CHAPTER 4

Community Resilience and Health Outcomes in Mississippi Counties

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Abstract

This chapter explores the relationship between community resilience and public health outcomes using the community resilient measure developed by Sherrieb and colleagues (2009) and maternal-child health indicators, with Mississippi pre-Hurricane Katrina as the case study. The Norris et al. (2008) model of resilience links adaptive capacities for community resilience with functioning and wellbeing, and assumes that resilient communities will adapt so that health and wellbeing will ultimately be promoted and maintained. Thus, in general, people living in more resilient communities would have better health and functioning than those living in less resilient communities. We test this assumption using the Mississippi pilot data in which we measured community resilience at the county level. Health outcomes are defined as the maternal-child measures of infant mortality rate, low birth rate, and premature birth rate. We found that community resilience was significantly and negatively correlated with the outcomes of infant mortality and low birth weight, though not with premature birth rates. Thus, community resilience is related to specific indicators of health and may have a protective effect for the health and wellbeing of women and children.

What are the qualities or characteristics that allow a community to survive, adapt, or even thrive following adversity? Communities con-

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front adversity in many different forms, including disasters, war, epidemics, and economic recessions, and they respond to these challenges in just as many ways. This process is not merely the additive result of individual responses in the wake of a problem but emerges from the capacities or strengths a community embodies prior to experiencing the threat. Given the unpredictability of some potential hazards it becomes important to understand the characteristics that make entire communities adaptable to unexpected events. This chapter will briefly discuss a model of community resilience, review the measurement of community resilience developed by Sherrieb, Norris and Galea (2009), and explore the relationship between community resilience and public health outcomes, with Mississippi pre-Hurricane Katrina as the case study.

Understanding community resilience

Norris, Stevens, Pfefferbaum, Wyche, and Pfefferbaum (2008) have outlined a theory in which they apply the concept of resilience to explain the responses of communities to events such as disasters. In this model, pre-event capacities influence the potential for resilience, which in turn influences the functioning, health and wellbeing of community members and the community as a whole as it responds to trauma. In this theory, four sets of networked resources or capacities - Economic Development, Social Capital, Information and Communication, and Community Competence - define and shape the process of community resilience, i.e., the community's ability to "bounce back" from severe stress. These adaptive capacities are not specific strategies for emergency preparedness but are a part of the social and economic fabric of the community. In theory, communities with the right mix and balance of these resources will support and sustain positive functioning, while communities with limited capacities run the risk of delayed recovery or prolonged dysfunction. Thus, three components are linked in the resilient process following a severe stress - pre-stress adaptive capacities, a trajectory of adaptation following the stress, and the outcome of positive functioning and wellbeing after responding to the event.

The broader meaning of resilience has shaped the specific appli-

cation of resilience to communities in Norris et al.'s model. The concept of resilience appears in a variety of disciplines, including physics and engineering (Bodin & Wiman 2004; Gordon 1978), biology and ecology (e.g. Holling 1973), sociology (e.g. Adger 2000; Godschalk 2003), and psychology (Bonanno 2004; Rutter 1993; Werner & Smith 1982). Across domains of concern, most definitions of resilience emphasize a capacity for successful adaptation in the face of a disturbance, stress, or adversity. Attempting to integrate various definitions across levels of analysis, Norris and colleagues (2008: 130) defined resilience as "a process linking a set of adaptive capacities to a positive trajectory of functioning and adaptation after a disturbance". This definition of resilience encompasses two primary conceptions that are important (Norris, Sherrieb & Pfefferbaum 2009).

First, in this definition, resilience *emerges from* adaptive capacities, but it is not synonymous with those capacities. Resilience is not a trait that a community invariably has or does not have. Post-event trajectories or responses are contingent upon both the capacities and the stressor. Resilience occurs when resources are sufficiently strong to buffer or counteract the effects of a stressor such that a return to functioning, adapted to the altered environment, occurs. For example, cities with strong adaptive capacities should, when a disaster hits, experience less structural destruction, fewer deaths and injuries, and fewer breakdowns in communications and recovery efforts (Godschalk 2003). In the case of Hurricane Katrina, fewer deaths would have occurred if low-income citizens were not stranded because they lacked money and/or methods for evacuating the city (Cutter et al. 2006).

