Published in final edited form as:
J Health Soc Behav. 2005 September ; 46(3): 289–305.

Environmental Stressors: The Mental Health Impacts of Living Near Industrial Activity*

LIAM DOWNEY and
University of Colorado

MARIEKE VAN WILLIGEN
East Carolina University

Abstract

A growing literature examines whether the poor, the working class, and people of color are disproportionately likely to live in environmentally hazardous neighborhoods. This literature assumes that environmental characteristics such as industrial pollution and hazardous waste are detrimental to human health, an assumption that has not been well tested. Drawing upon the sociology of mental health and environmental inequality studies, we ask whether industrial activity has an impact on psychological well-being. We link individual-level survey data with data from the U.S. Census and the Toxic Release Inventory and find that residential proximity to industrial activity has a negative impact on mental health. This impact is both direct and mediated by individuals' perceptions of neighborhood disorder and personal powerlessness, and the impact is greater for minorities and the poor than it is for whites and wealthier individuals. These results suggest that public health officials need to take seriously the mental health impacts of living near industrial facilities.

A growing body of literature seeks to determine whether the poor, the working class, and people of color are disproportionately likely to live in environmentally hazardous neighborhoods (United Church of Christ 1987; Mohai and Bryant 1992; Hofrichter 1993; Anderton et al. 1994; Clarke and Gerlak 1998; Hockman and Morris 1998; Stretesky and Hogan 1998). An important underlying assumption of this literature is that the presence of negative environmental characteristics (such as industrial pollution, hazardous waste, and noise) and the absence of positive environmental characteristics (such as parks, trees, and open spaces) are detrimental to human health. However, while many researchers have addressed the issue of differential proximity and exposure to environmental hazards, the underlying assumption that environmental hazards negatively impact human health has been less well documented.

We seek to remedy this shortcoming by asking whether industrial activity, measured at the neighborhood level, has a negative impact on individual psychological well-being. Drawing upon the sociology of mental health and environmental inequality studies we hypothesize that residential proximity to industrial activity has a negative impact on mental health and that this impact is both direct and mediated by individual perceptions of neighborhood

*We are full coauthors. Data collection for the Community, Crime, and Health Survey was supported by a National Institute of Mental Health grant RO1 MH51558 to Catherine E. Ross and Chester Britt. We thank Ross and Britt for allowing us to use these data for this project. We also thank the American Sociological Association/National Science Foundation Fund for the Advancement of the Discipline, the East Carolina University Thomas Harriot College of Arts and Sciences, and the East Carolina University Faculty Senate for grants to Van Willigen and Downey that helped support this project.

Address correspondence to Marieke Van Willigen, Department of Sociology, 406A Brewster, East Carolina University, Greenville, NC 27858 (vanwilligenm@mail.ecu.edu).

disorder and feelings of personal powerlessness. Finally, we hypothesize that the negative impact of industrial activity upon mental health is more pronounced for minorities and the poor than it is for whites and wealthier individuals.

In setting forth these hypotheses, we are not arguing that residential proximity to industrial activity is psychologically harmful because residents of industrial neighborhoods are disproportionately exposed to environmental pollutants, although this may in fact be the case. Instead, we are arguing that residential proximity to industrial activity is psychologically harmful because many individuals perceive industrial activity negatively, as a potential health threat or a sign of neighborhood disorder. We believe that many individuals find residential proximity to industrial activity to be stressful and, therefore, that people who live near industrial activity experience worse mental health than those who do not live near industrial activity. In other words, while not discounting the possibility that residential proximity to industrial activity has physiological effects that adversely impact mental health, we wish to explore the possibility that residential proximity to industrial activity negatively impacts mental health by increasing individuals' levels of stress.

LITERATURE REVIEW

Stress and Mental Health

Sociologists interested in explaining individual- and group-level variation in mental health outcomes have broken the "stress process" down into three components: sources, mediators, and manifestations of stress (Pearlin et al. 1981). Individual- and group-level variation in mental health outcomes can be explained by differences in exposure to stressors and in access to resources that help individuals cope with stress.

Sources of stress include life events, such as divorce or a death in the family, and ongoing conditions associated with particular social roles and contexts, commonly referred to as chronic strains or stressors. Chronic stressors, which include living under conditions of economic hardship and being widowed, are "relatively enduring problems, conflicts, and threats that many people face in their daily lives" (Pearlin 1989:245). Turner, Wheaton, and Lloyd (1995) find that chronic stressors contribute more to social group differences in mental health than do discrete life events, and Avison and Turner (1988) conclude that chronic strains have a greater long-term impact on psychological well-being than do life events.

Most researchers examining the impact of chronic stressors on mental health have focused on individual-level chronic strains such as the characteristics of the social roles individuals inhabit, socioeconomic status, and household responsibilities. Only recently have researchers focused on the link between the broader social context and psychological well-being. For instance, in later versions of his stress process model, Pearlin (Pearlin and Skaff 1996; Pearlin 1999) argues that the social environment contains a set of potential chronic stressors he calls "ambient strains" that can negatively affect mental health outcomes. New research on the impact of social context on mental health supports Pearlin's model (Tausig and Fenwick 1999; Ross 2000; Aneshensel and Sucoff 1996). For example, Reynolds (1997) demonstrates that industrial employment conditions have a significant impact on the psychological well-being of industrial employees, and Caspi and colleagues (2000) find that children's mental health is worse in neighborhoods dominated by government subsidized housing, low incomes, high unemployment, and single parent households than it is in other neighborhoods.

In the following sections we present our argument for why local industrial activity should also be considered a neighborhood-level chronic stressor that, like employment conditions and neighborhood poverty, negatively impacts mental health.

Environmental Inequality, Industrial Activity, and Stress

The field of environmental inequality studies arose in the late 1980s and early 1990s in response to claims made by environmental justice activists that poor, working class, and people of color communities are disproportionately exposed to environmental pollutants, are angry about their disproportionate exposure, and want the burden of exposure to be distributed more equitably throughout society (Mohai and Bryant 1992; Szasz and Meuser 1997). In making these claims, environmental justice activists were not simply arguing that environmental inequality is an important social problem. They were also challenging assumptions made by mainstream environmental organizations, business leaders, and government officials that poor, working-class, and minority communities do not care about environmental issues and that these communities care more about the availability of industrial jobs than the pollution and health risks associated with industrial activity (Bullard 1992a; Taylor 1992; Mohai and Bryant 1998).

This critique has important implications for social scientists. In particular, it forces us to reevaluate our own assumptions about the value that poor and working-class communities place on local industrial activity and to ask whether local industrial activity represents a positive social good, a negative social good, or some combination of the two. On the one hand, if as spatial mismatch theorists and others have assumed (Wilson 1987; Bullard 1992a; Ihlanfeldt and Sjoquist 1998; Mohai and Bryant 1998), local industrial activity is good for and viewed positively by poor and working-class individuals—as a source of jobs and tax revenue—then it is unlikely that residential proximity to industrial activity has a negative effect on individual mental health. On the other hand, if poor and working-class individuals, like their middle- and upper-class counterparts, view local industrial activity negatively—as a potential health threat or sign of neighborhood disorder—then proximity to industrial facilities is likely to be stressful regardless of class, and as a result it is likely to have a negative impact on mental health.

Industrial activity as health threat—Evidence that many people find industrial activity to be noxious and personally threatening comes from two sources: environmental justice movement activism and social science survey data. When the 1993 General Social Survey (Davis, Smith, and Marsden 1999) asked a sub-sample of respondents a battery of questions about the environment and environmental pollution, 51 percent of these respondents stated that industrial air pollution is “very to extremely” dangerous to their families, 54 percent viewed water pollution as being dangerous to their families, and 90 percent believed that the government should regulate industry in order to protect the environment.

