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Suicide in the City: Do Characteristics of Place Really Influence Risk?*

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Abstract

Objective—This article investigates the role of social context on individual suicide mortality with attention paid to the possibility that contextual effects are simply the sum of individual characteristics associated with suicide.

Methods—We use restricted data from the 1986–2006 National Health Interview Survey-Linked Mortality Files, which include nearly one million records and 1,300 suicides, to examine the role of familial and socioeconomic context on adult suicide.

Results—Results show that adults living in cities with more socioeconomic disadvantage and fewer families living together have higher odds of suicidal death than adults living in less disadvantaged cities and cities with more families living together, respectively, after controlling for individual-level socioeconomic status, marital status, and family size.

Conclusion—The findings support classic sociological arguments that the risk of suicide is indeed influenced by the social milieu and cannot simply be explained by the aggregation of individual characteristics.

Emile Durkheim ([1897] 1951), a founding member of sociological inquiry, argued that suicide was an inherently social act, one that is heavily influenced by broader social factors and thus could not be understood solely at the individual level. Many researchers since have explored the role of social context in shaping suicide rates, and both classical and contemporary works have identified aggregate traits that correspond with the risk of suicide

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death (Baller and Richardson 2002; Burr, Hartman and Matteson 1999; Wadsworth and Kubrin 2007). Much of this work has been driven theoretically by Durkheim's ([1897] 1951) early claims that places with low levels of social integration and regulation would experience higher rates of suicide.

While most contemporary scholars give Durkheim credit for being a pioneer in empirical sociology and proposing the first sociological theory of suicide, his work has been subject to concerns over the appropriate level of analysis. The most common critique has been that Durkheim fell victim to the ecological fallacy, making inferences about individual relationships from observations of aggregate-level data and then assuming equivalence across levels (van Poppel and Day 1996). To illustrate, Durkheim analyzed area rates for suicide and religious affiliation to assert that Protestants were more likely to commit suicide than Catholics. To state that *rates* of suicide were higher in areas with higher rates of Protestantism is accurate. The problem arises with the claim that Protestants living in these areas have higher risks of suicide whereby an assumption about individuals is based solely on aggregate traits.

However there is also a critique concerning Durkheim's claims that did not involve—in fact explicitly avoided—any assumptions about individual level traits, but instead suggested that suicide rates are influenced by the characteristics of geographic areas. This claim can be thought of in much broader terms as one of the overarching themes of sociology, that area-level forces external to individuals matter for individual outcomes. The potential problem here is the possibility of committing what we call the *contextual fallacy*.¹ This error in logic assumes that aggregate results reflect something more than individual relationships. The potential error (the assertion that context matters) occurs when what is treated as a contextual effect is really just the result of aggregating individual-level patterns (i.e., due to the composition of the aggregate). For instance, do higher marital and birth rates actually increase levels of integration in a geographic area which in turn lowers overall suicide rates, including the suicide rate of persons without spouses or children? Or are the findings simply the result of a lower suicide propensity for married persons and parents, and thus differences in the marital and child composition of populations? The latter possibility challenges the very nature of sociological arguments that suicide is shaped by social context and, instead, allows for the possibility that suicide causation can be entirely understood by the varied distributions of suicide-related characteristics of individuals.

While researchers interested in other important social problems relating to disadvantage in the United States (U.S.)—including health (Kawachi and Berkman 2003), crime (Sampson, Raudenbush and Earls 1997), and education (Borman and Dowling 2010; Jencks and Mayer 1990)—have recognized the significance of disentangling the various levels of influence, the study of suicide has lagged behind methodologically. Instead, contemporary work on suicide, framed as a modern evaluation of Durkheim's theory of integration and suicide, has continued to highlight the relevance of social context without explicitly recognizing the

¹The “contextual fallacy” should not be confused with the “individualist fallacy” (sometimes called the “atomistic fallacy”) which involves the assumption that individual-level relationships will also be true for the aggregate. For instance, if we found that unemployed individuals were more likely to commit suicide we would be committing the individualistic fallacy if we assumed that this meant that areas with high unemployment would also have higher levels of suicide.

possibility of the contextual fallacy. In fact, much of the individual-level research in the area of suicide reinforces these concerns by demonstrating that characteristics often used to generate aggregate-level measures of social integration (e.g. marital, parental, and employment status) do in fact influence the risk of suicide at the individual level. Given the possibility of the contextual fallacy, these individual-level results imply but cannot fully demonstrate the existence of a contextual effect. In this paper, we produce the first U.S. evaluation of the simultaneous influence of individual- and aggregate-level indicators of household composition and socioeconomic disadvantage on suicide risk for a large nationally representative sample of adults.

