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An ecological analysis of US county-level suicide rates : an application of spatial patterning models

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AN ECOLOGICAL ANALYSIS OF US COUNTY-LEVEL SUICIDE RATES:
AN APPLICATION OF SPATIAL PATTERNING MODELS

A Dissertation

Submitted to the Graduate Faculty of the
Louisiana State University and
Agricultural and Mechanical College
in partial fulfillment of the
requirements for the degree of
Doctor of Philosophy

in

The Department of Sociology

by
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August 2013

This dissertation is dedicated

in loving memory of Maurie Jude Ledet

April 18, 1938- February 4, 2007

Those we love can never be more than a thought away

for as long as there's a memory,

they live in our hearts to stay.

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TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

ABSTRACT

Suicide has been studied sociologically since the late 19th century when theorists like Durkheim ([1897] 1951) found that the spatial patterning of suicides was not random. Looking beyond psychological troubles, suicide studies began to address the social factors that affected suicide rates. Building on the work of early scholars, contemporary studies mainly focus on variations in levels of social integration variables within communities to explain the nature of suicide rates. Many of these contemporary studies, however, only consider one type of social integration, like religion, and how variations in participation affect the suicide rate. To date, no study simultaneously considers multiple indicators of social integration nor focuses on the contextual environment these social integration variables create within communities in order to decipher if/where spatial regimes exist with regard to suicide in the United States.

The aim of this study was to use spatial patterning techniques to determine the extent to which religious organizations, civic community organizations, social isolation, and economic deprivation affected the social integration and infrastructure of communities thereby affecting the spatial patterning of suicide rates within the United States. Drawing from the civic community and social capital perspectives, communities with greater levels of integration have been found to have better health outcomes and lower levels of mortality than communities with low levels of integration (Lee 2010). Inversely, communities with higher levels of social isolation and economic deprivation have a weak community infrastructure, less social integration, low social capital, and low levels of civic engagement as evidenced by weak social networks, fewer civic institutions, and a sub-par public health infrastructure (Blanchard, Bartkowski, Matthews, and Kerley 2008; Lee 2010; Young and Lyson 2001). Therefore, the

presence or absence of integration factors shape the community environment, which in turn impacts the suicide rate of that community.

Specifically, the present study aimed to test the hypothesis that civically engaged communities, with low isolation and low economic troubles, produced a community environment that resulted in lower suicide rates, while communities that had high levels of social isolation and economic deprivation had lower chances for civic engagement and therefore suffered from higher suicide rates. Results showed, however, that each of these integration variables had a varying impact on the suicide rate in different regions, which led to the conclusion that spatial regimes exist in the United States.

CHAPTER 1: INTRODUCTION

This dissertation analyzed the ecological context and spatial patterning of suicide rates in the United States (US) for the beginning of the 21st century. While suicide has been studied sociologically for over 100 years, contemporary developments in suicide theory and statistical analysis paved the way for innovative and cutting edge analysis of suicide rates from an ecological perspective. This manuscript furthers contemporary studies of US suicide rates by focusing on the ecological and spatial perspectives.

Sociological interest in suicide dates back to the late 19th century when theorists like Masaryk, Tarde, and Durkheim promoted theories of suicide that looked past individual, psychological predictors to look at structural, environmental factors that were related to suicide rates. The vast majority of this research focused on how the specific aspects of the social context of a society or community (like religion or imitation) influenced suicide rates. Researchers of this time realized that individual choice alone could not account for suicide rates because of the patterned clusters of suicides across geographical space. In other words, the geographical pattern of suicide was and remains non-random (Durkheim [1897] 1951; Masaryk [1881] 1970; Tarde, 1903).

The United States has been experiencing a relatively steady increase in the rate of suicide since late 2000 (American Foundation for Suicide Prevention 2012). As of 2009, suicide was the tenth overall leading cause of death for persons over the age of 10 and the third leading cause of death for persons between the ages of 15 and 24, accounting for 36,891 deaths in 2009 alone (Kochanek et al. 2011). The most significant changes, however, have been for the age group 35-64. This group of middle age adults saw a substantial increase in the suicide rate from 1999-2010, from 13.7 suicides per 100,000 persons to 17.6 suicides (a 28.4% increase) (Centers for

Disease Control and Prevention 2013). In addition, the suicide rates in all four Census-defined geographic regions (Appendix A) increased significantly during this same time frame and the highest rate increases were for adults 35-64 (Centers for Disease Control and Prevention 2013).

Geographically, the US has a very extreme clustering of suicide rates (Centers for Disease Control and Prevention 2012a; McIntosh 2012). Between 2000 and 2006, suicide rates were highest in the western and northwestern regions of the US with rates as high as 84 suicides per 100,000 people in some counties, compared with rates as low as 5 suicides per 100,000 people in counties in other parts of the US (Centers for Disease Control and Prevention 2012a)[1]. Contemporary research shows that social integration factors are some of the key predictors explaining the geographical patterning of suicide rates (for examples, see Gibbs and Martin 1958, 1964; Pope 1976; Travis 1990), but these factors do not operate in all regions of the US to the same degree (Baller and Richardson 2002). Baller and Richardson (2002:885-886) found that suicide rates clustered in the same geographical areas where "internal structural predictors of suicide, including multiple measures of social integration, also cluster[ed] in space".

Ecological research on all-cause mortality has found that a community's infrastructure can affect the social integration of that community and ultimately community members' risk of mortality (Lee 2010). Strong civic communities are recognized as having various civic institutions available to residents, having residents that are engaged in their community, and strong economic and entrepreneurial activity within the community (Tolbert, Lyson, and Irwin 1998). Civically strong communities have also been found to have better health outcomes and lower rates of mortality (Lee 2010). In addition, strong civic communities have the ability to lobby for, secure, and maintain health facilities, and provide evenly distributed health care to all

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[1] Counties reporting less than 20 deaths during this time period are not reported in these statistics due to the fact that their rates are considered unreliable.

members of the community, which depresses the mortality rate in these communities, (Blanchard et al. 2008; Tolbert, et al. 1998; Young and Lyson 2001). In contrast, communities with high levels of social isolation and economic deprivation typically have lower chances for civic engagement and lower levels of trust and cohesion within the community, which can lead to a weak community infrastructure, worse health outcomes, and higher levels of suicide (Berkman 2000; Blanchard et al. 2008; House, Landis, and Umberson 1988; Kawachi and Berkman 2001; Lee 2010; Putnam 2000; Tolbert et al. 1998).

The theoretical link between community infrastructure and individual health is found within the social capital perspective. The social capital literature suggests that the availability of and participation in civic organizations promotes and enhances collective norms and community trust, which are central to the production of collective well-being, or social capital, in the community, better health outcomes, positive psychological states, and lower levels of mortality (Berkman 2000; House et al. 1988; Kawachi and Berkman 2001; Putnam 2000). Communities with opportunities for civic engagement, like religious congregations and civic community organizations, are expected to have increased community cohesion and solidarity and high levels of social capital, which should help to increase health outcomes, decrease mortality, and therefore lower suicide rates in these communities.

Researchers are aware, however, that communities are not acting independently and their spatial proximity to one another should be considered in a contemporary analysis of suicide rates (for examples, see Baller, Anselin, Messner, Deane, and Hawkins 2001; Baller and Richardson 2002; Congdon 2010; Wasserman and Stack 1995). In the past, researchers lacked sophisticated statistical techniques to address the spatial patterning of suicides. Researchers like Durkheim ([1897] 1951) relied entirely on maps that simply plotted suicide occurrences. Modern

3

techniques of spatial analysis, however, allow researchers to analyze the degree to which the spatial proximity of communities to one another can account for the clustering of suicides far beyond anecdotal clustering measurements. To date, however, spatial analysis techniques have almost exclusively been used to look at the spatial patterning of homicide rates in the US (for exceptions, see Baller and Richardson 2002; Congdon 2010; Wasserman and Stack 1995).