Similarly, using data from the University of Michigan’s 1990 Detroit Area Study, Mohai and Bryant (1998) found that respondents’ concerns about their local environment increased with greater residential proximity to polluting industrial facilities, commercial hazardous waste facilities, and uncontrolled hazardous waste sites. This suggests not only that Detroit metropolitan area residents are aware of the presence of industrial facilities in their neighborhoods, but also that they would like to avoid living in the heavily polluted, industrial neighborhoods that make up much of their metropolitan area.

Finally, the increase in recent decades in the number of community-based environmental organizations dedicated to removing or banning industrial hazards from their neighborhoods indicates that concern over the negative impact of industrial activity is widespread (Taylor 1992; Austin and Schill 1994). Between 1992 and 2000, the number of environmental

justice organizations listed in the People of Color Environmental Groups Directory increased from 200 to over 400 (Bullard 1992b; Environmental Justice Resource Center 2000). Furthermore, according to a representative from the Center for Health, Environment, and Justice, an environmental justice organization that offers advice to community-based environmental justice groups, each year the organization receives calls from individuals and groups in 560 cities and towns throughout the United States.

Given the apparently widespread belief that industrial activity is noxious and threatening, and that residential proximity to such activity is highly undesirable, it is reasonable to expect that many people find residential proximity to industrial activity to be chronically stressful and, therefore, psychologically distressing.

Residential proximity to industrial activity is also likely to increase individual feelings of personal powerlessness, further increasing distress. Powerlessness is a learned expectation that life outcomes are the result of forces external to oneself (Seeman 1959, 1983; Mirowsky and Ross 1986, 1989). Powerlessness develops as individuals learn to expect that their actions will not lead to desired outcomes as a result of repeated exposure to situations over which they have little control (Geis and Ross 1998).

There is reason to expect that living near industrial facilities may expose individuals to such situations. Industrial and governmental decision makers are often anonymous or distant figures who have few if any ties to local communities. Moreover, decisions about safe pollution levels, pollution mitigation, and economic development are often made with little or no consultation with local communities, and sometimes such decisions are made in the face of significant community resistance (Bullard 1994; Hofrichter 1993). Furthermore, individuals who live in industrial neighborhoods may lack the resources to enable them to escape such neighborhoods. Continued exposure to negative neighborhood conditions has also been linked theoretically and empirically to feelings of fear and powerlessness in prior research (Seligman 1975; Taylor and Shumaker 1990; Ross, Reynolds, and Geis 2000), and feelings of personal powerlessness are an important predictor of psychological distress (Seeman 1959, 1983; Mirowsky and Ross 1989, 1990). Thus, it is likely that the impact of residential proximity to industrial activity on psychological distress is at least partially mediated by feelings of powerlessness.

Industrial activity, perceptions of disorder, and distress—Ross and colleagues (2000) argue that neighborhood disorder—which can be defined as the repeated violation of neighborhood norms within neighborhood boundaries (Meier 1982; Sampson and Groves 1989)—increases psychological distress by continually reminding neighborhood residents that they live in unsafe, unhealthy environments:

> Neighborhood order and disorder are indicated by visible cues perceived by residents. Neighborhoods characterized by order are clean and safe … neighborhoods characterized by disorder present residents with observable signs that social control has broken down. In these neighborhoods, residents encounter litter, vandalism, graffiti, noise, drug use, trouble with neighbors, and other incivilities associated with a breakdown of social control. (Ross et al. 2000:584)

Thus, perceptions of neighborhood disorder are based on visible signs that may be both social and physical in nature (Skogan 1990; Skogan and Maxfield 1981; Taylor and Hale 1986).

We extend Ross and colleagues' argument (2000) by hypothesizing that industrial activity may also be perceived as a visible sign of social disorder that, like noise, vandalism, and drug use, increases psychological distress by constantly reminding residents that they live in

an unsafe, unhealthy, and socially undesirable neighborhood. This is particularly likely to be the case when residents perceive industrial activity to be threatening to their health and that of their loved ones. In addition, residents may perceive industrial activity to be a sign of social disorder because industrial facilities bring more traffic and noise into a neighborhood than is socially desirable or because individuals who work in and deliver goods to industrial facilities may not be influenced by neighborhood social norms and may use neighborhood resources while contributing little to the community. Residents may also believe that industrial facilities degrade the natural beauty of their neighborhoods and prevent the establishment of neighborhood green spaces. Thus, even if residents do not perceive industrial activity to be a direct health threat, they may still perceive industrial neighborhoods to be more disorderly than nonindustrial neighborhoods.

We argue, therefore, that industrial activity should lead to psychological distress at least in part because of its impact on perceptions of social disorder. Moreover, the inability to escape disorderly neighborhoods, exert control over dangerous or undesirable conditions, and influence decisions affecting neighborhood order are likely to engender feelings of personal powerlessness (Ross et al. 2000). As a result, people living near industrial activity should report relatively high levels of neighborhood disorder and personal powerlessness, which ultimately should lead to psychological distress.

The Social Distribution of Distress: Differential Proximity versus Differential Impact

As noted above, the social distribution of distress is determined not only by unequal exposure to stressful life conditions, but also by two important mediating factors: (1) unequal access to physical and psychological resources that relieve stress and (2) the specific positive or negative values individuals and groups assign to potential stressors (McLanahan and Booth 1989; Pearlin 1989; Reynolds 1997).

Because resources and values likely vary from one social group to another, the impact of industrial activity on psychological well-being also likely varies across social groups. For example, proximity to industrial activity may have a less pronounced psychological impact on low-income and minority individuals than on wealthier individuals and whites because low-income and minority individuals may be more likely to perceive industrial activity as a normal feature of their residential environment or as a source of potential employment. Conversely, because poor people and minorities tend to have higher levels of distress and fewer stress-mediating resources than do whites and wealthier individuals (Mirowsky and Ross 1986, 1990), they may experience greater psychological harm from living near industrial activity than do wealthier individuals and whites. Thus, it is important to differentiate between proximity inequality (inequality in the distribution of social groups around industrial facilities) and impact inequality (inequality in the social distribution of psychological distress arising from residential proximity to industrial activity). The former suggests that we will find a statistical correlation between subordinate group status and the presence of industrial activity, while the latter suggests we will find an interaction effect of industrial activity and subordinate group status on distress. These expectations are not mutually exclusive.

SUMMARY

The analyses presented test the following hypotheses (see Figure 1): (1) residential proximity to industrial activity has a direct, positive association with perceptions of neighborhood disorder, feelings of personal powerlessness, and psychological distress; (2) perceptions of disorder mediate the relationship between residential proximity and feelings of personal powerlessness; (3) perceptions of disorder and powerlessness mediate the relationship between residential proximity and distress; and (4) the relationships between

residential proximity and distress, disorder, and powerlessness vary according to respondent income and minority status. We also test the environmental inequality hypothesis that lower-income people, blacks, and Hispanics are more likely than higher-income people, whites, and non-Hispanics to live near environmental hazards.

DATA AND METHODS

Data

We link individual-level data from the 1995 Community, Crime, and Health Survey (CCH: Ross and Britt, principal investigators) with 1990 U.S. Census data and 1995 Toxic Release Inventory (TRI) data, using Census tracts as our unit of analysis. We use the CCH data to measure distress, feelings of personal powerlessness, and perceptions of neighborhood disorder; the TRI data to create indicators of visible industrial activity; and the Census data to control for neighborhood context.

The Community, Crime, and Health Survey—The CCH is a telephone survey of a probability sample of Illinois households. Respondents were selected using a prescreened random-digit dialing method and were limited to English-speaking adults (18 or older). Interviews were completed with 2,482 respondents, about 73 percent of the eligible persons who were contacted (Ross et al. 2000).