BACKGROUND

Suicide as a Social Phenomenon

As a leader of premature mortality in the U.S. and other developed nations, suicide is a social problem that arouses continued concern from researchers and policymakers alike. In the U.S. alone, suicide accounts for nearly 40,000 deaths annually (Hoyert and Xu 2012) and is often viewed as a tragic outcome of an individual's struggle with difficult psychological and emotional issues.

Since Durkheim's publication of *Suicide*, theoretical work has built on the social nature of suicide, promoting the idea that contexts of various realms influence social environments that contribute to or inhibit the risk of suicide (Marris 1969; Pescosolido and Georgianna 1989). Much of this work has either followed in Durkheim's footsteps by focusing on the effects of social integration or examined the role of social disadvantage on suicide (see reviews by Stack 2000a; Stack 2000b). In the extant literature, the two proposed causal processes are not always completely distinguishable from each other, as community social and economic disadvantage are often thought to represent a lack of integration into wider mainstream society (Burr, Hartman and Matteson 1999; Kubrin, Wadsworth and DiPietro 2006; Wadsworth and Kubrin 2007). And many of the same aggregate measures have been used to represent one or the other, or elements of both.

Some of the social indicators that have been found to be significant predictors of suicide rates include unemployment (Almgren et al. 1998; Chuang and Huang 1996; Crawford and Prince 1999), poverty and income inequality (Burr, Hartman and Matteson 1999; Crawford and Prince 1999; Kubrin, Wadsworth and DiPietro 2006; Wadsworth and Kubrin 2007), and divorce and family structure (Baller and Richardson 2002; Stockard and O'Brien 2002). Most of these findings have been used to offer support to the integration-regulation thesis. As illustrations, Almgren et al. (1998) suggested that high levels of unemployment were positively associated with suicide rates among young African American men at least in part because unemployment and other types of economic disadvantage hindered social cohesion within the community. Wadsworth and Kubrin (2007) argued that cultural assimilation among Latinos actually decreased levels of social integration and solidarity within the Latino community and resulted in higher rates of suicide. Burr and colleagues (1999) studied suicides among black males in metropolitan areas and found support for theories of social integration and theories of inequality, in their case, racial inequality between whites and blacks. The authors of these studies conclude that strong family and community ties

decrease suicide risk by increasing social solidarity and community integration. More recent work has also suggested that families and communities can create social cohesion and integration and build social capital for residents, which in turn reduces suicide risk (Martikainen, Maki and Blomgren 2004).

In sum, scholars have identified numerous relationships between aggregate suicide rates and various measures of social and economic cohesion. While the social integration-regulation thesis was intended to help elucidate the macro-level processes that shape individual behavior, we question whether these contextual characteristics are, in fact, directly influencing individual suicide or if the relationship at the area-level is driven by the aggregation of individual-level relationships. Without empirically addressing this question the process by which aggregate characteristics shape patterns of suicide is unclear.

A smaller body of work has emerged that uses individual-level data to examine factors that may influence a person's risk of suicide. This line of research has produced some results consistent with the findings from aggregate analyses (Stack 2000a; Stack 2000b). For instance, just as areas with high rates of marriage and employment demonstrate lower rates of suicide, married and employed persons are less likely to commit suicide than their divorced or unemployed counterparts (Denney et al. 2009; Kposowa 2000). But individual-level analyses have suffered from a variety of challenges due to the problematic nature of suicide data. Stack (2000a) notes that many individual-level studies have relied on simple bivariate models, limiting the robustness of the findings. This limitation has been due in part to a lack of substantial numbers of deaths for investigation, especially when considering multiple covariates. Individual-level studies have also often focused only on high-risk populations, such as psychiatric patients (Tremeau et al. 2005).

Like aggregate data alone, individual-level data alone cannot address the crux of the question of whether context matters because they neither identify the level at which social integration influences suicide nor the additive or interactive nature of the macro and micro influences on suicide (Maimon and Kuhl 2008). While such data can determine that married or employed individuals are less likely to commit suicide, they cannot assess, for example, whether area unemployment rates influence individual propensity for suicide. Without simultaneously modeling contextual- and individual-level factors, such influences cannot be distinguished. Duncan and associates (1996) contend that progress in statistical modeling can assist social scientists in the important task of separating the distinct effects of composition from the effects of context.