While researchers are aware of the spatial clustering of suicide, no single study of suicidal patterning has been able to demonstrate how variations in multiple social integration factors affect suicide rates across geographical areas in the US. To date, the study by Baller and Richardson (2002) is the only study of the geographical patterning of suicide to consider social integration in the spatial analysis of suicide rates. Their analysis of 1990 US county-level suicide data, however, does not consider many of the structural variables which affect community integration like civic community organizational participation, social isolation, and economic deprivation, and only considers the West/Non-West regions of the US. The aim of the present manuscript was to advance the study of suicide and suicide theory by providing a more comprehensive examination of the social integration and ecological factors associated with suicide in the US and to demonstrate how the presence or absence of these factors varies across communities in the US.

To address the lack of spatial research of suicide rates, the present study used data from the Centers for Disease Control and Prevention's (CDC) Compressed Mortality Files for 2001-2010, The Association of Religious Data Archives (ARDA) *Religious Congregations and Membership Study, 2000*, the Economic Census' County Business Patterns (CBP) and Census summary file 3 (SF3) and summary file 1 (SF1) from the 2000 Census to address the spatial patterning of suicide rates in the US. With these data, spatial maps were created to assess the

patterning of suicide rates across the US. It was found that the distribution of suicide rates in the US was not random, suggesting spatial autocorrelation of the county-level suicide rates. Further, it was found that the patterning of suicide rates presented spatial regimes depicting areas where the suicide rate was related to its geographic location (Baller et al. 2001). The regimes created represented the four Census-defined US regions, and they were incorporated into the multivariate analysis. While measures of social integration varied in each region, in general, it was found that counties with low rates of suicide had high levels of civic engagement (as measured by significantly high levels religious and civic participation) and low levels of social isolation and economic deprivation. Again, the specific impact of these social integration variables varied by regime and these variations will be discussed in detail.

The remainder of this dissertation is organized in the following manner: Chapter 2 discusses Durkheim's (1897) theory of suicide and the contemporary advancements and adjustments made to his theory by contemporary researchers. Chapter 3 reviews the contemporary suicide literature providing in-depth summaries of the suicide rate's relation to religious participation, civic community participation, social isolation, and economic deprivation. This chapter concludes with a summary of contemporary findings and a list of research hypotheses. Chapter 4 outlines the data, measures, and methods of this study. Chapter 5 presents the results from the data analysis. Finally, Chapter 6 provides an introduction/summary of the manuscript, major findings, research limitation and future research, limitations of the study, and conclusions.

CHAPTER 2: THEORETICAL OVERVIEW

Introduction

While Durkheim was not the first to write about suicide, he was the first to advance the scientific analysis of suicide utilizing a coherent sociological theory (Giddens 1965). The premise of his book, *Suicide: A Study in Sociology* (1897), was based on his belief that there was a clear difference between the psychological factors that caused someone to commit suicide and the suicide rate. He believed the factors influencing the suicide rate of communities or societies were markedly different than the factors influencing an individual's decision to commit suicide (Giddens 1965). Durkheim distinguished between four types of suicide, based on the social integration and regulation of that society, that acted to produced high rates of suicide within that society: egoistic, altruistic, anomic, and fatalistic suicide (Durkheim [1897] 1951).

This chapter, discusses the four types of suicide Durkheim postulated. It is necessary to begin here because Durkheim's work represents the point of departure for most contemporary studies and the remainder of the present manuscript. Then, it continues with a discussion of the contemporaries of Durkheim and how their work has departed from the four-type model into a singular theory of social suicide. This revised version of Durkheim's social suicide theory was used as the theoretical basis for the present manuscript.

Durkheim and Suicide

Emile Durkheim's book, *Suicide: A study in Sociology* (1897) is one of the most recognized of the classical studies of social suicide rates. Other theorists, like Masaryk (1881) and Tarde (1903) studied suicide as well but without the detail and absolute attention to society's role in the suicide rate. Therefore, any study focused on the social aspect of suicide should begin with a thorough overview and understanding of the classic study by Durkheim (1897).

Durkheim's book, typically referred to as *Suicide*, focused on variations in the level of communities' social solidarity, the extent to which groups are held together by various social factors, and how this solidarity (or lack thereof) affected suicide rates of a geographical area. Durkheim saw social integration and social regulation as two factors directly impacting social solidarity and believed there were four types of suicide which resulted from extreme levels of integration and regulation in a society: egoistic, anomic, altruistic, and fatalistic suicide. He stated that extreme levels of social integration could lead to egoistic and altruistic suicide while extreme levels of social regulation could lead to anomic and fatalistic suicide (Durkheim [1897] 1951).

Social Integration

Social integration refers to a collective state of mind and consists of the attachments, commitments, and obligations that bound humans to a collective group. "When society is strongly integrated, it holds individuals under its control, considers them at its service and thus forbids them to dispose willfully of themselves" (Durkheim [1897] 1951:209). Integration, therefore, is a positive aspect of community cohesion, but too much or too little integration can have detrimental effects on community solidarity and may lead to egoistic or altruistic suicide (Durkheim [1897] 1951).

Durkheim began his study by focusing on social integration and egoistic suicide. He stated that egoistic suicide was present when there was minimal integration of a person into society, which then led the person to be separated from society (Durkheim [1897] 1951). Durkheim ([1897] 1951) believed that egoistic suicide varied inversely with the degree of integration of the social factors religion, family, and political society.

Durkheim ([1897] 1951:170) believed that religion had a protective effect because it allowed the individual to be part of a society, "the stronger the integration of the religious community, the greater its preservative value". Durkheim ([1897] 1951:170) found that Protestant countries had higher suicide rates than Catholic or Jewish countries "because the Protestant church has less consistency than the others, it has less moderating effect upon suicide". Durkheim also looked at the effect of domestic society (essentially the nuclear family) and found that like religious society, the domestic society was also "a powerful counteragent against suicide" (Durkheim [1897] 1951:198). His results showed that "immunity [from suicide] increases with the density of the family, that is the number of its elements" (Durkheim [1897] 1951:198). Finally, Durkheim looked at the association between political society and egoistic and he found that political disturbances and national wars provided a protective effect against suicide when the people of the country were passionate about the cause. He thought lower suicide rates during these times were due to higher social integration where the people thought less of themselves and more for the common cause (Durkheim [1897] 1951:208).

Durkheim's ultimate conclusion with regard to egoistic suicide was that it varied inversely with the degree of integration of religious society, domestic society, and political society. He concluded that the only quality possessed by each of these groups was that they were each strongly integrated social groups. As such, he reached the general conclusion that "suicide varies inversely with the degree of integration of the social groups of which the individual forms a part" (Durkheim [1897] 1951:209). Social groups with high levels of integration have lower levels of suicide compared to groups with only moderate integration among its members (Durkheim [1897] 1951).

The second type of suicide Durkheim explored was altruistic suicide. While insufficient integration led to egoistic suicide, excessive integration led to altruistic suicide. The decision to commit suicide was made by or for the group to which the individual belonged. While each of the examples of altruistic suicide presented by Durkheim was represented by primitive societies, he stated that altruistic suicides could also be present in modern civilizations. He used the examples of Christian martyrs and soldiers. In both instances, the individual renounces life for something they love better than themselves- their religion or their country (Durkheim [1897] 1951).

Social Regulation

The other two major types of suicide that Durkheim discussed in his book focused on the social regulation aspect of social solidarity. Social regulation refers to the "power controlling [individuals]" in society (Durkheim [1897] 1951:241). As with social integration, too much or too little regulation may lead to increased levels of suicide.

The first type of suicide related to social regulation was anomic suicide. Durkheim ([1897] 1951:258) believed that anomic suicide was found in societies, which had too little social regulation. Durkheim ([1897] 1951:246) found that both times of crises and prosperity had increased suicides "because they are crises, that is, disturbances of the collective order".

In his analysis, Durkheim focused on economic, occupational, and domestic anomie to illustrate how anomic suicide presented itself. Durkheim ([1897] 1951:241) noted that economic crises like market crashes and increases in bankruptcies had an "aggravating effect on suicidal tendencies" because these crises make it more difficult for people to achieve expectations. However, Durkheim ([1897] 1951:243) noted that "even fortunate crisis, the effect of which is to abruptly enhance a country's prosperity, affect suicide like economic disasters". In these

instances, individuals' expectations rise, causing a similar rise in suicides. Durkheim thought that the only insulation from suicide related to economic crisis and prosperity was poverty.