The Toxic Release Inventory—The TRI is an Environmental Protection Agency database that records the number of pounds of specified toxic chemicals released into the environment each year by manufacturing facilities that employ 10 or more full-time workers and manufacture, process, or use these specified chemicals in specified quantities.[1] The TRI also records the number of pounds of toxic waste that TRI facilities generate each year. This number is calculated by summing the pounds of waste that each facility recycles, treats, burns, transfers to other sites, and releases into the environment each year.

We use the TRI to create our indicators of "visible industrial activity" for several reasons. First, the TRI is the most comprehensive, address-specific record of U.S. manufacturing activity that is currently available to the public. Second, the TRI is used by many environmental inequality researchers. Thus, the results of our analyses are directly comparable to those of many other environmental inequality studies. Third, we can use the pounds of waste generated by each facility as a proxy for facility size and visibility.[2] Fourth, by eliminating the smallest, least visible manufacturing facilities from the database, the TRI allows us to create more valid indicators of visible industrial activity than we could create if we included in our calculations all the manufacturing facilities that exist in our study area.

Study Area

Because locating manufacturing facilities on a map is a very time intensive endeavor that is easier to accomplish in highly urbanized areas than in rural areas, our study area is limited to respondent Census tracts in 18 Illinois counties, including all counties in the Chicago metropolitan area (study area maps are available from the authors upon request). Study area counties were chosen based on the number of respondents in each county and the percentage of manufacturing facilities in each county that were successfully located on a map. No study area county had fewer than 22 respondents or a successful facility mapping rate below 53.8

[1]In 1995, the specified quantities were 25,000 pounds for facilities that manufacture or process TRI chemicals and 10,000 pounds for facilities that use TRI chemicals.

[2]Other measures of facility size and visibility—such as the number of employees, square footage, or economic output of the facilities in the database—would have been preferable. However, these measures are not available in the TRI database.

percent,[3] and most study area counties had significantly higher mapping rates and at least 50 respondents.[4] In order to determine whether low facility mapping rates affected our results, we reran the analyses reported below using data derived solely from the 5 study area counties with the highest facility mapping rates. The results of these analyses are substantively identical to those presented, giving us confidence that our results are not unduly affected by measurement error.

Our 18 county database includes 1,210 of the 2,482 respondents in the original CCH database. Respondents included in the 18 county database are broadly representative of the sample as a whole, with only one exception. Black respondents make up 13 percent of our respondents, as opposed to 9 percent in the original dataset. Nevertheless, the distributions of the outcome variables of interest are remarkably similar among the respondents included in the analyses versus those in the broader sample (detailed results are available from the authors upon request).

Concepts and Measurement

Outcome measures—*Depression*, our measure of psychological distress, is measured with a modified version of the Center for Epidemiological Studies Depression Scale (Radloff 1977; Ross and Mirowsky 1984). Respondents were asked, "How many days during the past week (0–7) have you …" (1) "felt you couldn't get going," (2) "felt sad," (3) "had trouble getting to sleep or staying asleep," (4) "felt that everything was an effort," (5) "felt lonely," (6) "felt you couldn't shake the blues," (7) "had trouble keeping your mind on what you were doing," (8) "enjoyed life," (9) "felt happy," and (10) "felt hopeful." Items 8–10 were reverse coded. Responses were averaged to create an index ranging from 0 to 7, with higher numbers representing greater symptoms of depression (alpha = .83).

Individuals' relative sense of having control over their lives (*power* vs. *powerlessness*) is measured using a 2 × 2 index that balances statements claiming or denying control over good or bad outcomes (Mirowsky and Ross 1991). Individuals were asked to indicate the extent to which they agree or disagree with the following statements: (1) "The really good things that happen to me are mostly luck"; (2) "There's no sense planning a lot—if something good is going to happen it will"; (3) "Most of my problems are due to bad breaks"; (4) "I have little control over the bad things that happen to me"; (5) "I am responsible for my own successes"; (6) "I can do just about anything I really set my mind to"; (7) "My misfortunes are the result of mistakes I have made"; and (8) "I am responsible for my failures." Responses to the perceived lack of control questions (1–4) are coded strongly disagree (−2), disagree (−1), agree (1), strongly agree (2), and responses to the perceived control questions (5–8) are coded strongly disagree (2), disagree (1), agree (−1), strongly agree (−2). Respondents who indicated they "don't know" were coded 0 on all questions. From these responses, a mean score, perceived control index was created, ranging from a high sense of powerlessness (2) to a low sense of powerlessness (−2) (alpha = .57).

Perceived neighborhood disorder was measured using the Ross-Mirowsky Perceived Neighborhood Disorder Scale (Ross and Mirowsky 1999). The scale takes into account aspects of both physical and social order and disorder. To measure physical order/disorder, respondents were asked to indicate the extent to which they agree with the following statements: (1) "There is a lot of graffiti in my neighborhood"; (2) "My neighborhood is noisy"; (3) "Vandalism is common in my neighborhood"; (4) "There are a lot of abandoned buildings in my neighborhood"; (5) "My neighborhood is clean"; and (6) "People in my

[3]No nonstudy area county had more than 16 respondents, and most had fewer than 5.
[4]We could have greatly increased our manufacturing facility mapping rate by restricting the study to Chicago. However, we did not want to confine our analysis solely to a major metropolitan area.

neighborhood take good care of their houses and apartments." To measure social order/disorder, respondents were asked the extent to which they agree with the following statements: (1) "There are too many people hanging around on the streets near my home"; (2) "There is a lot of crime in my neighborhood"; (3) "There is too much drug use in my neighborhood"; (4) "There is too much alcohol use in my neighborhood"; (5) "I'm always having trouble with my neighbors"; (6) "In my neighborhood people watch out for each other"; (7) "My neighborhood is safe"; and (8) "I can trust most people in my neighborhood." The original questions were coded strongly agree (1) to strongly disagree (4). Negatively worded questions were reverse scored, and the responses to the 15 questions were averaged so that 4 indicates a high level of perceived disorder and 1 indicates a low level of disorder (alpha = .91).

Industrial activity—Our industrial activity indicators were created by first locating TRI facilities on a Census tract map and then converting this map into a rectangular grid composed of cells whose dimensions are 25 meters by 25 meters in length. We then calculated (1) the number of TRI facilities located within a ¼-kilometer radius of the center of each grid cell and (2) the pounds of waste generated within a ¼-kilometer radius of the center of each grid cell. Finally, for each of these variables we took the sum of the values of all the cells in each tract and divided this sum by the number of cells in each tract. This gave us two tract-level indicators: the *average number of facilities* in a tract, or the number of TRI facilities within a ¼-kilometer radius of the average tract cell, and the *average waste generated* in a tract, or the pounds of waste generated within a ¼-kilometer radius of the average tract cell (measured in tens of thousands of pounds).[5] We use average waste generated in addition to average number of facilities because average waste generated provides us with a gauge of facility size not captured by average number of facilities or any of the other variables included in the TRI. This is important because it is likely that large facilities will be perceived as more noxious, threatening, and disorderly than small facilities.

In using average waste generated as a proxy for facility size we are assuming that larger facilities generate more waste than smaller facilities. This assumption is supported by Grant, Bergesen, and Jones (2002), who found that chemical factory size is positively associated with facility emissions. Still, we cannot discount the possibility that any association we uncover between average waste generated and mental health is due to toxic waste exposure rather than negative perceptions of large facilities.