In the current work, we take Duncan et al.'s (1996) suggestion to heart. Two of the factors that have received the most attention in the sociological literature on suicide are marriage/family formation and economic disadvantage. Studies cited above have shown these factors to be important at both the individual and aggregate level but very few have modeled both levels of influence simultaneously. Some studies have estimated contextual and individual effects at the same time (Agerbo, Sterne and Gunnell 2007; Collings et al. 2009; Hawton et al. 2001; Maimon and Kuhl 2008; Martikainen, Maki and Blomgren 2004). Studying suicide attempts in adolescents and young adults in the United States, Maimon and Kuhl (2008)

observed that integration at the neighborhood level associated with fewer suicide attempts after controlling for important individual-level controls.

For studies that focus on completed suicide among adults, many used data from more homogenous areas outside of the United States and have come to some disparate conclusions. Agerbo and colleagues (2007) used register data from Denmark and found that area level measures of family living and SES did not associate with suicide risk once individual-level measures were accounted for. Martikainen and colleagues (2004) used Finnish data and found that area-level measures of SES and family cohesion are attenuated with the inclusion of individual measures but they remain significantly related to suicide risk. Similar results with area-level indicators of socioeconomic deprivation only were also reported in England (Hawton et al. 2001). And the Collings study (2009) used national data from New Zealand and found that a measure of neighborhood deprivation exerted important effects on suicide risk even after accounting for individual-level measures.

We examine completed adult suicide using a national sample from the United States and focus on the influence of family versus nonfamily living and socioeconomic disadvantage at the city level while simultaneously modeling the role of individual-level marital status, family size, employment status, and income, along with a variety of other respondent characteristics. Such an approach assists in understanding the impact of social and economic disadvantages on suicide mortality by breaking through bifurcations between individual and aggregate effects (Wray, Colen and Pescosolido 2011) and analyzing relationships simultaneously at multiple levels (Kawachi and Berkman 2003).

Mechanisms of Compositional and Contextual Influence

In thinking about contextual and compositional effects, it is useful to consider why household formation and socioeconomic factors may influence suicide. For families, scholars have pointed to the importance of social support that members provide (Denney 2014, 2010) as well as a sense of obligation that may inhibit the suicidal tendencies of respondents with families who depend on them for material or emotional support (Gibbs 2000; Kposowa 2000). We anticipate such social support and obligation to be stronger among family members who are living together. This includes spouses as well as dependent children and parents. Thus, if areas with high rates of family living have lower suicide, that may be because the area is composed of more individuals who are members of families who both provide and receive support from other family members.

Durkheim and others have argued that in addition to the social support that family formation provides, areas with more families experience lower suicide rates not simply as a result of higher quantities of persons living in families but rather as a contextual effect due to an increase in social solidarity and integration/regulation (Lester 1994). Though types and qualities of individual families can certainly differ, more family households in an area encourage increased levels of supervision and a stronger sense of common values, beliefs, and norm-abiding behavior (Sampson 1987). These community characteristics are thought to exert contextual effects on individuals because they influence the behavior of individuals, regardless of their own living situation.

Turning to socioeconomic indicators, at the individual level both employment and socioeconomic status are correlated with suicide propensity. Unemployed individuals have a higher likelihood of suicide (Denney et al. 2009), and while the findings are less consistent, some researchers have identified an inverse relationship between socioeconomic status and suicide (Li et al. 2011). Henry and Short (1954) suggested that suicide should be positively, and homicide negatively, correlated with socioeconomic position, but the theory has not received much support in the study of suicide. Generally, scholars have posited that unemployment can lead to a sense of identity confusion, depression, and substance abuse, all of which increase the likelihood of suicide. The observed inverse relationship between socioeconomic status and suicide may also be the result of increased stress associated with poverty as well as feelings of despair, frustration, and alienation that may stem from economic struggles and the associated cultural meanings. In the aggregate, these individual-level relationships may produce the area-level relationships that have been observed between unemployment and socioeconomic disadvantage and suicide.

On the other hand, the influence of rates of unemployment and disadvantage can be considered contextual if they influence the behavior of area residents above and beyond the residents' individual employment and socioeconomic characteristics (Knox, Conwell and Caine 2004). Thus, high rates of unemployment and poverty can create a sense of social isolation, despair, and nihilism at the community level that contributes to suicide even among employed and nonpoor residents (Kubrin, Wadsworth and DiPietro 2006). Economic disadvantages can also decrease opportunities for meaningful social participation in civic organizations, churches, schools, businesses, and other organizations that offer structure and purpose (Sampson and Wilson 1995).

Hypotheses

To examine if context matters for individual suicide risk, two primary hypotheses serve as the foci of our analyses and support for these hypotheses would provide evidence against a contextual fallacy:

Hypothesis 1—Socioeconomic disadvantage at the city-level will associate with higher odds of suicidal death for inhabitants after controlling for education, employment status, income and other individual-level characteristics of residents.