In relation to economic pressures, Durkheim ([1897] 1951:257) stated, "Industrial and commercial functions are really among the occupations which furnish the greatest number of suicides" because these occupations had the potential to produce the most comfort and therefore the most suffering as well. Again, Durkheim saw poverty as an insulator from suicide due to the fact that those in the lower classes are limited by those above them, keeping their desires modest (Durkheim [1897] 1951).

Durkheim also recognized that widowhood, or a similar change in the family structure, could cause increases in suicides because "he is not adapted to the new situation in which he finds himself and accordingly offers less resistance to suicide" (Durkheim [1897] 1951:257). "The uncertainty of the future plus his own indeterminateness therefore condemns him to constant change. The result of it all is a state of disturbance, agitation, and discontent which inevitably increases the possibilities of suicide" (Durkheim [1897] 1951:271).

Durkheim's fourth and final type of suicide was known as fatalistic suicide and was found only in a footnote in his book. Durkheim did not discuss this type of suicide in much detail because he believed it had little contemporary importance and if it did exist, cases were difficult to find.

Summary of Durkheim's *Suicide*

To summarize Durkheim's analysis of the four types of suicide, he believed that suicide was not an individualistic action. Rather, it presented itself based on the level of social solidarity and cohesion within the society that individuals were a part of; too much or too little integration or regulation between individuals and their society lead to increased rates of suicide. Ritzer

(2000) argues that Durkheim makes two basic arguments through his analysis: 1) different societies have different collective consciousness (solidarity) and therefore different suicide rates; and 2) changes in the collective consciousness are associated with changes in suicide rates. This was evidence to Durkheim ([1897] 1951) that the suicide rate could only be studied sociologically. Therefore, Durkheim's ([1897] 1951) study emphasized the importance of studying social groups and societies both in solidarity and in comparison with one another due to the fact that integration and regulation manifest with different degrees in the context of the social environment to which the groups are surrounded (Bradatan 2007).

Durkheim's ([1897] 1951) analyses of the four types of suicide also gave future researchers a basis for choosing social and contextual variables which influence the suicide rate. Those variables typically include religious participation, presence of family or the lack thereof, and economic and occupational pressures. These variables first introduced by Durkheim as still seen as indicators of social integration in contemporary studies of the social nature of suicide because these indicators have been found to change the solidarity of communities which in turn affects suicide rates.

Contemporary studies have attempted to replicate Durkheim's ([1897] 1951) findings, apply his theories and findings to other nations around the world, and dispute various aspects of Durkheim's work. The next section highlights some contemporary studies that have attempted to confirm and/or challenge Durkheim's iconic study of suicide.

Contemporary Studies of Suicide

Durkheim's ([1897] 1951) book on suicide has been the departure point for many in an attempt to advance the understanding of the social context and social factors affecting suicide rates today. Modern analyses of Durkheim's theory of suicide have led many to conclude that

while Durkheim argued for four types of suicide based on varying levels of integration and regulation, his theory really implied that there is only one cause of suicide - social integration (Gibbs and Martin 1958, 1964; Johnson 1965; Pope 1976; Travis 1990).

Durkheim (1897[1951]) stated that egoism and egoistic suicide resulted from a lack of integration into society, which caused one to be separated from society and to have no collective conscience. The argument which precedes this is that if one experiences a lack of interaction with their society and therefore has no collective conscience with it, then it follows that that society also lacks social regulation upon that individual (Henry and Short 1954; Johnson 1965). Because adequate levels of regulation cannot exist without adequate levels of integration, the two concepts should be treated as one, namely social integration (Johnson 1965; Pope 1976). Consequently, if regulation is a part of integration (not separate from it), then anomie is merely one aspect of egoism (Johnson 1965).

In addition, Gibbs and Martin (1958; 1964) argued that Durkheim ([1897] 1951) himself supported the notion that a lack of regulation underlies anomic suicide but a lack of integration is also responsible. Although he separated integration and regulation in his study of suicide, Durkheim himself saw that the two were one in the same:

> "Two factors of suicide especially have a peculiar affinity for one another; namely egoism and anomy. We know that they are usually merely two different aspects of one social state; thus it is not surprising that they should be found in the same individual" (Durkheim [1897] 1951:288).

If integration and regulation are found within the same individual, then they must be considered simultaneously in their relation to suicide rather than separate (Johnson 1965). Therefore, Durkheim's model (arguably) only considers varying levels of social integration (Gibbs and Martin 1958, 1964; Johnson 1965; Pope 1976; Travis 1990).

More recent studies of suicide have accepted this assertion and agree that Durkheim often merged the concepts of egoistic and anomic suicide into one cause (social integration) for both concepts (for examples, see Baller and Richardson 2002; Gibbs and Martin 1958, 1964; Pope 1976; Travis 1990). Pope (1976:48) depicted the ways both egoistic suicide (due to low integration) and anomic suicide (due to low regulation) can result from either a loss of meaning or a means/needs imbalance. In her interpretation, she argued Durkheim's explanation of integration/regulation and egoistic/anomic suicide can both result from the same social forces and therefore can be linked to one overarching social force- social integration (Pope 1976). Due to the overwhelming support for this view of Durkheim's theory of suicide (for examples, see Baller and Richardson 2002; Gibbs and Martin 1958, 1964; Pope 1976; Travis 1990), the present manuscript focuses on various social integration factors associated with suicide rather than focusing on varying types of suicide.

Summary

Durkheim's *Suicide* (1897[1951]) is typically seen as the first major contribution to the social study of suicide. He postulated there were four different types of suicide with each related to extreme levels of integration or regulation. His theory has evolved in modern times in an attempt to clarify his thesis and to also utilize modern statistical techniques to test his theory. Modern studies have accepted the fact that while Durkheim believed integration and regulation acted separately, regulation is actually part of integration and not separate from it (for examples, see Baller and Richardson 2002; Gibbs and Martin 1958, 1964; Pope 1976; Travis 1990).

Therefore, modern studies typically focus only on the social integration of a society or community when studying suicide rates. Communities with high levels of social integration are recognized as being civically engaged due to the various civic institutions available to residents,

13

having residents that are engaged in their community, and strong economic and entrepreneurial activity (Tolbert et al. 1998). In addition, because increased social integration promotes and enhances community cohesion, collective norms and community trust, better health outcomes, and positive psychological states, communities with high levels of integration have also been found to have lower rates of mortality (Berkman 2000; House et al. 1988; Lee 2010; Kawachi and Berkman 2001; Putnam 2000). Specifically, this manuscript focuses on the impact religious congregations, civic community organizations, social isolation, and economic deprivation have upon community integration and infrastructure and how this integration, or lack thereof, is reflected in the suicide rates of these communities.

The next chapter expounds the discussion of social integration and suicide by delineating specific aspects of social integration which were first introduced by Durkheim in his study of *Suicide* (1897 [1951]), and recent findings regarding how these social integration variables are related to the suicide rates in modern societies. Although Durkheim's theory has changed over time, some of the same social integration variables that he used to describe his four types of suicide are still used in suicide studies today as indicators of community-level social integration.

CHAPTER 3: LITERATURE REVIEW

Introduction

This section begins with a discussion of contemporary literature focusing on each of the

social integration factors which have the strongest effects on the social context of communities

and therefore the spatial patterning of suicide rates in the US: religious organizations, civic

community organizations, social isolation, and economic deprivation. These are some of the

same social forces that Durkheim considered in his study of *Suicide* (1897 [1951]). Unlike

Durkheim's study, however, types of suicide are irrelevant due to the fact that recent studies

have determined that social integration alone is the true driving force behind social suicide rates

(Baller and Richardson 2002; Gibbs and Martin 1958, 1964; Pope 1976; Travis 1990).