There is perhaps no community that would *always* exhibit resilience or a community that would *never* exhibit resilience. The current emphasis on resilience is essentially a reframing or evolution of stress theory, now decades old, in which stress outcomes are viewed as the product of stressors interacting with risk and protective factors (Dohrenwend 1978). Importantly, however, the contemporary frame of resilience directs attention to the potential of communities to adjust and stay well in the face of threats, losses, and challenges. Be-

cause adaptive capacities are more than just resources that relate to specific emergency preparedness, and refer more to the social and economic fabric of a community, the potential for resilience could theoretically be fostered in a community so that it can respond effectively to any stressor, be it natural or human-made, intentional or unintentional.

Second, resilience *is manifest in* outcomes of interest, but it is not synonymous with those outcomes. The definition of resilience as a process implies that it is not observed or measured directly, but it is evident in the patterns of change observed after significant stress. Norris, Tracy, and Galea (2009) outlined six possible trajectories for post-traumatic stress symptoms in individuals, of which resilience was just one, the others being resistance, recovery, relapsing/remitting, delayed dysfunction, and chronic dysfunction. In analyses of two four-wave data sets collected from population-based samples after the 1999 floods/mudslides in Mexico and the 2001 terrorist attacks in New York, all of the hypothesized trajectories except one (relapsing/remitting) occurred with measurable frequency in one or both of the samples.

While the analyses conducted by Norris et al. (2009) focused on one particular outcome (posttraumatic stress), "wellness" provides a more complete criterion for assessing human adaptation (Cowen, 1983; 1994; 2000; Norris et al. 2008). Wellness goes beyond the mere absence of psychopathology to include healthy patterns of behaviour, adequate role functioning, and quality of life. Community-level adaptation can be understood as "population wellness," defined as high and non-disparate levels of mental and behavioural health, role functioning, and quality of life in constituent populations. However, it is important not to confuse resilience, the process, with wellness, the outcome. A resilient trajectory could be observed for one outcome (e.g. mental health, well-being) but not for another (e.g., quality of life). The outcomes of interest vary across levels of analysis, as do the specific resources that influence the patterns of change, but the basic nomenclature of adaptive capacities, observed trajectories, and adequate functioning applies to all.

Testing a model of community resilience

a. Defining the unit of analysis

There are multiple steps required to fully test a model of community resilience that emphasizes pre-event capacities, post-event trajectories, and population health outcomes. The first step is to decide on a unit of analysis. In our work in the United States, we have used the county as the unit of measurement to describe "community." Much debate has been dedicated to understanding what appropriately constitutes a community. Existing research has used various definitions of communities, including communities as identified by their residents, block groups, census tracts, and clusters of census tracts (Curtis & Rees Jones 1998). However, conceptually, there is likely no single contextual unit that is important to the exclusion of all other units. For example, studies of social capital and health have been conducted at both the small community scale in Chicago and the statewide scale across the United States (see Kawachi et al. 1997; Sampson et al. 1997).

Therefore, we recognized that "communities" are social constructs that need to be defined on a case-by-case basis and proposed to focus on county as the key community unit of analysis. There were several advantages to this choice. One advantage is that counties are generally important for U.S. disasters because disaster declarations are made at the county level. Also, there is precedence for measuring characteristics of counties in disaster research. An excellent example is the Social Vulnerability Index (SOVI; Cutter, Boruff, & Shirley 2003). Cutter and colleagues conducted factor analyses with data from all U.S. counties to create the SOVI. It contains 11 factors representing income, age, race/ethnicity, occupation, commercial establishment density, single-sector industry, and housing and infrastructure dependence to depict community vulnerability to environmental hazard. Although social vulnerability should be related (inversely) to community resilience, it is conceptually distinct, suggesting that new measures are needed.

Moreover, for our specific work, it is important that counties, in most states, are an important unit of government. In Mississippi, which contains 82 counties, each county has an elected board of su-

pervisors and departments offering county-specific services. The counties are the seats of municipal administrative responsibility across Mississippi and decision-making powers that influence material resource distribution, thus affecting social and economic capacities. Counties also vary in population and resources; the county population in Mississippi in the 2000 census ranged from 2,274 to 250,800. Several studies have used the county as the unit of analysis, demonstrating their usefulness as community units (Felix & Stewart, 2005; Ruphasingha et al. 2006). Nonetheless, the methods we use are independent of the unit of analysis and could just as easily be used with other community units, given the availability of data.