Control variables—We include two neighborhood-level control variables in our analyses, neighborhood stability and neighborhood poverty. These measures have a documented association with social control and disorder (Ross et al. 2000; Schulz et al. 2000).[6] *Neighborhood stability* is defined as the percentage of people in a tract who lived in the same house five years ago, and *poverty* is defined as the percentage of families in a tract living in poverty in 1990. The *percentage of black residents* and the *percentage of Hispanic residents* are used in testing the environmental inequality hypothesis. We transformed each of these variables into a mean deviation score by subtracting the mean from each value of the variable in order to avoid multicollinearity between these variables and individual measures of socioeconomic status also included in the analyses (Bryk and Raudenbush

[5]These indicators take facility location and tract size into account. They also allow facilities located within a ¼ kilometer of a tract boundary to influence people living on the other side of that boundary. As a result, they are more valid indicators of visible threat than are the number of facilities or pounds of waste in a tract.

[6]Previous studies on the relationship between community context and psychological well-being find that other neighborhood-level characteristics—such as the percentage of single parent households, percentage of people without high school diplomas, and percentage of vacant housing in the tract—are also related to psychological well-being (Robert 1999; Ross 2000). We tested these community-context variables and found them to be insignificant predictors of our outcome variables. Thus, we pruned them from the analyses.

1992). We also include a control variable in the multivariate analyses, which is coded 1 if the respondent lives in the *Chicago metropolitan area* and 0 if outside the metropolitan area. This allows us to control for any unmeasured differences that may exist between the metropolitan area and other regions in the study area.[7]

Finally, we include a set of *individual- and family-level control variables* that have been associated with mental health outcomes in previous research (Horwitz and Scheid 1999). *Female respondent* is coded 1 if the respondent is female and 0 if the respondent is male. *Education* is the highest year of schooling the respondent has completed, coded intervally. *Employed* is coded 1 if the respondent is employed in a paid job outside the home and 0 if not. *Married* is coded 1 if the respondent is married or lives with a "significant other" and 0 if not. *Own house* is coded 1 if the respondent indicated that he or she owns the home in which she or he lives and 0 if he or she rents or has some other arrangement. *Parent* is coded 1 if the respondent has children under the age of 18 living in his or her home and 0 if not. *Age* is the respondent's age in years. *Black respondent* is coded 1 if the respondent identified him or herself as black or African American and 0 if not.[8] *Hispanic respondent* is coded 1 if the respondent identified herself or himself as Hispanic, Puerto Rican, or Latin American and 0 if not. *Family income* is the respondent's pretax family income in 1993, measured in thousands of dollars. Missing values for income were imputed using regression analysis and reassigned based on the individual's sex, race, age, education, employment status, marital status, and parental status. The analyses presented below were replicated without the imputation of missing values on income, and the results were the same.

Spatial Autocorrelation

Approximately 56 percent of the respondents in our sample lived in a tract with at least one other respondent, raising the possibility that ordinary least squares (OLS) regression residuals would be spatially correlated. In order to test for this possibility, we calculated two measures of spatial correlation—Moran's I statistic and Geary's C ratio—using S-plus, a statistical software package that can calculate the neighbor-weights matrices used to test and control for spatial autocorrelation. Although we detected spatial autocorrelation when we used the second and third neighbor weights matrices, the results we obtained using S-plus's autoregressive modeling techniques were virtually identical to those we obtained using OLS regression. Thus, we report our OLS results.

RESULTS

The first hypothesis we test is that study area facilities and pollution are distributed "inequitably" according to race, Hispanic ethnicity, and income. Table 1 shows that neither black respondent nor percent black in the Census tract is significantly associated with average number of facilities or average waste generated. However, Hispanic respondent, percent Hispanic, percent poverty, and respondent's family income are all weakly correlated with average number of facilities and average waste generated in the expected directions. Thus, respondents with higher incomes live in tracts with lower average facility and average waste levels than do respondents with lower incomes ($r = -.044$ and $r = -.046$; $p < .05$); Hispanic respondents live in tracts with higher average facility and average waste levels than do non-Hispanic respondents ($r = .113$ and $r = .088$, $p < .001$); and as the percentage of Hispanics in a Census tract increases, so too do the number of facilities and pounds of waste within a ¼-kilometer radius of the average tract cell ($r = .151$ and $r = .128$, $p < .001$). Finally, as the proportion of people in a tract living in poverty increases, so too do the

[7]We also estimated the multivariate models replacing the Chicago control variable with population density. The results were identical.
[8]Ninety percent of those who did not identify themselves as black or African American identified themselves as white, and 95.2 percent of study area respondents identified themselves as being black, white, and/or Hispanic.

number of facilities and pounds of waste within a ¼-kilometer radius of the average tract cell (r = .088 and r = .090, $p < .001$).

Thus, while we find some evidence of differential proximity to facilities and waste, particularly according to Hispanic ethnicity and percent Hispanic in a tract, the significant relationships are relatively weak. This is typical of much, but by no means all, environmental inequality research, which finds consistently significant relationships between neighborhood income and environmental hazard presence, but inconsistent and often weak statistical associations between race, Hispanic ethnicity, and environmental hazard presence (Anderton et al. 1994; Oakes, Anderton, and Anderson 1996; Yandle and Burton 1996; Szasz and Meuser 1997; Sadd et al. 1999).

Table 1 also shows that industrial activity is weakly but consistently correlated with disorder, depressive symptoms, and powerlessness. Individuals who live in tracts with high average facility levels report more symptoms of depression (r = .051, $p < .05$), perceive their neighborhoods to have greater levels of disorder (r = .084, $p < .01$), and feel that they have less control over their lives (r = .069, $p < .01$) than do individuals who live in tracts with lower average facility levels. Likewise, individuals who live in Census tracts with high levels of average waste report higher levels of depression symptoms (r = .050, $p < .05$), higher levels of disorder (r = .071, $p < .01$), and lower levels of control (r = .068, $p < .01$) than do individuals who live in tracts with lower average waste levels.

Although these results support our hypothesis that industrial activity is positively associated with perceptions of disorder, feelings of personal powerlessness, and symptoms of depression, they may be spurious. In order to test the hypothesis that residential proximity to environmental hazards is positively associated with feelings of disorder, net of individual and other neighborhood characteristics, we regress disorder on our two measures of industrial threat, controlling for neighborhood poverty, neighborhood stability, the Chicago metropolitan area dummy, and a set of respondent characteristics listed at the bottom of Table 2. Model 1 presents the regression for average number of facilities, and model 2 presents a regression for average waste.

Table 2 shows us that the relationship between disorder and industrial activity is curvilinear, regardless of which indicator of industrial activity we use. Average number of facilities and average waste are positively associated with perceptions of social disorder until the relationship plateaus, when the average number of facilities in a tract equals .482 in model 1, and average waste equals 3,087,541 pounds in model 2.[9] Since less than 1 percent of the respondents in the study area lived in tracts with a higher average facility level than .482, and since only one respondent lived in a tract with a higher average waste level than 3 million pounds, it is safe to conclude that the relationship between industrial activity and perceptions of social disorder is positive for the vast majority of respondents. Moreover, standardized coefficients reveal that the industrial activity indicators are more strongly associated with disorder than are neighborhood stability and any of the individual-level controls (the standardized coefficients for the individual-level controls are available from the authors upon request). These results provide strong support for the hypothesis that residential proximity to industrial activity is positively associated with perceived disorder.

Table 3 tests the hypothesis that residential proximity to industrial activity is positively associated with feelings of powerlessness and that this association is mediated by perceptions of disorder. Models 1 and 2 do this for average number of facilities, and models

[9]The following equation solves for the turning point at which the slope begins to decline: $b_1 + 2b_2 X = 0$, therefore $X = -b_1/2b_2$, where b_1 is the coefficient for the single term and b_2 is the coefficient for the squared term.

3 and 4 do this for average waste. Model 1 demonstrates that controlling for individual and neighborhood characteristics, but not disorder, there is a positive *linear* relationship between average number of facilities and perceived powerlessness (b = .339, $p < .05$).[10] The significant association between average waste and perceived powerlessness (model 3) is positive until average waste equals 2,847,000 pounds and becomes negative thereafter. Only one respondent in the study area lives in a tract with average waste levels greater than 2,847,000 pounds.