This chapter begins with a discussion of two types of civic engagement, religious and

civic organizations, and how participation and community presence of each affects the social

integration and cohesion of communities. Durkheim ([1897] 1951:170) believed that religion had

a protective effect because it allowed the individual to be part of a society, "the stronger the

integration of the religious community, the greater its preservative value". Contemporary

literature has found that both religious organizations and civic community organizations provide

resources to a community, such as social networks, social trust, and cohesion, which help protect

the community from criminal and deviant activities (Lee and Bartkowski 2003; Putnam 2000).

"The essence of civic engagement involves active participation in the social and political

institutions that foster social ties, promote social trust, enhance the development of shared norms

and values, and often focus on the achievement or production of locally oriented social goals and

goods" (Lee 2008:454). In addition, social interaction variables have a greater effect on the

suicide rate than other factors such as mood disorders or type of occupation (Duberstein et al. 2004).

While both religious and civic organizations provide similar benefits to their community, it is also the case that there are variations in communities' availability and participation in each of these forms of civic engagement as well as regional variations in availability and participation (Lee and Bartkowski 2003). Therefore, religious organizations' and civic community organizations' impact on the suicide rate are considered separately in this chapter.

Next, the impact of social isolation[2] on the suicide rate is considered. Social isolation is both the emotional and physical absence of others at moments of crisis (Trout 1980). Isolation can occur in both urban and rural settings. Emotional isolation is measured by looking at single person households and the proportion of the population divorced or widowed in communities. Durkheim ([1897] 1951:198) stated that "immunity [from suicide] increases with the density of the family, that is the number of its elements" and a stronger and larger family unit can protect members from suicide. In a solitary living arrangement, one is emotionally isolated from others resulting in low levels of contact and integration with others and their community (Kposowa 2000; Trout 1980).

Isolation from others can occur in very physically isolated places as well where neighbors, family, and basic services are physically distant and community members are great distances from one another. Physical isolation, measured by population density, is typically associated with suicide because it physically limits the civic engagement and social integration of persons due to increased distance between community members and lack of basic services in

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[2] In this paper, the term social isolation represents the physical isolation of one person from others. This is in contrast to the same term used by W.J. Wilson in writings proceeding Trout (1980) in which Wilson used the term to represent a break between individuals and mainstream society due to the concentration of urban poverty (Sampson and Wilson 2005).

the community (Trout 1980). In either emotional or physical isolation, the outcome remains the same; isolation can indirectly lead to suicide increased suicide rates.

Finally, this study investigates the impact of economic deprivation upon the suicide rate. Durkheim ([1897] 1951) believed three economic factors were associated with suicide: economic crisis, economic prosperity, and poverty. In a first-of-its-kind study by Luo et al. (2011), research confirmed Durkheim's ([1897] 1951) thesis that poor economic conditions can be a factor linked to increasing suicide rates but discounted his assertion that times of prosperity and rapid change can also cause increases in the suicide rate. With regard to poverty, while Durkheim ([1897] 1951) believed that it could insulate one from suicide because it provided restraint and self-discipline, researchers today find that poverty is no longer an insulator from suicide in modern times (Fedden 1938; Hamermesh and Soss 1974; Rehkopf and Buka 2006; Stack 2000). Therefore, there is evidence that both poor economic conditions and poverty are related to suicide rates.

Religion and Suicide

Religion has been a main focus of the social research on suicide due mainly to the work of Durkheim (1897 [1951]). Many recent studies have moved away from Durkheim's denominational approach to religion and suicide, however, due to findings that show no denominational differences in the suicide rate at various levels of analysis (Bainbridge 1989; Bainbridge and Stark 1981; Bankston, Allen and Cunningham 1983; Pope 1976; Pope and Danigelis 1981; Stack 1980, 1981; Stark, Doyle, and Rushing 1983). Instead, contemporary studies look at *any* religious participation as an agent of social integration capable of dampening the suicide rate in communities. It is commonly believed that because religious participation promotes high moral values, acceptance of legal authority, and belief that one can be punished

for violations of the law by both the legal authority and in the supernatural world, religious people should have lower rates of suicide than those who are not religious (Hirschi and Stark 1969). Religious congregations provide a place for members to be helped by pastors and other members, are socially integrated into the community, and provide otherworldly intervention when necessary (Stark et al. 1983). If religion offers real guidance and comfort, then its influence should be present in its diminishing effect on crime and deviance, including suicide (Stark et al. 1983).

In a study of the relation between religiosity (measured by church attendance) and adolescent deviance (measured by various acts of theft, vandalism and assault), Hirschi and Stark (1969) found no relation between the two. Conventional thinking would have one believe, however, that religiosity would have a negative effect upon deviance rates. Therefore, when Hirschi and Stark (1969) found no relation between church attendance and deviance, many began to question how this finding could be.

In a later study, Burkett and White (1974:456) point out that the deviant acts measured by Hirschi and Stark (1969) are frowned upon not only by churches but also by "any other respectable body of opinion outside the religious community." This could account for the finding of "no relation" between religiosity and deviance in the Hirschi and Stark (1969) study. A more appropriate measure of correlation between church attendance and delinquency should focus on acts seen as deviant by churches but condoned by the secular community (Burkett and White 1974). The findings of Burkett and White's (1974) study show deviant acts like smoking marijuana and underage drinking do, in fact, have a relationship with church attendance. Those youth who have higher rates of church attendance, have lower levels of these types of deviance. This led Burkett and White (1974) to conclude that religiosity can have an effect on certain types

of deviant acts; namely on those acts condemned by the religious community but not the secular community (like suicide).

Similar studies have been conducted using church membership (the number of persons belonging to churches) rather than church attendance (those self-reporting actually attending church) to study religion's relationship to varying types of deviance, including suicide. Bainbridge (1989) looked at the deterring effect of religious membership on suicide, crime, homosexuality, and cultism. Essentially, he was interested in testing the effect religion had upon these varying crimes and acts of deviance. Bainbridge (1989) found a substantial negative correlation between church membership and the suicide rate.

Additional studies, which also looked at the effect of church membership on suicide rates, also found that church membership (regardless of religious denomination) depressed the suicide rate (Pope and Danigelis 1981; Stark et al. 1983). In an extensive macro-level study of various social integration variables, Breault (1986) found that church membership was one of the strongest deterrents of suicide between 1933 and 1980 at both the state and county level. In addition, he noted the West was consistently higher in suicide, lower in church membership, and lacked social integration (Breault 1986). Findings from these studies confirm Burkett and White's (1974) assertion that religiosity can affect certain types of deviant acts, like suicide. It is evident that while religion does not have an effect on all types of crime and deviance, there is evidence that religiosity (as measured by church attendance or church membership) does have an effect on suicide rates; namely as religiosity increases, the suicide rate decreases.

In more recent literature, the bridge between religion and its depressing effect upon mortality in a community has been explained from an ecological point of view (Blanchard et al. 2008; Lee 2010 Tolbert et al. 1998). The argument from the ecological standpoint is that it is not

necessarily the case that only those who are religious are less likely to commit suicide. Rather, having a community that is religious or has an abundance of religious organizations creates a moral community environment which cultivates a distinct social context within the community that is not present in communities lacking religiosity or religious organizations (Blanchard et al. 2008; Lee 2010 Tolbert et al. 1998). Blanchard et al. (2008) refer to this as a religious environment. The religious environment of a community is a major component of the social structure of the community. They find evidence that having a robust religious environment exerts a cultural influence on community residents by influencing social networks, collective conscience, and a willingness to invest in public health, which all influence rates of mortality in the community (Blanchard et al. 2008). Communities with a robust religious environment have residents who are engaged with their community (social integration) and have a mutual willingness to collectively invest in and maintain public health services, which can help to depress mortality (Blanchard et al. 2008), including suicide rates. Therefore, in the ecological framework, it is not necessary to measure church membership or church attendance, but rather congregation presence in the community, in order to capture the effect religion has upon the community's suicide rate.