b. Operationalizing community resilience

The second step in testing a model of community resilience is to measure the range of capacities that represent the potential for community-level resilience in a range of settings. In order to empirically explore and test this model of resilience, the pre-adaptive capacities of economic development, social capital, information and communication, and community competence had to be defined and measured. This step was completed by Sherrieb, Norris, and Galea (2009). They explored the use of publicly available data for assessing capacities for community resilience to create a metric that can be applied across communities. They used the state of Mississippi as their pilot case, with county as the unit of analysis. In reviewing the literature related to the measurement of the capacities included in the Norris et al. (2008) model, Sherrieb et al. (2009) observed that Economic Development and Social Capital had structural characteristics that were possible to measure with secondary data, but the same was not true for Information and Communication and Community Competence. Sherrieb et al. (2009) described previous measures of economic development and social capital in some detail, noting both their strengths and limitations with regard to utility for inclusion in a measure of community resilience. Through a multi-step process beginning with a "wish list" of measures and continuing through searching for and selecting indicators and validating indices, Sherrieb et al. (2009) selected ten indicators to form an index of Eco-

nomic Development. The *level of resources* in a community was measured with indicators representing employment rate, household income, rate of community medical doctors, corporate tax revenues, and the rate of occupations classified as "creative." The *equity of resources* was measured with the indicators for income equity and racial differences in educational attainment. The *diversity of resources* was measured with indicators for the net gain/loss rate in businesses, occupational diversity, and urban influence on the community. Likewise, they selected seven indicators to form an index of Social Capital. *Social support* was measured with the ratio of two parent households to one parent households. *Social participation* in the community was measured with the indicators for density of sports/arts organizations and of civic organizations, voter participation in presidential elections, and religious membership. The *level of community bonds* was measured with the indicators for community in/out migration and the inverse of the property crime rate. Thus, indicators that yielded the community resilience measurement were observable and measurable. These indicators were then linked to create a parsimonious yet relevant index we named the community Resilience Index, which measures adaptive capacities thought to be important in the resilient process.

In their initial research, Sherrieb and colleagues (2009) were able to validate their community resilience measure against the SOVI measure of social vulnerability, as well as against aggregated survey data from 21 Mississippi counties. They found a significant and inverse correlation between their resilience measure and the SOVI. In addition, they found a strong correlation between their composite measure for social capital and Mississippi survey data measuring community collective efficacy, two concepts believed to overlap in definition. Finally, the distribution of scores was also consistent with what is known about different regions of Mississippi. For example, the rural region bordering the Mississippi River known as the Delta was in the highest 20% for social vulnerability across the state as well as in the entire United States using the SOVI. Alternatively, and providing support for the Sherrieb and colleagues' (2009) community resilience measure, this region was in the bottom 20% for community resilience.

c. Defining population health outcomes

The third step in testing a model of community resilience, and one of the goals of this chapter, is to define measures of community health. In general, people living in more resilient communities should have better health and functioning than those living in less resilient communities. In the current study, we tested this assumption using the Mississippi pilot data. Using the Mississippi county-level communities from the Sherrieb et al. (2009) work, we assigned the maternal-child health population outcomes of infant mortality rates, low birth weight rates, and premature birth rates to represent health outcomes specific to women and infants to test the relationship of community resilience and health outcomes. We chose these specific indicators because historically women and children are at significant risk for poor health and mental health outcomes following disasters (Norris, Friedman, Watson, et al, 2002). Maternal and infant health indicators are identified as short-term health indicators because they can be influenced by short-term changes that occur over the nine-month period of a pregnancy and thus act as an early warning system to presage long-term health problems experienced by the larger community over a longer course of time (Galea & Ahern 2005).

For decades, the infant mortality rate (IMR), defined as the number of deaths in children under 1 year of age per 1,000 live births in a given year, has been used as a proxy for population health (Newman, 1906; Woodbury, 1925; Yankauer, 1990; Wise, 1993; Reidpath & Allotey, 2003; Black, Morris, Bryce, 2003; Zeitlin, Wildman, Bréart, Alexander, Barros, et al. 2003). As early as 1906, Newman indicated that "a nation grows out of its children; and if its children die in thousands in infancy it means that the sources of a nation's population are being sapped, and further that the conditions which kill such a large proportion of infants injure many of those which survive" (p. 2). Indeed, this measure has been a key indicator for comparison of population health by the World Health Organization, the Office of Economic Development, and EUROSTAT (Statistical Office of the European Communities), three organizations who regularly compile cross-country comparison data (Zeitlin et al. 2003)

as well as by the United States Centers for Disease Control and Prevention (Matthews, & MacDorman 2008). In Europe, these maternal-child measures were being followed as early as the mid-nineteenth century; following the wars in the first half of the twentieth century, public health interventions focused on women and children, and IMR became the indicator of choice for measuring population health (Zeitlin et al. 2003). The IMR, along with low birth weight and prematurity rates are attainable for most industrialized countries from birth and death records, and efforts have been made to standardize documentation of these indicators to facilitate cross-country comparisons.