When we include perceived disorder in the regression equation, the association between average number of facilities and perceived powerlessness becomes only marginally significant (model 2), as does the association between average waste and perceived powerlessness (model 4). These findings are consistent with our prediction that the relationship between industrial activity and powerlessness is at least partially indirect, with industrial activity leading to perceptions of disorder that in turn lead individuals to feel powerless to control their lives.

Table 4 tests the hypothesis that industrial activity is positively associated with depression and that this relationship is mediated by perceived powerlessness and disorder. Model 1 demonstrates that controlling for individual and neighborhood characteristics, but not perceived disorder and powerlessness, the relationship between average number of facilities and depressive symptoms is curvilinear, with the positive effect of facility presence tapering off at an average of .388 facilities in a tract. Only 1 percent of residents live in tracts with more than this level of exposure. This relationship is no longer significant, however, once perceived disorder and powerlessness are stepped into the equation (model 2). Results not reported here demonstrate that when powerlessness and disorder are stepped into the model individually, they each contribute about equally to explaining the relationship between average number of facilities and symptoms of depression.

The results are quite different for average waste, which has a positive linear relationship with depressive symptoms both when perceived disorder and powerlessness are left out of the equation (model 3, b = .003, $p < .05$) and when they are included in the equation (model 4, b = .003, $p < .05$). Thus, as the average waste in a tract increases, so too do the number of depressive symptoms respondents report experiencing.

Finally, we test the hypothesis that the relationship between industrial activity and psychological well-being varies according to respondent income and minority status. To test this hypothesis, we calculated interaction terms between each of the two measures of industrial activity and the black respondent, Hispanic respondent, and respondent income variables. We then entered the interaction terms individually into the final models presented in Tables 3 through 4.

The interaction results show that high levels of waste production result in fewer depressive symptoms (b = −.0007, $p < .01$) and lower levels of powerlessness (b = −.0002, $p < .05$) among higher income respondents than among lower income respondents and in more depressive symptoms (b = .013, $p < .001$) and a greater sense of powerlessness (b = .005, $p < .05$) among Hispanic respondents than among non-Hispanic respondents. Hispanic respondents are also more likely than non-Hispanic respondents to describe neighborhoods with high average facility presence levels as being disorderly (b = 1.540, $p < .01$). Finally, high levels of waste production produce a greater sense of powerlessness among black respondents than white respondents (b = .073, $p < .05$).

[10]Average number of facilities squared was dropped from models 1 and 2 because it was not significantly associated with the dependent variable.

DISCUSSION

Our goal in this article has been to test the argument that residential proximity to industrial activity has a negative impact on psychological well-being. The results reported in the previous section support this argument. They demonstrate that residential proximity to industrial activity has a direct, positive association with perceptions of neighborhood disorder, feelings of personal powerlessness, and depression; that perceptions of disorder mediate the relationship between residential proximity and feelings of personal powerlessness; and that perceptions of disorder and feelings of personal powerlessness mediate the relationship between residential proximity and depression when proximity is measured using the average number of facilities in a tract but not when it is measured using average waste generated. Moreover, standardized coefficients show that the average number of facilities in a tract and the average waste generated both have a stronger impact on perceptions of disorder than do neighborhood stability or any of the nine individual-level control variables included in the analysis. They also show that average waste is more strongly associated with depression than is living in the Chicago metropolitan area, neighborhood stability, or tract poverty rates. Finally, the interaction results demonstrate that the relationship between residential proximity and feelings of personal powerlessness varies according to respondent income, Hispanic status, and racial status and that the relationship between residential proximity and depression varies according to respondent income and Hispanic status.

In addition to demonstrating that there is a link between residential proximity to industrial activity and psychological well-being, these findings advance our knowledge of the stress process and environmental inequality in several ways. First, they suggest that mental health researchers need to continue to expand their models to consider the impact that multiple aspects of community context have on individual well-being. Not only did the industrial activity measures employed in this study have a greater impact on depression than did most of the individual-level variables traditionally included in mental health research, but they also had an important impact on powerlessness, consistently one of the most important predictors of psychological well-being in previous research (Mirowsky and Ross 1990). This conclusion is consistent with those of other studies cited earlier in the article, which also find community and social context to be important determinants of psychological well-being. Second, these findings suggest that industrial activity may contribute to the well-documented social gradient in health, not only because blacks, Hispanics, and lower-income individuals often live in closer proximity to industrial activity than do whites and wealthier individuals (Pastor, Sadd, and Morello-Frosch 2002; Sadd et al. 1999; Szasz and Meuser 1997), but also because the mental health impact of living in proximity to industrial activity is greater for blacks, Hispanics, and lower-income individuals than it is for others.

Third, the findings reported above substantiate environmental inequality researchers' claims that concerns about industrial production are not confined solely to white, middle-class America (Taylor 1992; Mohai and Bryant 1998). Black and lower-income respondents were just as likely as white and higher-income respondents to associate industrial activity with neighborhood disorder, and Hispanics were more likely than non-Hispanics to associate industrial activity with neighborhood disorder. This finding demonstrates that blacks, Hispanics, and lower-income people are aware of nearby industrial activity, and it suggests that they are at least as likely as whites, non-Hispanics, and higher-income people to view such activity negatively.

Fourth, in showing that at similar levels of industrial activity black respondents experience higher levels of powerlessness than do whites, while lower-income and Hispanic respondents experience higher levels of powerlessness and depression than do their

counterparts, this article demonstrates that the residential distribution of social groups around industrial facilities does not coincide perfectly with the social distribution of psychological distress arising from residential proximity to industrial activity. In other words, the social distribution of distress arising from residential proximity to industrial activity cannot be fully explained by proximity inequality. This supports Pearlin's argument (1989 (1999) that mediating factors play an important role in the stress process, and it suggests that the impact of industrial activity can be greater for some social groups than it is for others, even when these groups are distributed evenly around industrial hazards.

Finally, the fact that the association between average number of facilities and depression is fully mediated by disorder and powerlessness while the association between average waste and depression is not suggests that the effect of industrial activity on depression is only partially mediated by disorder and powerlessness. How we evaluate this finding depends on our interpretation of the average waste variable. If, on the one hand, as argued earlier, average waste is an indicator of facility size, then this finding (1) suggests that individuals perceive larger industrial facilities to be more noxious and threatening than smaller industrial facilities and (2) supports our argument that industrial activity increases depression in part because individuals perceive industrial activity to be noxious and threatening. If, on the other hand, we consider average waste to be an indicator of pollution exposure, then this finding suggests that residential proximity to industrial activity may increase depression levels through physical exposure to toxic and hazardous pollutants. It is possible, of course, that both interpretations are correct.

As with any research, there are weaknesses with our study that deserve mention. First, low facility mapping rates in many rural counties disqualified those counties' respondents from our analysis. As a result, our study overrepresents the experiences and perceptions of urban and suburban residents. Nevertheless, our sample is neither a purely urban sample, nor completely nonrandom. Our sample includes respondents from counties with population densities ranging from 77 to 5,398 people per square mile, and although we did not select counties at random, respondents from each county were selected at random for inclusion in the survey sample. Second, although we exclude data from many low mapping rate counties, some of the counties included in this study still have relatively low mapping rates. However, as stated earlier, analyses conducted with data drawn solely from the five highest facility mapping rate counties produced results substantively identical to the results presented here.