Although the religious environment can help to reduce suicide rates, religious involvement has become less pervasive over the past century and continues to be less and less influential as secularization takes over the modern world (Hout and Fischer 2002; Pope and Danigelis 1981). The percentage of people who reported having "no religion" in 1990, doubled in 2000, from 7 percent to 14 percent (Hout and Fischer 2002). If religion is becoming less important in modern times, then its impact upon the suicide rate should be visible. While religion is one social integration component affecting the suicide rate, other social forces are also at work

helping to keep the suicide rate relatively steady. As religious organizations decline in size and

impact in communities, they are replaced by other organizations that can provide the social

structure and integration within communities that religion once provided.

Civic Community Organizations and Suicide

The second form of civic engagement included in this study focuses on civic community

organizations[3]. These organizations, such as the boy scouts, YMCA, or Knights of Columbus,

give community leaders the opportunity to influence the moral and social development of

community members (Rotolo 1999). Whether religious or secular, these organizations provide

support to the community inhabitants and may protect the community from various forms of

crime and deviance, including suicide (Lee and Bartkowski 2003; Lee 2008; Rotolo 1999).

Research considering the link between civic community organizations and their

dampening effect upon the suicide rate is lacking, and this manuscript is the first to explore this

relationship. Most macro-level studies of civic community organizations focus on the link

between organizational participation and crime rates. These studies have found that communities

with higher levels of civic community organizational participation have lower crime rates (Lee

and Bartkowski 2003; Messner and Rosenfeld 1994; Sampson and Groves 1989). If we infer that

the impact civic community organizations have upon diminishing the crime rate similarly

influences acts of deviance, it can be hypothesized that the suicide rate is similarly affected by

the presence of civic community organizations.

Lee and Bartkowski (2003:10) state "it is widely assumed that civic participation

provides a forum through which mainstream middle-class norms that do not condone violence,

and more generally crime, are transmitted". These norms transferred to residents' belief systems

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[3] Civic community organizations include both religious organizations, like the Knights of
Columbus, as well as secular organizations.

can be found in all strata of the socioeconomic classes in the community (Anderson 1999; Wilson 1996). In addition, civically engaged communities "should function with shared normative understandings of acceptable and unacceptable behavior" (Lee and Bartkowski 2003:1011). Communities with high levels of civic community organization participation benefit in a variety of ways including having lower levels of poverty, unemployment rates, lower violent crime rates, and higher median incomes (Lee 2008; Lyson, Torres, and Welsh 2001; Rosenfeld, Baumer, and Messner 2001; Tolbert et al. 1998). It is reasonable to assume that the same norms present in communities with a strong civic participation base which help to protects it from high crime rates may also help to protect the community from high suicide rates.

In addition to a presence of shared community norms, Putnam (2000) suggested that civic participation also helps to build social networks and community trust. Collectively, these social forces are known as social capital. Research has found that communities with higher levels of social capital have lower crime rates (Anderson 1999; Rosenfeld et al. 2001; Sampson and Groves 1989). It is therefore inferred that communities with higher levels of social capital will also have lower suicide rates.

Trends in civic organization participation in the United States have shown an increase in participation since 1985 (Rotolo 1999) which has remained steady through the late 1990s (Andersen, Curtis and Grabb 2006). Baumgartner and Walker (1988) found a steady increase since 1952 in the number of associations in the US as well as overall participation in organizations, which suggests an increasing demand for civic organizations in communities. The increase in overall civic organizational availability and participation in the US, while religious affiliation has decreased, could account for the changes in the suicide rate over this same time

period. Civic organizational participation may now assist in providing the "buffer" that religion alone once provided.

Religious and civic participation provide physical social interaction among members, which helps to foster ties between members and their community at large (Lee 2010; Tolbert et al. 1998). Some parts of the US, however, do not have the opportunity to provide the social integration necessary to foster community cohesion and social capital. This can be due to a lack of religious and community organizations or because of physical and emotional isolation from religious and secular organizations and others in the community. The next section focuses on how isolation is related to suicide.

Social Isolation and Suicide

The emotional and physical absence of relevant others in our life, commonly referred to as social isolation, is another social factor found to be significantly related to suicide. Trout (1980:10) defines social isolation as "a state in which interpersonal contacts and relationships are disrupted or nonexistent." This form of social isolation can be found in people who live alone (Kposowa, Breault, and Singh 1995; Murphy and Robins 1967; Pierce 1977; Shneidman and Swenson 1969), who have recently lost a spouse (due to divorce or death) (Choron 1972; House et al. 1988; Kposowa 2000), or who live in very remote areas far removed from others (Frankel and Taylor 1992; Hirsch 2006; Wagenfeld, Murray, Mohatt, and DeBruyn 1994; Wilkinson and Israel 1984). Therefore, isolation can occur because one is physically removed from the presence of others or it can occur because one is emotionally removed from contact with others. Studies have found that social isolation or diminished social integration is associated with deteriorated health conditions (psychological and physical) and increased likelihood of death (House et al. 1988). In fact, the health outcomes for persons with a lack of social relationships rivals the health

risks associated with smoking, high blood pressure and obesity (House et al. 1988). While not a direct causation, social relationships provide protective health benefits through social support by diminishing psychological stress and other health hazards (Cassel 1976; Cobb 1976).

Social isolation is an important factor in suicide research because as Dublin (1963:167) stated, "The major intervention against [suicide] is the meaningful presence of other people at the moment of crisis". Murphy and Robins (1967) found that those who experienced a crisis (due to depression or alcoholism) represented the majority of suicides in an urban city. Among these suicides, they found the main difference between suicides with depression and the general population was the fact that those committing suicide were more likely to be living alone (Murphy and Robins 1967). Of the suicides among alcoholics, 32% experienced a disruption in affectional relationships (divorce or separation) within six weeks of their suicide and/or were living alone (Murphy and Robins 1967). Being deprived of contact with family and/or friends, during moments of crisis can cause one to become lonely, uninterested, and/or uninvolved. This state can lead to higher rates of suicidal feelings, suicide attempts, and suicide completions (Carstairs 1961; Paykel, Myers, Lindenthal, and Tanner 1974).

Many other studies of US cities, counties, and states, have also found that persons living alone, divorced persons, widowed persons, and separated persons have higher rates of suicide than the general population (Choron 1972; Duberstein et al. 2004; Grove and Hughes 1980; Hempstead 2006; House et al. 1988; Li 1974; Pierce 1977; Shneidman and Swenson 1969; Stack 1980). Based on a myriad of research looking into social isolation and risk of suicide, Trout (1980) concluded that lack of social involvement and solitary living had a primary and direct role in completed suicides. Through a lack of contact with relevant others and/or lack of help/response to suicidal feelings and behaviors, a state of isolation is confirmed and risk of a

suicide attempt or completion becomes a viable option (Quevillon and Trenerry 1983; Trout 1980). While many studies of social isolation base their findings on individual level analyses, these findings nonetheless have important implications to the ecological study of suicide rates, and can be used to inform macro-level researchers to community level attributes associated with elevated suicide rates.

Maris (1969) noted that social isolation is often a symptom of physical (geographic) isolation. Therefore, another way to measure social isolation is to look at the geographic isolation of persons via population density; having fewer people in a given area is indicative of increased distance between and isolation from others. Studies looking at the population density of various levels of analysis (city, county, and state) have found that areas with low population density have higher rates of suicide (Frankel and Taylor 1992; Hempstead 2006; Wilkinson 1982; Wilkinson and Israel 1984). Additionally, areas labeled as rural (low population density) have higher suicide rates than urban areas (Besson 2000; National Center for Health Statistics 2001; Wagenfeld et al. 1994).

Dispersion of population affects the suicide rate because it limits the positive effects that can come from community living, like the presence of civic community organizations, social services and facilities, and opportunities for social interaction (Wilkinson 1982; Wilkinson and Israel 1984). In a study looking at population density and suicide rates, among the seven states in the US with the highest suicide rates in 1988, each had a population density of less than 32 people per square mile, far below the national average of 72 people per square mile (Frankel and Taylor 1992). Conversely, of the 11 states (and the District of Columbia) with the lowest suicide rates, 9 had a population density greater than 200 people per square mile (Frankel and Taylor 1992).