Hypothesis 2—Low levels of familial integration at the city-level will associate with higher odds of suicidal death for inhabitants after controlling for marital status, family size and other individual-level characteristics of residents.

Alternatively, a compositional hypothesis (support for a contextual fallacy) predicts that these city-level relationships should disappear when models control for individual characteristics (Agerbo, Sterne and Gunnell 2007).

DATA AND METHODS

Analyzing individual and contextual risk factors for suicide has been difficult in the past due to a variety of data limitations. A primary issue has been the limitation of individual-level

suicide data. Fortunately, suicide is a relatively rare event and even large longitudinal data sets based on national samples tend to include few suicides. Second, to evaluate the role of context, data sets must include geographic identifiers that allow the researcher to link individual-level data to geographic measures. Given concerns with confidentiality, such geographic identifiers are rarely available. When they are available, they can usually only be accessed under tight agency control.

The National Center for Health Statistics (NCHS), through their Research Data Center (RDC), provides a unique opportunity to overcome these limitations. The National Health Interview Survey (NHIS) collects a variety of demographic, lifestyle, and health-related data from a national sample of about 100,000 respondents per year and serves as the principal source of information on the health of the noninstitutionalized U.S. population. We use the restricted use geocoded files of the NHIS between 1986 and 2003 prospectively linked to mortality through 2006 (NCHS 2009). We restrict our analyses to adults because of additional concerns over confidentiality for those suicides under age 18 and because youth suicide comes with additional sets of risk factors (Bossarte and Caine 2008; Stockard and O'Brien 2002).

The NHIS records were linked to 1990 and 2000 Census SF-1 and SF-3 data at the Consolidated Metropolitan Statistical Area / Metropolitan Statistical Area (CMSA/MSA) level using the RDC's restricted use geocoded data files. Approximately 75% of NHIS respondents over the NHIS study period lived in areas for which the Census Bureau produces CMSA/MSA level data. To be consistent with much of the aggregate-level suicide research, which has focused on the MSA or city as the context of interest (Burr, Hartman, and Matteson 1999; Wadsworth and Kubrin 2007), we included only NHIS respondents who were residing in metropolitan areas at the time of the survey.² To most accurately reflect aggregate conditions for respondents at the time of interview, we employed a strategy of matching 1990 Census measures to respondents interviewed from 1986 to 1994 and 2000 Census measures to respondents interviewed between 1995 and 2003. Similar procedures have been employed in other suicide studies by Wadsworth and Kubrin (2007), Burr and colleagues (1999), and Crawford and Prince (1999).

For the years used here, fewer than 3.0% of cases include insufficient identifying data to create a mortality record, and NCHS (2009) provides weights that adjust for the exclusion of ineligible records. Our final data set, after dropping an additional 1.0% of cases missing data on key variables, includes information and mortality status on 979,070 adults, of which there are 1,320 suicides through the end of 2006 (NCHS restricted data use agreements require rounding of Ns to the nearest 10). Overall, the strengths of the dataset include a large national sample, a long follow-up period, a rich set of covariates, record linkages to geographic variables, and a large number of suicide deaths.

²Important urban-rural differences in suicide exist. Suicide was considerably more prevalent in urban than in rural areas in the United States in the first half of the 20th century, but since the 1960s suicide has become much more prevalent in rural than urban areas (Singh and Siahpush 2002). Importantly, core tenets of the integration-regulation thesis that serves as a premise in the current work have found greater support in urban than rural areas (Kowalski, Faupel and Starr 1987). As cities represent major centers for both innovation and inequality, understanding contextual correlates of suicide in urban areas is important. Although the current work does not allow us to examine the role of context in more rural areas, this is an important avenue for future research.

Variables

The dependent variable, suicide mortality, is coded 1 for suicidal death, defined in the World Health Organization's (2007) 10th revision of the *International Statistical Classification of Diseases, Injuries, and Causes of Death* (ICD-10) as death from intentional self-harm (codes X60-X84); and coded 0 for all other respondents, who either survived the follow-up or died from other causes. NCHS ensured that all deaths over the study period were comparable to ICD-10 cause-of-death codes (see http://www.cdc.gov/nchs/data/datalinkage/nhis_file_layout_public_2010.pdf). Classification of a death as suicide rests on individuals with varying levels of medical knowledge and training (Timmermans 2005) and researchers have demonstrated that it is generally not misreported in a systematic way (Pescosolido and Mendelsohn 1986), though Klugman and colleagues (2013) find underreporting to be more common among elected coroners.