Social variations in maternal-child health indicators are well documented. In 1906, Newman noted that infant mortality in the UK was higher among births to unmarried women compared to births to married women, reflecting the social and economic disadvantages experienced by unmarried women during that time. Woodbury, in 1925, found differences in IMR in eight U.S cities related to maternal employment and paternal income. Other social and economic factors associated with the maternal-child health indicators of interest in this study include social class (Antonovsky & Bernstein 1977), poverty (Gortmaker 1979), educational attainment (Singh & Yu 1995), access to prenatal care (Cramer 1987; Centers for Disease Control and Prevention 1999), and race/ethnicity in the U.S. (James 1993; Singh & Yu 1995; Centers for Disease Control and Prevention 2002a; Centers for Disease Control and Prevention 2002b; Hessol & Fuentes-Afflick 2005) as well as internationally (Smith et al. 2000; Barros et al. 2001; Schulpen et al. 2001; Burgard & Treiman 2006; Friborg et al. 2004; Pearson 1991), although this latter factor may be considered a proxy for socioeconomic status or racial discrimination (Smith 2000; Braveman et al. 2001; Kreiger 2001). Thus, there is a differential risk for infant morbidity and mortality that is related to the social and economic status of women.

More importantly, there are ecological-level determinants for infant mortality that are related to the social and economic environments in which women and children live. According to Macintyre and Ellaway (2000), ecologic factors refer to the socioeconomic context of a community rather than the socioeconomic status of the in-

dividuals that live in that community and these may in turn, significantly influence health. In our study, community resilience is an ecological-level variable that measures the capacity for resilience at the community level and not necessarily the resilience of individuals who live in that community. Neighbourhood or community effects have been identified as important factors in infant mortality (Ellen et al. 2001). Income inequality, or the unequal distribution of income in a defined area, has been found to be positively associated with infant mortality (Rodgers 1979; Flegg 1982; Sohler et al. 2003; Macinko et al. 2004). Neighbourhoods with a high concentration of poverty are associated with higher rates of low birth weight births as compared to neighbourhoods with less concentrated poverty (Collins & David 1990; O'Campo et al. 1997; Rodwin & Neuberg 2005; Cerdá et al. 2008). The neighbourhood effect of racial segregation for African Americans is negatively associated with IMR (Yankauer 1950; Brooks 1980; Guest et al. 1998). Finally, Kawachi, Kennedy, Lochner, and Prothrow-Stith (1997) found that income inequality was related to IMR as a result of a decrease in neighbourhood social capital. There are, however, no studies to date that have tested the relationship between community resilience and maternal-child health indicators.

d. Testing the relationship between community resilience measures and health outcomes

The next step, and the other goal of this chapter, is to test the relationship between concurrent measures of community resilience and health outcomes. We used the Community Resilience Index, briefly described above and in more detail in Sherrieb et al., 2009, as the independent variable. The community resilience score was standardized with a mean of 0 and a standard deviation of 1. We defined three separate dependent variables for this study: infant mortality, low birth weight rate, and preterm birth rate. Infant mortality rate is defined as the number of deaths in the first year of life per 1,000 live births. Low birth weight rate is defined as the percentage of children weighing less than 2,500 grams at birth. Preterm birth rate is defined as the percentage of births occurring at less than 37 weeks gestation.

We calculated the mean yearly rate using the years 2002, 2003, and 2004 for low birth weight rate and preterm birth rate, and the years 2000 through 2004 for the infant mortality rate (Mississippi Statistical Abstract, 2002, 2003, 2004). We chose to include these years because they closely matched the time period for the measurement of community resilience which included indicators measured at the 2000 census or as the mean of 2002-2004 yearly data.

Bivariate correlations were calculated between (a) each maternal-child health outcome measure and (b) the Community Resilience Index and its component scores for Social Capital and Economic Development. These results are shown in Table 1. Community resilience was significantly and negatively associated with low birth weight rates, as well as with infant mortality rates in Mississippi counties. Figure 1 illustrates this for the total community resilience index and infant mortality. As expected, the composite measures were negatively and significantly correlated respectively with low birth weight rates and with infant mortality. However, economic development had a stronger correlation than social capital with low birth weight rates whereas the opposite was true for infant mortality rates. Although the associations were negative between the community resilience measures and preterm birth rates, they were not statistically significant for a sample of 82 counties.