Geographic social isolation limits one's ability to readily obtain support from others in times of crisis (Dublin 1963; Murphy and Robins 1967; Quevillon and Trenerry 1983; Trout 1980; Wilkinson and Israel 1984). Measures of low population density and high proportions of single person households have been found to be correlated with high suicide rates (Frankel and Taylor 1992; Hempstead 2006; Wilkinson 1982; Wilkinson and Israel 1984). As with low religious and secular organizational presence, an increase in social isolation limits the community's ability to provide civic engagement and social capital among its members.

Economic Deprivation and Suicide

Durkheim ([1897] 1951) thought that the only insulation from suicide related to economic crisis and prosperity was poverty. Durkheim ([1897] 1951) believed periods of economic crisis, economic prosperity, and poverty were associated with increased suicide rates. Because recent studies look at each of the factors individually, the association between each economic factor and suicide is discussed separately.

While Durkheim ([1897] 1951) believed both economic crisis and prosperity caused increases in suicide rates due to disruptions in the collective order, others have found contradicting evidence. Luo et al. (2011) conducted a study looking at US business cycles (recessions and expansions) and the suicide rate from 1928-2007. This comprehensive study was the first of its kind and provided empirical evidence on how economic recessions and expansions affected the overall US suicide rate over an extended period of time. Using unemployment and gross domestic product to measure economic conditions, Luo et al. (2011) found that "the overall suicide rate generally increased in recessions, especially severe recessions that lasted longer than one year. […] and mostly fell during economic expansions". Specifically, people in prime working ages (25-64 years) were found to be most affected by the recession (Luo et al. 2011).

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They note that during expansion periods the economy experienced both fast growth and low unemployment but not increases in suicide (Luo et al. 2011). These findings confirm Durkheim's thesis that poor economic conditions can be a factor increasing suicide rates but discount his assertion that times of prosperity and rapid change also cause increases in the suicide rate.

Durkheim ([1897] 1951) also believed that poverty could insulate one from suicide because it provided restraint and self-discipline. In modern times, however, we find that poverty is no longer an insulator from suicide (Fedden 1938; Hamermesh and Soss 1974; Rehkopf and Buka 2006; Stack 2000). In fact, Hamermesh and Soss (1974) found suicide rates were generally lower among higher-income groups, thus arguing that *wealth* was actually an insulator from suicide. Fedden (1938:54) points out that poverty can be an important cause of suicide in modern society due to our increasingly materialistic nature. In a similar study, Rehkopf and Buka (2006) reviewed 86 publications from 1897-2004 and their analysis of the ecological relationship between socioeconomic status (SES) of place and suicide. The majority (70%) of the analyses found a significant negative relationship between SES and suicide (Rehkopf and Buka 2006). In other words, impoverished areas had higher rates of suicide than those with higher SES.

One aspect of poverty that Durkheim did not consider is economic inequality (relative deprivation). Recent studies have found an association between the size of the income gap between the rich and poor and suicide rates in affluent countries (Kaplan et al. 1996; Kawachi and Kennedy 1997; Kawachi, Kennedy, Lochner, and Prothrow-Smith 1997; Kennedy, Kawachi, and Prothrow-Stith 1996; Lynch, Smith, Harper, and Hillemeier 2004; Wilkinson 1992). The negative association indicates that the greater the dispersion of income within a given society, the lower the life expectancy (Kawachi and Kennedy 1997). In a 100-year national study of income inequality and mortality, Lynch et al. (2004) found evidence for a relationship between

income inequality and suicide noting that the 100-year trends in suicide resemble the trends in income inequality. Interestingly, only trends in suicide and homicide mortality had evidence of this association.

Income inequality is associated with increased mortality due to under-investment in human capital (Kaplan et al. 1996) and a loss of social cohesion and disinvestment in social capital (Wilkinson 1992). Kawachi et al. (1997) tested the idea that social capital was a mediating factor linking the association between income inequality and mortality. They found that income inequality was strongly correlated with group membership and lack of social trust, and both group membership and social trust were associated with mortality, supporting their hypothesis (Kawachi et al. 1997).

Summary and Statement of Research Questions

Durkheim (1897[1951]:133) predicted that the geographic clustering of suicides was due to the clustering of social integration variables; "this diffusion [of suicide rates] within a single region may well spring from an equal diffusion of certain causes favorable to the development of suicide, and from the fact that the social environment is the same throughout the region". Durkheim ([1897] 1951) believed that extreme levels of social integration (too low or too high) led to high levels of suicide for that region due to the social environment created.

As evidenced in the literature above, the presence of religious and community organizations within communities creates a social environment that fosters increased civic participation, strong social networks, high levels of trust, and community cohesion (Blanchard et al. 2008; Lee 2010; Tolbert et al. 1998). Together, these characteristics help to create a community infrastructure that promotes better health outcomes and lowers levels of mortality, including suicide (Lee 2010). Therefore, areas of the US with high levels of civic engagement, as

measured by the presence of religious and civic organizations, should have lower levels of suicide than areas with low levels of civic engagement.

Areas of the US plagued by a lack of community cohesion and social networks due to isolation and poor economic conditions have worse health outcomes (Fedden 1938; Frankel and Taylor 1992; Hamermesh and Soss 1974; Hempstead 2006; Rehkopf and Buka 2006; Stack 2000; Wilkinson 1982; Wilkinson and Israel 1984). Therefore, areas of the US with high levels of social isolation and economic deprivation should also have lower civic engagement and higher rates of suicide than areas with low levels of social isolation and economic deprivation and high civic engagement.

In a case-control study comparing 86 suicides with 86 comparable living controls, Duberstein et al. (2004) found that those committing suicide were more likely to have been never married, widowed, divorced, and have no children, and were less likely to participate in religious or civic community activities and have lower levels of overall social interaction, even after controlling for mental disorders. While this is an example of individual-level analysis, this small-scale study shows support for the association between a majority of the social integration variables previously mentioned (religious participation, civic community participation, and social isolation) and their effect on suicide, above and beyond the effect of psychological factors. Arguably, these findings give merit to the idea that suicide should be studied from an ecological perspective and through a macro-sociological lens.

While the previously mentioned literature has attempted to explain suicide rates sociologically, much of the literature has ignored the spatial clustering of suicide rates. In a country as diverse as the US, suicide research should test for spatial autocorrelation and adjust for multicollinearity in the data. Failing to do so can lead to false results. Using previous

literature of suicide studies as a base, this study advances the understanding of suicide by not only using spatial analysis, but also considering four social integration variables associated with civic engagement and social capital which are thought to affect suicide rates of communities. Focusing specifically on religious congregations, civic organizations, social isolation, and economic deprivation, this study uses spatial analysis techniques to depict how these measures of social integration affect the social context and infrastructure of communities in the US and therefore shape the geographical patterning of suicide rates across the US.

Based on previous research, the specific hypotheses for this study are as follows:

Hypothesis 1: Regions with a higher per capita rates of churches and civic organizations will have lower suicide rates due to increased opportunity for civic engagement in the community.

Hypothesis 2: Regions with lower social isolation rates will have lower suicide rates due to increased opportunity for civic engagement in the community.

Hypothesis 3: Regions with lower economic deprivation rates will have lower suicide rates because more economically prosperous areas typically have higher levels of civic engagement (which helps to depress suicide rates).

CHAPTER 4: DATA, MEASURES, AND METHODS

Introduction

The current study measures various forms of social integration in order to ascertain how the presence of each affects the social context of the community thereby affecting the suicide rate of that community. In particular, my research answers the question: Is the geographic patterning of suicide rates in the US associated with the patterning of various social integration variables at the county level, and does this variation create spatial regimes in the US? It is expected that the presence and variation in the levels of religious congregations, civic community organizations, spatial isolation, and economic deprivation will have varying effects on the suicide rates of the counties and regions throughout the US due to the creation of unique social contexts within the community. The presence or absence of these social integration variables creates a social environment within the community that either increases or inhibits social integration and civic engagement among residents which in turn affects the suicide rate of the community. Specifically, it is expected that low suicide rates will be attributed to the presence of high levels of civic engagement, as evidenced by their high levels of religious and/or civic community organizations. Low levels of civic engagement opportunities and high levels of social isolation and/or economic deprivation, on the other hand, will plague counties and regions with high suicide rates.

