and commercial characteristics were associated with heat wave mortality, and to what extent did these factors account for neighborhood-level structural effects on heat wave vulnerability?* When considered in separate models, network interaction/exchange and collective efficacy exhibited protective effects for mortality under *average* conditions, consistent with prior research demonstrating the beneficial effects of social capital on neighborhood all-cause mortality. The findings of Lochner et al. (2003), for instance, suggest that a combination of trust and network ties aids in the collective reduction of mortality within Chicago neighborhoods. We view network ties, however, as distinct from social trust and related expectations for prosocial action on behalf of the community. Collective efficacy is a more robust predictor of average mortality than networks, suggesting that networks may work, in part, through their effects on generalized norms promoting community well-being.

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Hypotheses regarding the protective effects of collective efficacy and neighborhood network ties *during the heat wave,* however, were not supported in our analyses. Models examining the impact of collective efficacy and network ties on heat wave mortality revealed no evidence of a protective effect. Neither process appears to have reduced vulnerability to heat-related deaths, despite their beneficial average effects. These factors may not have effectively diminished mortality during the heat wave due to the speed with which the unusually high temperatures took their toll. Collective efficacy may work through normative orientations that encourage attention to, and support of, local elderly. Communities, however, must have information about local crises and threats in order to translate norms of social support into effective action. A substantial proportion of the heat-related deaths occurred within two to three days of the temperature increase, potentially before community social resources could be mobilized. Thus neighborhood social organization may exert protective effects only after collective recognition of a crisis has occurred—an important area for future research.

In contrast, the level of commercial decline characterizing Chicago neighborhoods was positively associated with 1995 excess death and

explained virtually all of the affluence effect on heat-related mortality. The negative association between affluence and commercial decline is consistent with Wilson's (1996) model of neighborhood deterioration. As the presence of middle-class residents decreases within urban communities, the resource base capable of supporting viable commercial enterprises is depleted. Well-maintained businesses and the dynamic social ecology generated by lively and diverse commercial activity is replaced by decaying physical infrastructure. Disadvantaged communities may also experience the concentration of business activity around a more narrow range of products (liquor stores, bars, and currency exchanges, for instance). Elderly urban residents may perceive the clientele of these businesses as potentially threatening, inhibiting outdoor activity.

Moreover, commercial decline also accounted for a portion of the beneficial effect of the concentration of older residents within urban neighborhoods. This finding suggests that high proportions of older residents may draw and sustain elder-relevant services, including businesses. Concentrations of older adults may also be able to resist more effectively the decline of local institutions and the shift toward potentially fear-inducing commercial enterprises such as liquor stores and bars.

During the heat wave, visible cues of neighborhood deterioration and the potential victimization threat represented by a declining commercial infrastructure likely operated in the short-term to encourage reclusion in stiflingly hot, and ultimately lethal, residences. Although fear of victimization would plausibly be related to the neighborhood crime rate, neither measures of violent victimization within Chicago neighborhoods (based on PHDCN-CS data) nor the neighborhood homicide rate were significantly related to heat wave mortality.[9] In fact, the actual crime rate may be a less visible neighborhood-based phenomenon than the typically highly salient condition of local commercial enterprises.

Commercial decline may be particularly relevant for neighborhood residents who do not have access to other sources of information about neighborhood functioning. Older individuals who experience limited mobility are constrained in their ability to accumulate network-based information, some of which may take precedence over information provided by the condition of local businesses. As social sources of information constrict with age, visible cues regarding neighborhood functioning—available, in some cases, with a simple glance out the window—may acquire priority in the process of assessing victimization threat. Commercial decline, then, constituted an important dimension of neighborhood well-being in the context of the rapid-onset 1995 heat wave.

In contrast, we observed no effect of commercial decline on mortality during average conditions. As Klinenberg points out, the "bunker mentality" of many older residents may have helped them avoid victimization under normal circumstances. Many elderly may have organized their day-to-day lives to minimize the need to leave their apartments, reducing the impact of declining neighborhood conditions on their well-being—until a crisis emerged.

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The powerful association between commercial decline and heat-related mortality leads to our final question: *To what extent did healthy commercial conditions effectively protect urban communities from the mortality impact of the heat wave?* Figure 1 demonstrates that communities characterized by very low levels of commercial decline (-2 standard deviations) were largely shielded from heat-related mortality. In contrast, neighborhoods with very high levels of commercial decline (+2 standard deviations) experienced mortality rates over six times their magnitude under average conditions. Our findings suggest that commercial conditions were associated with considerable variation in vulnerability to the heat wave.