Third, we do not know from these data whether respondents in facility neighborhoods lack the power to keep facilities out of their neighborhoods or have chosen to live in facility neighborhoods knowing that the facilities were already there. This is a general problem in the literature on environmental inequality. However, there is some evidence that facilities are more likely to be sited in low-income and minority communities than in other communities (Pastor, Sadd, and Hipp 2001) and that poor people and minorities do not move into industrial neighborhoods in greater numbers than they move into other neighborhoods (Oakes et al. 1996; Pastor at el. 2001). Most importantly, however, even if poor and minority residents do move disproportionately into neighborhoods with industrial facilities, it is likely the result of the high levels of economic and racial segregation present in contemporary America (Massey and Denton 1993; Massey 1996). Thus, it is likely that individuals who move into industrial neighborhoods have fewer residential choices than those who do not and, therefore, that free choice should not be assumed.

Fourth, because TRI facilities represent only one type of industrial environmental hazard, it is possible that we have inaccurately estimated the association between industrial activity and psychological well-being. In order to determine whether results would have differed had we included other industrial environmental hazards in our data set, we ran a set of analyses

using hazardous waste data obtained from the Environmental Protection Agency's Biennial Reporting System (BRS) and Comprehensive Environmental Response, Compensation, and Liability Information System (CERCLIS). We chose these data sets because environmental inequality activists and researchers have been as concerned with the possible effects of proximity and exposure to hazardous wastes as they have been with the effects of proximity and exposure to factory pollution and because there is reason to believe that hazardous waste facilities are more likely than factories to be located in minority and low-income neighborhoods. Analyses show that BRS facilities—both large quantity generators and treatment, storage, and disposal facilities (TSDFs)—are associated with powerlessness and depression in the expected direction and at similar levels, and that TSDFs are associated with perceived disorder in the expected direction. CERCLIS facilities (national priority list facilities and non–national priority list facilities) are not significantly associated with disorder, powerlessness, or depression, although this may be due to the fact that there are relatively few CERCLIS facilities in our 18 county database. Finally, in our study area, BRS and CERCLIS facilities are no more likely than TRI facilities to be located in minority or low-income respondent neighborhoods. Given the general consistency of our TRI and BRS findings, it appears unlikely that we have misestimated the association between industrial activity and psychological well-being. Nevertheless, the anomalous findings regarding CERCLIS facilities bear further investigation.

Finally, although it is beyond the scope of this article to determine why race and class are not associated with any of these hazard indicators in Illinois, it is noteworthy that, unlike in Krieg's study of Boston (1998), our environmental inequality findings are the same no matter which measures we use. As Krieg points out in his comparison of the associations between race and income with Superfund sites and with TRI releases in the Boston area, historical processes of industrialization and deindustrialization may play a role in shaping patterns of environmental inequality within a given region.

CONCLUSION

In this article we have combined two research traditions—the sociology of mental health and environmental inequality studies—to examine the impact of industrial activity on individual well-being and have found that industrial activity is associated with perceptions of individual powerlessness and neighborhood disorder, leading to higher levels of psychological distress. Further research and more detailed survey data are needed to determine exactly why industrial activity is associated with perceived disorder, powerlessness, and depression and whether the association between industrial activity and depression is due, in part, to physical exposure to industrial pollutants. Nevertheless, this article has important implications for public health policy. Most importantly, it suggests that public health officials need to take seriously the mental health impacts of living near industrial facilities. It also suggests that if true equity in health impacts is to be achieved, minority and low-income neighborhoods should be chosen *less often* than other neighborhoods for the siting of industrial facilities because individuals from these groups experience greater mental health impacts than others from residential proximity to industrial activity.

References

Anderton, Douglas L.; Anderson, Andy B.; Oakes, John Michael; Fraser, Michael R. Environmental Equity: The Demographics of Dumping. Demography. 1994; 31(2):229–48. [PubMed: 7926187]

Aneshensel, Carol S.; Sucoff, Clea A. The Neighborhood Context of Adolescent Mental Health. Journal of Health and Social Behavior. 1996; 37(4):293–390. [PubMed: 8997886]

Austin, Regina; Schill, Michael. Black, Brown, Red, and Poisoned. In: Bullard, R., editor. Unequal Protection: Environmental Justice and Communities of Color. San Francisco, CA: Sierra Club Books; 1994. p. 53-74.

Avison, William R.; Jay Turner, R. Stressful Life Events and Depressive Symptoms: Disaggregating the Effects of Acute Stressors and Chronic Strains. Journal of Health and Social Behavior. 1988; 29(3):253–64. [PubMed: 3241066]

Bryk, Anthony S.; Raudenbush, Stephen W. Hierarchical Linear Models: Applications and Data Analysis Methods. Newbury Park, CA: Sage; 1992.

Bullard, Robert D. Environmental Blackmail in Minority Communities. In: Bryant, B.; Mohai, P., editors. Race and the Incidence of Environmental Hazards. Boulder, CO: West-view; 1992a. p. 82-95.

Bullard, Robert D. People of Color Environmental Groups Directory 1992. Riverside, CA: University of California—Riverside; 1992b.

Bullard, Robert D. Unequal Protection: Environmental Justice and Communities of Color. San Francisco, CA: Sierra Club Books; 1994.

Caspi, Avshalom; Taylor, Alan; Moffitt, Terrie E.; Plomin, Robert. Neighborhood Deprivation Affects Children's Mental Health: Environmental Risks Identified in a Genetic Design. Psychological Science. 2000; 11(4):338–42. [PubMed: 11273396]

Clarke, Jeanne Nienaber; Gerlak, Andrea K. Environmental Racism in the Sunbelt? A Cross-Cultural Analysis. Environmental Management. 1998; 22(6):857–67. [PubMed: 9732515]

Davis, James A.; Smith, Tom W.; Marsden, Peter V. General Social Surveys, 1972–1998: Cumulative Codebook. Chicago, IL: National Opinion Research Center; 1999.

Environmental Justice Resource Center. The People of Color Environmental Groups Directory 2000. Atlanta, GA: Environmental Justice Resource Center; 2000.

Geis, Karlyn; Ross, Catherine. A New Look at Urban Alienation: The Effect of Neighborhood Disorder on Perceived Powerlessness. Social Psychology Quarterly. 1998; 61(3):232–46.

Grant, Don; Bergesen, Albert; Jones, Andrew. Organizational Size and Pollution: The Case of the U.S. Chemical Industry. American Sociological Review. 2002; 67(3):389–407.

Hockman, Elaine M.; Morris, Charles M. Progress towards Environmental Justice: A Five Year Perspective of Toxicity, Race, and Poverty in Michigan, 1990–1995. Journal of Environmental Planning and Management. 1998; 41(2):157–77.

Hofrichter, Richard. Toxic Struggles: The Theory and Practice of Environmental Justice. Philadelphia, PA: New Society; 1993.

Horwitz, Allan V.; Scheid, Teresa L. A Handbook for the Study of Mental Health: Social Contexts, Theories, and Systems. Cambridge, United Kingdom: Cambridge University Press; 1999.

Ihlanfeldt, Keith; Sjoquist, David L. The Spatial Mismatch Hypothesis: A Review of Recent Studies and Their Implications for Welfare Reform. Housing Policy Debate. 1998; 9:849–92.

Krieg, Eric J. Methodological Considerations in the Study of Toxic Waste Hazards. Social Science Journal. 1998; 35(2):191–202.

Massey, Douglas S. The Age of Extremes: Concentrated Affluence and Poverty in the Twenty-first Century. Demography. 1996; 33(4):395–412. [PubMed: 8939412]

Massey, Douglas S.; Denton, Nancy A. American Apartheid: Segregation and the Making of the Underclass. Cambridge, MA: Harvard University Press; 1993.

McLanahan, Sara; Booth, Karen. Mother-Only Families: Problems, Prospects, and Politics. Journal of Marriage and the Family. 1989; 51:557–80.

Meier, Robert. Perspectives on the Concept of Social Control. Annual Review of Sociology. 1982; 8:35–55.

Mirowsky, John; Ross, Catherine E. Social Patterns of Distress. Annual Review of Sociology. 1986; 12:23–45.