It is accepted in the sociological literature that counties are a reasonable proxy for the concept 'community' (Lee 2010). The United States is comprised of 3,143 counties or county equivalents (US Department of Commerce 2009). For the purposes of this study, only those counties located within the 48 contiguous United States that have complete data from the Centers for Disease Control, Association of Religious Data Archives, Arizona State University GeoDa

Center, and the Census 2000 County Business Patterns, summary file 1, and summary file 3 data sets will be selected for inclusion. A county-level analysis was conducted for this study because it was the lowest geographical unit of analysis available for examining suicide rates from public use data sets. In addition, county-level analysis provided the most information and details pertaining to the clustering of suicide rates across the US because the data, with the use of spatial modeling techniques, had the ability to capture variations within and between counties, states, and regions. Finally, counties were the unit of analysis for many other important studies on suicide rates (for examples, see Baller and Richardson 2002; Breault 1986; Pescosolido and Georgianna 1989) which made the present study's results comparable to the results from these previous studies.

Data Sources

Suicide data was obtained from the CDC through their on-line database, CDC Wonder, which allowed for the extraction of a ten-year average of the age-adjusted suicide rate per 100,000 persons for each county in the US. According to the CDC, "Age adjustment is a technique for 'removing' the effects of age from crude rates, so as to allow meaningful comparisons across populations with different underlying age structures" (Centers for Disease Control and Prevention 2012b). The CDC suggested that age-adjusted rates be used when comparing groups living in different geographic areas because these rates (in comparison to crude rates) "eliminate differences that would be caused because one population is older than another" (Hoyert and Anderson 2001). Beginning in 1999, the CDC's National Center for Health Statistics (NCHS) began using the 2000 standard population to calculate age-adjusted death rates for CDC data (Hoyert and Anderson 2001).

Data regarding religious adherence and participation was obtained from the Association

of Religion Data Archives (ARDA) online database containing the *Religious Congregations and*

Membership Study, 2000 (Counties Files). According to ARDA, the data represented county-

level counts of the number of congregations within a county between 1999 and 2001. The 149

religious groups that participated included 139 Christian denominations, associations, or

communions; two specially defined groups of independent Christian Churches; Jewish and

Islamic estimates; and counts of temples for six Eastern religions. The *Religious Congregations*

and Membership Study, 2000 data was used because it contained the most complete data

available on religious congregations by county in the US for 2000.[4] For the purpose of this study,

the data collected from the *Religious Congregations and Membership Study, 2000* included

counts of the number of religious congregations in each county which were then transformed into

a rate per 1,000 persons in the county based on the county's population (Association of Religious

Data Archives 2000).

One data set obtained from the Census Bureau came from the Economic Census on

County Business Patterns (CBP) for 2000. Although CBP data is collected annually, the year

2000 was chosen to compliment the other demographic data obtained from the 2000 Census

summary file 1 and summary file 3. While the data set is typically used for studying economic

and business activity in the US, in this study, it was used to obtain county-level counts of social

and civic organizations.[5] For the purposes of this study, the data collected from the County

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[4] It should be noted that 14 non-participating religious bodies, including all historically African
American denominations, with more than 100,000 members each, are not represented in
congregations' data.

[5] As noted in Lee (2008), this measure of social and civic organizations is based upon
organizations that are established enough in the community that they have employees and are
required to pay taxes to the Internal Revenue Service. Therefore, informal organizations are not
included.

Business Patterns 2000 included counts of the number of social and civic organizations in each county which were then transformed into a rate per 1,000 persons in the county based on the county's population.[6]

The second data set obtained from the Census Bureau was the summary file 3 data from the 2000 Census. This data set was comprised of a sample of approximately 19 million housing units that received the 2000 Census long-form questionnaire (Census 2000). This summary file was used because it contained a sufficient, representative sample of the US population and included data on social, economic, and housing characteristics for US counties (Census 2000). For the purpose of this study, the data obtained from summary file 3 included county-level measures of gender, race, marital status, population turnover, household size, median household income, poverty, urban, and region.

The final set of data obtained from the Census Bureau was from the 2000 summary file 1 data set. This data set contained 100% of the US population and contained information on age, sex, households, household units, and families with detailed information on race/ethnicity (US Census Bureau 2000). This file was used to obtain the median age and population density of each county in the US.

Variables

Dependent Variable

Suicide is the dependent variable for this study and was operationalized as an age-adjusted rate for each county in the United States. Age-adjusted, county-level suicide rates were obtained for the years 2001-2010 and were averaged into one rate representing the ten-year

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[6] The social and civic organizations included consist of the County Business Pattern's North American Industry Classification System (NAICS) section 813 which includes religious, grantmaking, civic, professional, and similar organizations.

period[7]. A ten-year rate is appropriate because it increased the stability of rates for those counties that had fewer suicides and smaller populations (McLaughlin, Stokes, and Nonoyama 2001).

Explanatory Variables

Durkheim's ([1897] 1951) analyses of suicide focused on variables measuring levels of social integration that he believed were associated with the suicide rate. In his data analysis, however, he never provided an operational definition for measuring social integration or the variables he associated with social integration (Gibbs and Martin 1958; 1964). Therefore, the social integration variables chosen and the operationalization of each were based on contemporary studies which focused on the relationship between various forms of social integration and the suicide rate (for examples, see Blanchard et al. 2008; Breault 1986; Lee 2008; Lee 2010; Lee and Bartkowski 2003; Luo et al. 2011; Rotolo 1999; Stack 2000; Trout 1980). The explanatory variables measuring social integration in this study included religious congregations, civic community organizations, social isolation, and economic deprivation variables.

The concept of civic engagement included both religious and secular organizational participation. It was assumed that these organizations were present in the community because they had participating members and provided benefits to their community. Additionally, a study by Lee and Ousey (2005) found that the mere presence of religious and civic organizations in a community helped to reduce the homicide rate. The correlation between homicide and mortality rates has been most recently explained by civic community, moral community, and social capital theories (Berkman 2000; Blanchard et al. 2008; House et al. 1988; Kawachi and Berkman 2001;

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[7] The CDC suppresses suicide rates for those counties which had 0-9 deaths over the ten year period. These counties were given a value of "0". For those counties whose age-adjusted rate was listed as unreliable (10-19 suicides over the 10 year period), the mean of the upper and lower 95% confidence interval was used as the age-adjusted rate for the county.

Lee 2010; Young and Lyson 2001). These theories stipulate that ecological variables, such as community cohesion and trust, act to increase the social integration of the community thereby reducing mortality rates. Therefore, it is not membership in religious organizations that provided the buffer against suicide, but the social integration and community cohesion that was created in the community because of the presence of the various religious and civic organizations. Measuring their presence in the county served as an indicator of access to religious or civic organizations.

In line with Lee and Bartkowski (2003:16), the "main indicator of religious participation [was] designed to tap not actual participation but potential participation through the degree of access local residents have to religious institutions". To obtain this measure, the *Religious Congregations and Membership Study, 2000* was used to calculate the religious congregations access rate. This rate measured the number of church congregations per 1,000 residents for each county.

The indicator for civic participation also measured potential participation by measuring the degree of access local residents had to civic organizations. The economic census on county business patterns for 2000 was utilized to calculate the civic and social organization access rate. This rate measured the number of social and civic organizations per 1,000 residents for each county.

Social isolation is the loss of communication and contact with relevant others (Trout 1980). This can occur in the form of physical, geographic isolation or emotional isolation. A population density measure (population per square mile of land area) for each county was obtained from the Census 2000 summary file 1 in order to gauge the amount of physical distance between residents in a county. In addition, a measure of the proportion of single person

households (persons living alone divided by the total population in households) and a measure of the proportion not married (persons never married, divorced, or widowed divided by the population 15 and over) were included to capture county-level measures of emotional isolation.