Our primary interest is to evaluate the effects of MSA-level indicators of social integration and economic disadvantage on individual suicide risk while simultaneously assessing the individual's own social integration and economic position. We use two primary contextual indicators. The first is an index of socioeconomic disadvantage, which is comprised of measures that have been found most likely to predict suicide rates at aggregate levels (Rehkopf and Buka 2006): proportion of the population that has not completed high school, proportion unemployed, and the proportion of households in poverty. The index was created using principal components factor analysis and has a reliability alpha of 0.85. We standardized the index to have a mean of zero and a standard deviation of 1. Larger values represent more disadvantaged areas. This measure is similar to that used to measure socioeconomic disadvantage in other aggregate-level studies of suicide (Burr, Hartman, and Matteson 1999; Kubrin, Wadsworth, and DiPietro 2006).

Our main aggregate indicator of social integration measures one of the most common aspects of integration addressed in both the classical and contemporary literature—family versus nonfamily living arrangements. To maintain consistency across 1990 and 2000 decennial census data, this measure considers married-couple families and other family types (male or female householder with no spouse but with children or other relatives) as family living and compares them with households that are made up of householders living alone or with other nonrelatives (nonfamily households). For the analysis, we generated quartiles based on the percentage of family households and compare areas of high family integration (greater than 75% family households) to the others. We chose to use quartiles rather than a continuous variable to capture the possibility of threshold effects. Originally, we also included measures of population density, region of residence, and year of survey in the analyses. These did not alter relationships between the MSA measures and suicide risk; for parsimony, we excluded them from the final models.

To assess whether context matters after considering individual characteristics, we include a variety of individual-level sociodemographic and socioeconomic variables as well as respondent's health status at the time of interview. The demographic variables include age and an age squared term based on prior research that indicates a nonlinear relationship between age and suicide (Kposowa, Breault and Singh 1995), gender (female serves as the

referent), and race/ethnicity. Race is a dummy variable that compares non-Hispanic whites (the referent) to all others. Although there are important racial and ethnic differences in suicide rates (Kubrin, Wadsworth and DiPietro 2006; Wadsworth and Kubrin 2007), small numbers of deaths in some race/ethnic groups preclude more detailed analyses. Indicators of family relationships include marital status and family size. Marital status is coded categorically as married (referent), divorced or separated, never married, and widowed. Family size is a continuous variable and is top coded at four or more family members.

Socioeconomic variables include income, employment status, and education. The reference person for each family reports the total family income in categories defined by NCHS. We take the midpoint of each category to approximate a continuous measure, estimate a median value for the open-ended category (Parker and Fenwick 1983), adjust the value for the purchasing power of different-sized families (Van der Gaag and Smolensky 1982), and use the consumer price index to adjust for changes in purchasing power over the study period. About 17% of the family income data were missing. We use a less detailed income measure that asked whether family income was above, or at or below, \$20,000 and additional covariates in our data, to estimate values for the missing income variable. We incorporated stochastic variation into the predicted values to better represent the variability in the actual income data (Gelman and Hill 2007). Finally, we took the log of the family income variable to account for its skewed distribution, and include that in our analyses. Separate analyses (available upon request) included a dummy variable for missing income values, but we found no difference compared to the imputed incomes. Education is coded categorically as those with 0–11 years of school, high school graduates, and those with more than a high school education (referent). More detail on educational attainment is available only for certain years of the NHIS. Employment status is coded as employed (referent), unemployed, and not in the labor force.

The NHIS person files include no measures specifically on mental health, but research suggests that individuals giving subjective reports concerning overall health consider many dimensions of health (Idler, Hudson and Leventhal 1999; Schnittker 2005). Thus, self-rated health is included in models as a broad indicator of current health; it is measured continuously from 0, poor health, to 4, excellent health. Moreover, controlling for health status helps with issues of selection, as individuals in poor health at baseline may also lack social and economic resources and be more prone to suicide.

Estimation

Due to the multilevel character of the research questions, we estimate multilevel logit models (Rabe-Hesketh and Skrondal 2008). Kawachi and Berkman (2003) and others have documented the usefulness of studying social determinants of health and well-being at various aggregated or contextual levels. Doing so recognizes the implicit nesting of individuals in different contexts, including for example, families, neighborhoods, and cities. Ignoring nested structures of data by estimating traditional linear or binary models may bias parameter estimates and violate independence assumptions, leading to underestimation of standard errors (Guo and Zhao 2000; Raudenbush and Bryk 2002).