Mirowsky, John; Ross, Catherine E. Social Causes of Psychological Distress. New York: Aldine de Gruyter; 1989.

Mirowsky, John; Ross, Catherine E. Control or Defense: Depression and the Sense of Control over Good and Bad Outcomes. Journal of Health and Social Behavior. 1990; 31:71–86. [PubMed: 2313078]

Mirowsky, John; Ross, Catherine E. Eliminating Defense and Agreement Bias from Measures of the Sense of Control: A 2 × 2 Index. Social Psychology Quarterly. 1991; 54:127–45.

Mohai, Paul; Bryant, Bunyan. Environmental Racism: Reviewing the Evidence. In: Bryant, B.; Mohai, P., editors. Race and the Incidence of Environmental Hazards: A Time for Discourse. Boulder, CO: Westview; 1992. p. 163-76.

Mohai, Paul; Bryant, Bunyan. Is There a 'Race' Effect on Concern for Environmental Quality? Public Opinion Quarterly. 1998; 62:475–505.

Oakes, John Michael; Anderton, Douglas L.; Anderson, Andy B. A Longitudinal Analysis of Environmental Equity in Communities with Hazardous Waste Facilities. Social Science Research. 1996; 25:125–48.

Pastor, Manual; Sadd, Jim; Hipp, John. Which Came First? Toxic Facilities, Minority Move-In, and Environmental Justice. Journal of Urban Affairs. 2001; 23(1):1–21.

Pastor, Manuel; Sadd, James L.; Morello-Frosch, Rachel. Who's Minding the Kids? Pollution, Public Schools, and Environmental Justice in Los Angeles. Social Science Quarterly. 2002; 83:263–80.

Pearlin, Leonard I. The Sociological Study of Stress. Journal of Health and Social Behavior. 1989; 30:241–56. [PubMed: 2674272]

Pearlin, Leonard I. The Stress Process Revisited: Reflections on Concepts and Their Interrelationships. In: Aneshensel, Carol; Phelan, Jo, editors. Handbook of the Sociological Study of Mental Health. New York: Kluwer; 1999. p. 395-415.

Pearlin, Leonard I.; Lieberman, Morton A.; Menaghan, Elizabeth G.; Mullan, Joseph T. The Stress Process. Journal of Health and Social Behavior. 1981; 22(4):337–56. [PubMed: 7320473]

Pearlin, Leonard I.; Skaff, Marilyn McKean. Stress and the Life Course: A Paradigmatic Alliance. Gerontologist. 1996; 36(2):239–47. [PubMed: 8920095]

Radloff, Lenore. The CES-D Scale: A Self-Report Depression Scale for Research in the General Population. Applied Psychological Measurement. 1977; 1:385–40.

Reynolds, John R. The Effects of Industrial Employment Conditions on Job-Related Distress. Journal of Health and Social Behavior. 1997; 38(2):105–16. [PubMed: 9212533]

Robert, Stephanie. Socioeconomic Position and Health: The Independent Contribution of Community Socioeconomic Context. Annual Review of Sociology. 1999; 25:489–516.

Ross, Catherine E. Neighborhood Disadvantage and Adult Depression. Journal of Health and Social Behavior. 2000; 41(2):177–87.

Ross, Catherine E.; Mirowsky, John. Components of Depressed Mood in Married Men and Women: The Center for Epidemiologic Studies' Depression Scale. American Journal of Epidemiology. 1984; 119:997–1004. [PubMed: 6731436]

Ross, Catherine E.; Mirowsky, John. Disorder and Decay: The Concept and Measurement of Perceived Neighborhood Disorder. Urban Affairs Review. 1999; 34(3):412–32.

Ross, Catherine E.; Reynolds, John R.; Geis, Karlyn J. The Contingent Meaning of Neighborhood Stability for Residents' Psychological Well-Being. American Sociological Review. 2000; 65:581–97.

Sadd, James L.; Manuel Pastor, J.; Boer, Thomas; Snyder, Lori D. 'Every Breath You Take …': The Demographics of Toxic Air Releases in Southern California. Economic Development Quarterly. 1999; 13:107–23.

Sampson, Robert J.; Byron Groves, W. Community Structure and Crime—Testing Social-Disorganization Theory. American Journal of Sociology. 1989; 94(4):774–802.

Schulz, Amy; Williams, David; Israel, Barbara; Becker, Adam; Parker, Edith; James, Sherman A.; Jackson, James. Unfair Treatment, Neighborhood Effects, and Mental Health in the Detroit Metropolitan Area. Journal of Health and Social Behavior. 2000; 41:314–32. [PubMed: 11011507]

Seeman, Melvin. On the Meaning of Alienation. American Sociological Review. 1959; 24:783–91.

Seeman, Melvin. Alienation Motifs in Contemporary Theorizing. Social Psychology Quarterly. 1983; 46:171–84.

Seligman, Martin. Helplessness. San Francisco, CA: Freeman; 1975.

Skogan, Wesley G. Disorder and Decline. Berkeley: University of California Press; 1990.

Skogan, Wesley G.; Maxfield, Michael. Coping with Crime: Individual and Neighborhood Reactions. Beverly Hills, CA: Sage; 1981.

Stretesky, Paul; Hogan, Michael J. Environmental Justice: An Analysis of Superfund Sites in Florida. Social Problems. 1998; 45(2):268–88.

Szasz, Andrew; Meuser, Michael. Environmental Inequalities: Literature Review and Proposals for New Directions in Research and Theory. Current Sociology. 1997; 45(3):99–120.

Tausig, Mark; Fenwick, Rudy. Recession and Well-Being. Journal of Health and Social Behavior. 1999; 40(1):1–16. [PubMed: 10331318]

Taylor, Dorceta. Can the Environmental Movement Attract and Maintain the Support of Minorities?. In: Bryant, B.; Mohai, P., editors. Race and the Incidence of Environmental Hazards. Boulder, CO: Westview; 1992. p. 28-54.

Taylor, Ralph B.; Hale, Margaret. Testing Alternative Models of Fear of Crime. Journal of Criminal Law and Criminology. 1986; 77:151–89.

Taylor, Ralph B.; Shumaker, Sally A. Local Crime as a Natural Hazard: Implications for Understanding the Relationship between Disorder and Fear of Crime. American Journal of Community Psychology. 1990; 18:619–41. [PubMed: 2075895]

Turner, R Jay; Wheaton, Blair; Lloyd, Donald A. The Epidemiology of Social Stress. American Sociological Review. 1995; 60(1):104–25.

United Church of Christ Commission for Racial Justice. Toxic Wastes and Race in the United States: A National Report on the Racial and Socioeconomic Characteristics of Communities with Hazardous Waste Sites. New York: United Church of Christ; 1987.

Wilson, William Julius. The Truly Disadvantaged: The Inner City, the Underclass, and Public Policy. Chicago, IL: University of Chicago Press; 1987.

Yandle, Tracy; Burton, Dudley. Reexamining Environmental Justice: A Statistical Analysis of Historical Hazardous Landfill Siting Patterns in Metropolitan Texas. Social Science Quarterly. 1996; 77:477–92.

Biographies

Liam Downey is an assistant professor of sociology at the University of Colorado. His primary research interests revolve around race and class inequality in the political, environmental, and economic realms. He is currently studying environmental inequality in metropolitan America, the mental and physical health impacts of residential proximity to polluting manufacturing facilities, and the impact that residential segregation has on residential proximity to manufacturing jobs and pollution.

Marieke Van Willigen is an associate professor of sociology at East Carolina University. Her primary interests are gender and mental health. She is currently working on projects examining predictors of mental health among lesbians, race differences in the sociopsychological benefits of education for women, and the mental and physical health impacts of residential proximity to polluting manufacturing facilities.