Overall, however, we were able to confirm an inverse relationship between concurrent measures of community resilience and maternal-child health (rates of infant mortality and low birth weight births), using Mississippi as our case. Thus, in Mississippi counties, as community resilience increases, the rates of infant mortality and low birth weight births decrease. While the present study advances the case for the influence of community-level resources on population health, we did not include additional variables in our analyses that might influence the relationship between community resilience and maternal health outcomes, such as average population age. In addition, these correlational data cannot establish a causal relationship between community resilience and maternal-child health outcomes.

e. Predicting resilience in the aftermath of disasters

The final and future step required to fully test the model of community resilience is to study whether pre-event measures of community resilience influence the patterns or trajectories of health outcomes after disasters and other major community-level events. This step will answer the question of causality in the relationship between community resilience and health outcomes. Furthermore, establishing that community resilience is a determinant of health outcomes following community trauma can pave the way for the development of strategies that can be used to strengthen and improve community capacities and ultimately impact the resilient process in communities.

We have defined community resilience from a broad perspective. Our model of community resilience takes us beyond making plans for dealing with a specific and defined trauma or adversity to building strengths in a community that will facilitate the process of resilience when needed, regardless of the threat. Translation of our findings into policy recommendations, of course, involves a discussion of changes in the socioeconomic structure of communities. These challenges are not easily met. But they may be more manageable if they are disaggregated in terms of the components or even subcomponents of resilience identified in this paper, which opens up a whole new area for community research.

Note

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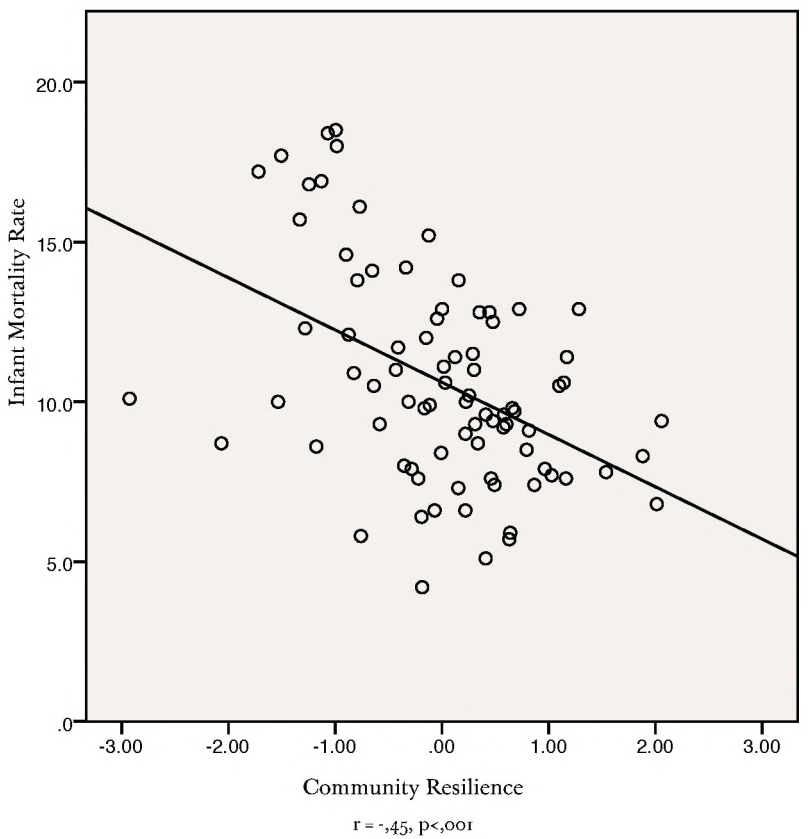
TABLE 1. Correlations of measures for the Community Resilience Composite and its components, Economic Development and Social Capital with the outcomes of Infant Mortality Rate and Percent Low Birth Weight using Mississippi county data (2000- 2004) (n=82).

	Community Resilience Composite	Economic Development	Social Capital
Infant Mortality Rate	-,45**	-,31**	-,46**
Percent low Birth Weight	-,55**	-,51**	-,39**

* p< ,05 ** p<,001

FIGURE 1. Scatter plot and fit line depicting the associational trend for community resilience and infant mortality rates in Mississippi counties (n=82)



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