Other municipal service-related factors not measured in our analyses, including spatially organized access to health care due to the concentration of hospital emergency rooms on "bypass" (i.e., not accepting additional patients) during the heat wave, may also have contributed to differential neighborhood vulnerability. A subsequent heat wave in July 1999 resulted in significantly fewer heat-related deaths (~114) despite comparable conditions with respect to

[9] Operationalizations of social and physical disorder (Skogan 1990) based on the Systematic Social Observation data (reproducing measures described in Sampson and Raudenbush 1999) also did not yield positive effects on heat wave mortality.

nocturnal temperatures and humidity (Palecki, Changnon, and Kunkel 2001). The substantially different heat-related mortality rates during the two heat waves suggest that the City of Chicago more effectively responded to the latter crisis, while allowing the conditions of vulnerability characterizing some urban neighborhoods to take their toll during the 1995 disaster. Evidence as to whether municipal neglect contributed to *differential* heat-related mortality across neighborhoods during the earlier crisis awaits the collection and analysis of more detailed data on municipal service delivery during the heat wave.

We acknowledge that the neighborhood-level factors we consider may be confounded with unmeasured individual-level characteristics with which heat-related mortality was potentially associated. Although we control for the age, race, and sex composition of Chicago neighborhoods as well as neighborhood-level economic disadvantage and the proportion living alone, we could not assess the independent contribution of economic resources or living alone at the individual level. Future research would also benefit from the collection of data on neighborhood-level norms specifically regarding the support of local elderly, orientations we could only indirectly tap through our measure of health-related collective efficacy. Finally, the sample size for our analysis of neighborhood heat wave vulnerability was limited to 80 Chicago neighborhoods. Consequently, we place less confidence in insignificant coefficients as representing the true absence of effects on mortality. On the other hand, the decreased likelihood of rejecting null hypotheses accompanying smaller sample sizes enhances our confidence in the validity of the significant findings we observe, including those for neighborhood collective efficacy and commercial decline. Moreover, our use of relatively large-scale datasets to construct neighborhood-level measures helps reduce analytic imprecision due to measurement error.

The plural nature of sociological method allows for multiple forms of evidence to be brought to bear on research questions. In the current case, we developed hypotheses regarding differential neighborhood vulnerability to heat-related mortality during the summer of 1995 by drawing on both Klinenberg's social autopsy as well as the emerging literature on neighborhood social organization and health. Thus our intention is both to cross-validate and enrich existing knowledge of the 1995 disaster.

The strategy of assessing the determinants of both typical and disaster-specific mortality helps shed light on the broader impact of neighborhood-based disparities. Inequalities at the neighborhood level are manifest across an array of domains including economic, social organizational, and infrastructural. The consequences of these inequalities are complex and, potentially, outcome and context specific. By assessing the impact of neighborhood disparities on differing mortality-generating events, such as floods, hurricanes, influenza epidemics, or heat wave–related morbidity and mortality, we can better understand how the consequences of "latent" vulnerabilities are triggered by crisis conditions.

The substantive findings of the analysis bear on research into the dynamics of disaster. The resources and conditions of urban neighborhoods are likely to be important determinants of geographic variability in the lethal impact of heat-related crises. Further, the dynamics of the Chicago heat wave exhibit significant parallels with other types of disasters. For instance, the decision to stay shuttered in during the heat wave rather than to seek help—and the concentration of these decisions within disadvantaged neighborhoods—is a phenomenon likely to be common to other disasters, even those for which advanced warning is issued. The logic that compels some residents to stay inside their homes when facing a potential disaster may be built on local knowledge of community resources and threats. When one's own community is perceived to pose a known risk, the more uncertain danger presented by potential disaster may be discounted. The tools of sociological analysis can shed light on the local conditions that constrain opportunities in the face of disaster.

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Christopher R. Browning *is Associate Professor in the Department of Sociology at Ohio State University. His current research interests include the causes and consequences of community social organization; the neighborhood context of crime, risk behavior, and health; the long-term effects of maltreatment during childhood; and multilevel statistical models. He is a co-investigator on the Neighborhood Organization, Aging, and Health Project funded by the National Institute on Aging (NIA).*

Danielle Wallace *is a Ph.D. student in the Department of Sociology at the University of Chicago. Her current projects explore the mediating mechanisms behind the link between neighborhood social disorder and individual health using the methodology of visual assessment surveys. She is also interested in the persistence of disorder and its consequences for social stratification.*

Seth L. Feinberg *is Assistant Professor in the Department of Sociology at Western Washington University. His research interests include neighborhood social organization in response to mortality and disaster, the National Football League as a labor market, media socialization, and patterns of suburban crime.*

Kathleen A. Cagney *is Assistant Professor in the Department of Health Studies and Faculty Associate in the Department of Comparative Human Development at the University of Chicago. Her research interests include racial and socioeconomic status differences in health, life course approaches to research in health and aging, and neighborhood social context and health. She is Principal Investigator of the Neighborhood Organization, Aging, and Health Project (R01 AG022488), NIA-funded research aimed at exploring the neighborhood-level factors that affect the lives of older adults in the City of Chicago.*

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