The multilevel model for binary outcomes adds to a traditional logit model with the inclusion of a MSA-level error component (u_j). The following equation represents the probability of suicidal death, allowing the risk of death to vary across cities and includes individual-level (x_{ij}) and MSA-level (z_j) explanatory variables:

$$\log [P_{ij}/(1-P_{ij})] = \beta_0 + \beta_1 x_{ij} + \beta_2 z_j + u_j \quad (1)$$

The probability (P_{ij}) that the i th individual in the j th city dies via suicide is determined in equation 1, where β_0 is the model intercept, $\beta_1 x_{ij}$ is a level 1 (individual) predictor, $\beta_2 z_j$ is a level 2 (MSA) predictor, and u_j is the random effect of MSAs on suicide risk. Error across cities is captured by a level-2 residual term with a mean of zero and an unknown variance σ_u^2 (McCulloch and Searle 2001). The variance of σ_u^2 can be used to estimate the extent to which residual variation in the log-odds of suicide is situated within or between MSAs. The intraclass correlation (ICC) is simply the ratio of level-2 residual variance to the overall residual variance ($\sigma_u^2 + \sigma_e^2$) and provides an estimate of how much variation in the risk of suicide is due to unobserved characteristics associated with respondents' cities. The variance of the standard logistic distribution ($\pi^2/3$) can be used as an estimate for the level-1 residual variance in multilevel models for binary data (Guo and Zhao 2000; Snijders and Bosker 1999).

We estimate random intercept models and treat the slopes of individual factors as fixed, allowing us to model unobserved heterogeneity across cities while estimating effects based on individual and MSA characteristics. All models use maximum likelihood estimation with adaptive quadrature using Stata software (Rabe-Hesketh and Skrondal 2008; StataCorp 2012), adjusting for clustering by MSA, different sample sizes for level-1 and level-2 units, heteroscedastic error terms, and varying numbers of cases within level-2 units—all problems that otherwise downwardly bias estimated standard errors (Raudenbush and Bryk 2002). In presenting multivariate results, we first estimate models with MSA-level variables to show their independent effects on an individual's odds of suicidal death and then add individual covariates to check for the enduring effect of context after considering individual differences. All results are presented as odds ratios.

RESULTS

Table 1 provides a description of the nearly 1 million respondents nested in 208 MSAs throughout the study period. At the MSA level, the socioeconomic disadvantage scale is standardized and classifies respondent's cities at higher and lower levels of disadvantage. Table 1 also shows that about 25% of the sample lives in MSAs characterized by a quarter or less of the population living in family-style living arrangements. In contrast, about 25% of respondents live in MSAs where at least 81% of the residents live in family settings.

The average individual in the nationally representative sample is middle aged, white, and slightly more likely to be female. In addition, the majority of individuals are married, more than a third of the sample lives in a household with four or more people, nearly half have more than a high school education, and 65% are employed. Finally, the average adjusted

family income is nearly \$36,000 and the average respondent reported their current health to be somewhere between good and very good.

Table 2 provides multivariate results incorporating two levels of influence, the role of individual-level characteristics at level 1 and contextual (MSA) level characteristics at level 2. For brevity, we focus on the level-2 associations as our individual-level associations are consistent with many previous investigations (see Denney et al. 2009; Stack 2000a; 2000b). Models 1 and 2 evaluate the baseline independent effects of the aggregate characteristics. Both socioeconomic disadvantage and family living arrangements at the MSA level influence individual risk of suicide. A one unit increase in MSA disadvantage is associated with 13% higher odds of suicide (Model 1). And, compared to MSAs with the highest proportion of residents living in family settings, persons in MSAs with the fewest family living residents have odds of suicide 2.4 times higher over the follow-up period (Model 2).

Given that our hypotheses aim to assess whether area measures of social integration and economic disadvantage associate with the odds of suicide once individual-level characteristics are included, Model 3 is key because it suggests that both aggregate measures impact individual risk of suicide after accounting for all individual and aggregate characteristics. Controlling for individuals' educational achievement, employment status, and family income reduces the odds ratio of socioeconomic disadvantage from 1.13 to 1.07, suggesting that a sizeable proportion of the MSA-level effect is compositional. However, a contextual effect persists as the odds of suicide are 7% higher for every one unit increase in the MSA's socioeconomic disadvantage, even after controlling for individual-level indicators of disadvantage.

Individual covariates also attenuate the association between MSA family living (OR of 2.40 in Model 2 and OR of 2.03 in Model 3) but the enduring contextual effect is sizeable. Regardless of their own marital status and family size, persons living in the lowest family living type MSAs have odds of suicide that are twice as high as persons living in the highest family living MSAs. The odds of suicide for those respondents living in the second highest and second lowest family living type MSA are 40% and 85% higher, respectively.

The findings in Table 2 support the claims of Durkheim as well as many of the researchers who have contributed to the literature on the contextual effects of suicide: above and beyond the influence of area composition resulting from individual characteristics, context matters. For robustness, we divided our sample by gender and age and found little difference in the aggregate risk factors between men and women and between younger and older respondents (all results available upon request). Socioeconomic disadvantage was significantly associated with an increased suicide risk only for men but tests of significance across the models found the difference between men and women did not reach significance. Further, family living related powerfully to both men's and women's risk and both younger and older respondents.