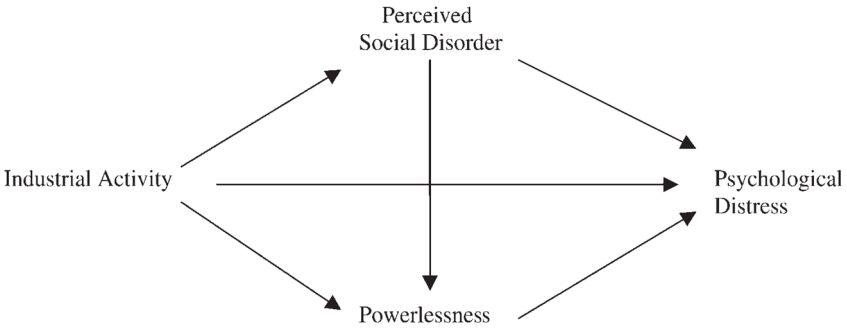

FIGURE 1.
Causal Model of the Relationship between Industrial Activity, Powerlessness, Disorder, and Depression

J Health Soc Behav. Author manuscript; available in PMC 2011 August 26.

TABLE 1

Bivariate Relationships between Outcome Measures, Facility Presence, Pounds of Waste, and Control Variables (N = 1,210)

	Depression	Disorder	Powerlessness	Number of Facilities	Pounds of Waste	Percent Black	Percent Hispanic	Tract Stability	Percent Poverty
Average number of facilities	.051*	.084**	.069**	—	.849***	.008	.151***	.012	.088***
Average pounds of waste	.050*	.071**	.068**	.849***	—	.001	.128***	−.006	.090***
Black respondent	.066**	.218***	.098***	−.010	−.012	.410***	−.144***	.075**	.310***
Hispanic respondent	.033	.078***	.078***	.113***	.088***	−.010	.191***	−.043	.074***
Age of respondent	−.112***	−.014	.102***	−.045*	−.054*	−.037	−.092***	.062**	−.043***
Female respondent	.065**	.000	.036**	−.007	.002	−.009	−.014	.029	.013
Married respondent	−.159***	−.157**	−.052*	−.016	−.016	−.097***	−.065***	.048*	−.138***
Respondent is a parent	.000	−.038*	−.030	.033	.043	.019	−.017	.059*	−.010
Respondent is home owner	−.080***	−.247**	−.037	−.015	−.024	−.152***	−.106***	.132***	−.231***
Employed respondent	−.054*	−.048**	−.146***	−.030	−.014	−.012	.060*	−.044	−.032
Education of respondent	−.083***	−.150**	−.217***	−.059*	−.051*	−.005	.024	−.123***	−.138***
Family income of respondent	−.097***	−.201**	−.199***	−.044*	−.046*	−.070***	−.011	−.026	−.211***
Perceived neighborhood disorder	.123***	—	.162***	.084***	.072**	.256***	.138***	−.074***	.331***
Percent black people in tract	.030	.256**	.034	.008	.001	—	.049*	−.215***	.348***
Percent Hispanic people in tract	.055**	.141**	.014	.151***	.128***	.049*	—	−.226***	.107***
Neighborhood stability in tract	−.017	−.072**	.056**	.012	−.006	−.215***	−.226***	—	−.093***
Percent people living in poverty	.087***	.326**	.091***	.088***	.090***	.348***	.107***	−.093***	—
Mean	.877	1.947	−.750	.026	1.871	.002	−.002	.004	−.001
Standard deviation	1.116	.638	.499	.085	24.220	27.659	11.597	12.090	10.612

* $p < .05$;

** $p < .01$;

*** $p < .001$ (two-tailed tests)

Note: Percent black and percent Hispanic people in tract are calculated as deviation scores from the mean.

TABLE 2

Ordinary Least Squares Regression Analyses of Disorder Regressed on Facility Presence, Pounds of Waste, and Control Variables (N = 1,210)

	Model 1		Model 2	
	b	**B**	**b**	**B**
Average number of facilities	1.353*** (.348)	.164	—	
Facilities squared	−1.404** (.496)	−.117	—	
Average pounds of waste	—		.005** (.002)	.175
Waste squared	—		−.000** (.000)	−.176
Chicago metro area	.430*** (.043)	.267	.449*** (.043)	.278
Neighborhood stability	−.004** (.001)	−.076	−.004** (.001)	−.070
Percent people in poverty	.017*** (.002)	.261	.018*** (.002)	.267
Constant	2.592*** (.116)		2.627*** (.117)	
Adjusted R-squared	.422		.419	
F-statistic	59.892***		59.048***	

† $p < .10$;

* $p < .05$;

** $p < .01$;

*** $p < .001$ (two-tailed tests)

Notes: Analyses control for respondents' age, black respondent, Hispanic respondent, sex, married, parent, employed, family income, and home owner. Standard errors are in parentheses.

TABLE 3

Ordinary Least Squares Regression Analyses of Powerlessness Regressed on Facility Presence, Pounds of Waste, and Control Variables (N = 1,210)

		Model 2			Model 4	
	Model 1 b	b	B	Model 3 b	b	B
Average number of facilities	.339* (.165)	.304† (.165)	.052	—	—	
Facilities squared	—	—		—	—	
Average pounds of waste	—	—		.003* (.002)	.003† (.002)	.138
Waste squared	—	—		−.000* (.000)	−.000† (.000)	−.138
Chicago metro area	.070†	.041	.036	.077* (.037)	.047 (.039)	.041
Neighborhood stability	.001 (.001)	.002 (.001)	.041	.001 (.001)	.002 (.001)	.042
Percent people in poverty	−.001 (.002)	−.002 (.002)	−.039	−.000 (.002)	−.002 (.002)	−.034
Perceived disorder		.066** (.025)	.094		.066** (.025)	.093
Constant	−.316** (.101)	−.488*** (.120)		−.300*** (.101)	−.474*** (.120)	
Adjusted R-squared	.129	.134		.129	.133	
F-statistic	13.823***	13.436***		12.898***	12.589***	

† $p < .10$;

* $p < .05$;

** $p < .01$;

*** $p < .001$ (two-tailed tests)

Notes: Analyses control for respondents' age, black respondent, Hispanic respondent, sex, married, parent, employed, family income, and home owner. Standard errors are in parentheses.

TABLE 4

Ordinary Least Squares Regression Analyses of Depression Regressed on Facility Presence, Pounds of Waste, and Control Variables (N = 1,210)

		Model 2			Model 4	
	Model 1 b	b	B	Model 3 b	b	B
Average number of facilities	1.282* (.699)	.695 (.686)	.053	—	—	
Facilities squared	−1.900* (.996)	−1.344 (.974)	−.071	—	—	
Average pounds of waste	—	—		.003* (.001)	.003* (.001)	.059
Waste squared	—	—		—	—	
Chicago metro area	.205* (.087)	.090 (.088)	.035	.222* (.086)	.095 (.088)	.037
Neighborhood stability	−.003 (.003)	−.003 (.003)	−.031	−.003 (.003)	−.003 (.003)	−.031
Percent people in poverty	−.001 (.004)	−.004 (.004)	−.041	−.001 (.004)	−.005 (.004)	−.046
Perceived disorder		.194*** (.057)	.123		.198*** (.056)	.125
Powerlessness		.464*** (.065)	.207		.464*** (.065)	.208
Constant	2.035*** (.234)	1.679*** (.273)		2.017*** (.233)	1.658*** (.273)	
Adjusted R-squared	.066	.113		.068	.116	
F-statistic	6.698***	10.096***		7.275***	10.932***	

† $p < .10$;

* $p < .05$;

** $p < .01$;

*** $p < .001$ (two-tailed tests)

Notes: Analyses control for respondents' age, black respondent, Hispanic respondent, sex, married, parent, employed, family income, and home owner. Standard errors are in parentheses.