DISCUSSION

Over a century ago, Durkheim argued that community social integration shaped rates of suicide. In the decades since, many scholars have claimed to empirically demonstrate the influence of various contextual factors on suicide rates. Research has primarily focused on how indicators of social integration and solidarity as well as social and economic disadvantage were associated with suicide rates. At the same time, investigators using individual-level data demonstrated the importance of marriage, employment status, parenthood, and dynamic individual-level factors in predicting the risk of suicide. The inability of area-level analyses to isolate conceptually distinct causal mechanisms gives rise to the concern that those findings may not be driven by contextual-level processes but are the result of area composition and the aggregation of individual-level relationships. And though researchers have examined this fundamental challenge to sociological inquiry across various health and achievement outcomes in the U.S. (Kawachi and Berkman 2003; Lopez Turley 2003; Sampson, Raudenbush and Earls 1997), we designate the potential error as the *contextual fallacy* and systematically investigate it with an enduring social problem as our outcome of interest. Doing this provides a basis from which researchers may theoretically and empirically develop and distinguish compositional from contextual effects across a number of relevant issues, including causes of ill health and mortality.

Using multilevel data and analyses along with links to prospective mortality records, our results suggest that area level measures of social integration and disadvantage do, in fact, directly influence the odds that a U.S. adult dies by suicide. The results demonstrate that respondents living in cities characterized by higher socioeconomic disadvantage were more likely to take their own lives than respondents living in less disadvantaged areas and, similarly, that respondents living in cities with a higher percentage of “family households” demonstrated lower risk of suicide compared to respondents living in cities with lower levels of family living. These findings were robust to the inclusion of individual-level indicators of socioeconomic standing and marital status and family size, respectively.

While it is difficult to empirically determine the mechanisms by which context exerts influence, our findings are consistent with previous statements that high rates of family households contribute to the stability and cohesion of a community, which in turn decreases non-normative and problematic behavior. Similarly, while we are unable to measure exactly why a city’s level of socioeconomic disadvantage is associated with suicide above and beyond the characteristics of the individual inhabitants, our findings offer general support to the claim that community-level disadvantage may have broad impacts on the mental and emotional well-being of residents (Kawachi and Berkman 2003) as well as the availability of opportunities for active community engagement (Sampson, Raudenbush and Earls 1997). Thus, prior evidence (Collings et al. 2009; Hawton et al. 2001; Maimon and Kuhl 2008; Martikainen, Maki and Blomgren 2004) combined with the results presented here suggests that communities can influence social integration and regulation, which can in turn influence longevity broadly, and the risk of suicidal death, specifically. Additionally, our analysis gets at the heart of the *contextual fallacy*: although both individual- and aggregate-level factors are associated with the risk of suicide mortality, they are not equivalent or interchangeable, and they need to be examined from a multilevel perspective.

Our investigation is not without limitations. One of these limitations is the length of the follow-up period as we are only able to assess characteristics such as marital and socioeconomic status at the time of the interview, not at the time of death. To explore the sensitivity of our effects we reran the analyses limiting the suicides under study to a shorter follow-up period (maximum of 5 years after the interview), which reduced the number of deaths by 60% but produced findings quite similar to the findings reported here (results available upon request). This type of measurement error would most likely work against our ability to establish statistically significant relationships and thus our estimates are more likely to be attenuated rather than exaggerated as a result of longer follow-up periods.

Second, the current research does not fully control for some unobserved individual-level characteristics—including depression, substance abuse, and religiosity (Li et al. 2011; Pridemore 2006; Stack 2000b)—that have been shown to influence suicide risk and contribute to a selection process by which individuals are more or less likely to marry or live with other family members. And, at the aggregate level, other potential indicators of social integration, such as migration patterns into and out of metropolitan areas would provide further tests of the contextual contributors to suicide risk.

Third, in order to maximize the size of our sample we assumed that the correlates of suicide would be consistent across the eighteen year interview period (1986–2004). For example, our analyses assume that the meaning of families in producing social integration and protections against suicide is the same across the long follow-up period. In fact, family formations and public opinion surrounding family structure, as well as the importance of family relationships for individual health, has changed and constitutes an interesting avenue of research in and of itself. To examine the sensitivity of the correlates of suicide risk over the period under study we divided the sample roughly evenly into an early (1986 to 1994) and late (1995 to 2004) period. Again, this left fewer suicide deaths for analysis but produced estimates that suggest no significant difference across the periods (results available upon request). Finally, we are matching aggregate data to individual records similar to researchers in the past (Crawford and Prince 1999). Despite the precedent, aggregate measures closer to interview may be preferred and future works might investigate using other data sources, such as the American Community Survey, to fill in the time gap between interview and area-level data.

As more mortality matches become available and the sample size increases, future research could build on our contributions in a variety of ways. In the realm of contextual analysis, we have attempted to answer the first question – Does context matter? Additional mortality matches would allow researchers to move past this initial question and test more explicitly how context might matter for individual suicide risk. Such analyses will include estimation of random effects and cross-level interaction models in which slopes for individual variables vary with area characteristics. While we conducted additional analyses to check for city-level interactions and cross level interactions between individual- and MSA-level measures, these models were preliminary and quite restricted by the limited number of suicides. The models interacting MSA-level socioeconomic disadvantage with the family living quartiles showed that the variables have independent direct associations, but interactions do not reach significance. And cross level interactions produced no new information. While this is

consistent with other studies showing that individual- and area-level measures both exert effects that may not vary by level of one or the other (Agerbo, Sterne and Gunnell 2007; Martikainen, Maki and Blomgren 2004), more examination could be informative.

In terms of theory, our findings support Durkheim's ([1897] 1951) classic arguments by demonstrating that the risk of suicide is indeed influenced by the social milieu, not just by individual-level factors. In terms of policy, our research can contribute to reducing the risk of suicide by encouraging more investment in both individual and area level resources aimed at fostering social integration and connectedness and eliminating socioeconomic disadvantages (Goldsmith et al. 2002; US Department of Health and Human Services 2012). Reducing suicide mortality can lengthen overall life expectancies *and* result in stronger, richer, more tightly-knit communities.

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Table 1

Descriptive statistics for individual- and MSA-level covariates.

MSA characteristics		mean	min	max
Socioeconomic disadvantage scale ^a		0.00	−2.37	7.00
Family Living Quartiles		sample proportion		
1st quartile, lowest		0.25		
2nd quartile		0.26 to 0.27		
3rd quartile		0.28 to 0.80		
4th quartile, highest		0.81		
Individual characteristics		Mean		
Age		44.1		
Race / ethnicity (non-Hispanic white, ref)				
Nonwhite		0.36		
Gender (female, ref)				
Male		0.46		
Marital Status (married, ref)				
Divorced or separated		0.11		
Widow		0.07		
Never married		0.20		
Family size				
One		0.16		
Two		0.30		
Three		0.20		
Four or more		0.34		
Education (more than high school, ref)				
Less than high school		0.21		
High school		0.34		
Employment status (employed, ref)				
Unemployed		0.04		
Not in the labor force		0.31		
Family income		\$35981		
Self-rated health		2.80		
Level 1 N ^b		979070		
Level 2 N		208		

Sources: 1986–2006 National Health Interview Survey-Linked Mortality Files. 1990 and 2000 decennial census files at the MSA-level.

^aStandardized scale created based on a principal components factor analysis and includes proportion high school educated or more, proportion unemployed, and proportion of households in poverty ($\alpha = 0.85$).^bPer our restricted data use agreements sample size rounded to the nearest 10.

Table 2

Summary of multilevel logistic regression showing odds ratios (OR) for individual- and MSA-level risks of suicide.

	Model 1	Model 2	Model 3
MSA characteristics			
Socioeconomic disadvantage	1.13 **		1.07 *
Family Living Quartiles (Highest, ref)			
1st quartile, lowest		2.40 **	2.03 **
2nd quartile		2.28 **	1.85 **
3rd quartile		1.54 **	1.40 **
Individual characteristics			
Age (continuous)			1.01
Age ²			0.99 *
Race / ethnicity (non-Hispanic white, ref)			
Nonwhite			0.41 **
Gender (female, ref)			
Male			4.34 **
Marital Status			
Divorced or separated			1.41 **
Widow			1.13
Never married			1.05
Family size (topped at 4+)			0.85 **
Education (more than high school, ref)			
Less than high school			1.26 **
High school			1.28 **
Employment status (employed, ref)			
Unemployed			1.45 **
Not in the labor force			1.45 **
Logged family income			1.01
Self-rated health			0.82 **
ICC	0.03	0.03	0.02
log likelihood	−10021.4	−9965.8	−9533.7
Level 1 N ^a	979070		
Level 2 N	208		

Sources: 1986–2006 National Health Interview Survey-Linked Mortality Files. 1990 and 2000 decennial census files at the MSA-level.

* p .05;

** p .01

^aPer restricted data use agreements sample size rounded to the nearest 10.