The variable median household income was included in the analysis as a measure of the economic standing (economic deprivation) of the county. The natural logarithm of the variable was taken to reduce skewness and to make the variable more normally distributed. This process also allowed for better interpretation of the unstandardized coefficient; a 1% increase in median household income resulted in a $\beta/100$ increase/decrease in the age-adjusted suicide rate.

Control Variables

The following individual-level variables have been found to influence the suicide rate in communities and are therefore included as control variables: age, gender, and race. Age is operationalized as the median age of the county. Age is controlled for due to increases in suicide rates for 25-64 year olds (Centers for Disease Control and Prevention 2009a). Gender is represented by the variable male and is operationalized as the total male population in a county divided by the total population of the county. Male is controlled for due to the high rate of male suicides compared to females (Centers for Disease Control and Prevention 2009b). In order to control for race, a Herfindahl index was created to measure the racial homogeneity of the county. Following the use of the index by Iannaccone (1991) and Ellison, Burr, and McCall (1997) to account for religious homogeneity, the index created here indicated a measure of racial homogeneity which is defined as:

$$H=\sum S^2$$

where S represents each race (white, black, and other) divided by the total population of the county, squared and then summed. The Herfindahl Index (H) represented the probability that two

randomly selected individuals in the county would be of the same race. The Herfindahl index ranges from 0.0 to 1.0, where a score equal to one represents complete racial homogeneity in the county. This measure was used in lieu of controlling for the presence of a single race or ethnicity in a county.

Finally, the following variables were included as control variables because they may indirectly affect the social integration of communities: population turnover, urban, region, and population size. Population turnover was operationalized as the number of persons 5 years and older in a county who were not living in the same house five years prior divided by the total population of the county 5 years and older. Urban is the total population of a county living in urbanized areas divided by the total population of the county. Indicator variables for all four census regions were included to parse out the influence of otherwise unmeasured regional effects (Lee 2010). Finally, the log of the total population was included as a control variable to control for the skewed distribution of the population across counties.

Descriptive Statistics

Table 1 contains the descriptive statistics for the dependent, independent, and control variables. For the dependent variable, there were an average of 13 (mean = 12.28) suicides per year (with a standard deviation of 7.13) for US counties in the 48 contiguous states for the ten-year period 2001-2010.

Descriptive statistics of the main explanatory variables are also provided in Table 1. Civic engagement measures indicate that on average there are a greater number of church organizations in counties than there are civic and social organizations. On average counties have 2.21 religious congregations for every 1,000 residents in the county with a standard deviation of 1.31, and have on average 1.34 civic/social organizations for every 1,000 residents in the county

with a standard deviation of 0.61. Measures of social isolation revealed that the average

population density of a county was 195.95 people per square mile of land area with a standard

deviation of 909.75, on average 10.14% of a county lived alone (with a standard deviation of

2.09), and 39.57% of a county was not married (with a standard deviation of 5.34). Finally,

analysis of the economic standing of a county revealed that the log of the median household

income in a county was 10.44 with a standard deviation of 0.23

Descriptive statistics of the control variables revealed that the median age of a county

was 37.39 years with a standard deviation of 3.95 years. On average, 49.49% of a county

population was male (standard deviation = 2.12) and 41.04% were not living in the same house 5

years prior (standard deviation = 7.42). The average racial homogeneity of a county was 78.62%

with a standard deviation of 16.76. The average percent of a county that was considered urban

(urban areas and urban clusters) was 39.78% with a standard deviation of 30.70.

Table 1: Descriptive Statistics for All US Counties

	Mean	Std. Dev.	Min- Max
Dependent Variable			
10 year Average, County-Level Age-Adjusted Suicides per 100,000	12.28	7.13	0.00-82.15
Explanatory Variables			
Religious Congregations 1,000	2.21	1.31	0.27-9.88
Civic and Social organizations per 1,000	1.34	0.61	0.04-5.49
Population Density per square mile	195.95	909.75	0.10-31709.30
Percent Living Alone	10.14	2.09	2.00-21.00
Percent Not Married	39.57	5.34	12.0-69.0
Median Household Income (ln)	10.44	0.23	9.45-11.33
Control Variables			
Median age	37.39	3.95	20.60-54.30
Percent Male	49.49	2.12	0.00-67.62
Percent Turnover	41.04	7.42	19.40-84.56
Percent Racial Homogeneity	78.62	16.76	34.00-100.00
Percent Urban	39.78	30.70	0.00-100.00
Population Size (ln)	10.22	1.42	0.00-16.07

N = 3058

Principal Components Analyses

In order to test for a statistical relationship among the variables included in the present study, a correlation matrix was created. Table 2 displays a correlation matrix including all explanatory and control variables. It was evident that there was correlation between several of the variables as evidenced by correlation scores above .5. In order to reduce this multicollinearity, it was determined that variables should be combined into indices.

Principal components factor analyses were used in an effort to reduce the multicollinearity among the explanatory and control variables. Table 3 contains the results of these analyses. While each variable was distinct in what it was measuring within counties, some variables may have been explaining some of the same variance as other variables being considered. Together, the correlation matrix and principal components factor analyses (Tables 2 and 3) helped to justify combining variables into indices in order to account for the common variance explained and allow for concepts to be more accurately analyzed. The obliquely rotated[8] principal components analysis resulted in three separate factors (Table 3).

Measures of religious congregation access and civic and social organization access were combined into an index representing civic engagement. While these variables were not highly correlated (as seen in Table 2, r = .383), conceptually, these variables are measuring similar concepts and the principal components factor analysis confirmed this due to their eigenvalue being greater than one and factor loadings greater than .5 with 69.16% of variance explained.

The measures of social isolation (live alone, not married, population density) were also combined into an index confirming that these variables were sharing in the explanation of

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[8] Oblique rotation assumes the variables are correlated.

Table 2: Correlation Matrix of Explanatory and Control Variables

		1	2	3	4	5	6	7	8	9	10	11
1	Religious Congregations per 1,000	1	-	-	-	-	-	-	-	-	-	-
2	Civic Organizations per 1,000	.383	1	-	-	-	-	-	-	-	-	-
3	Population Density per square mile	-.210	-.047	1	-	-	-	-	-	-	-	-
4	Live Alone	.313	.530	.131	1	-	-	-	-	-	-	-
5	Not Married	-.295	-.115	.274	.241	1	-	-	-	-	-	-
6	Median Household Income (ln)	-.545	-.070	.197	-.294	-.144	1	-	-	-	-	-
7	Turnover	-.520	-.210	.134	-.132	.212	.371	1	-	-	-	-
8	Median Age	.415	.407	-.110	.529	-.444	-.148	-.448	1	-	-	-
9	Urban	-.664	-.165	.307	-.062	.376	.450	.551	-.422	1	-	-
10	Racial Homogeneity	.229	.261	-.206	.183	-.461	.067	-.231	.424	-.296	1	-
11	Male	.022	.122	-.105	-.147	-.173	.069	.160	-.075	-.117	.025	1

some variance (eigenvalue > 1 and factor loading scores > .5) and therefore should be combined into an index. The variance explained in this index was 47.44%.

Table 3: Obliquely Rotated Principal Components Factor Pattern Matrices

	Factor Loading Scores		
Civic Engagement			
Religious Congregation Access Rate	.832		
Civic and Social Org. Access Rate	.832		
Social Isolation			
Live Alone		.769	
Not Married		.627	
Population Density		.672	
Transience			
Urban			.791
Population Turnover			.759
Median Age			-.777
Racial Homogeneity			-.624
Eigenvalue	1.38	1.44	2.20
Variance Explained	69.16%	47.88%	44.01%

Finally, the control variables were combined in a factor analysis which resulted in the creation of a third index representing transience in a county. This index included the variables urban, population turnover, median age, and racial homogeneity. Again, the eigenvalue for this index was greater than one and the factor loadings were greater than .5 with an explained variance of 44.01%. Areas of high transience are mostly urban areas with high population turnover, low median age, and racial heterogeneity. These three indices were included in the regression analyses.

Spatial Autocorrelation Analyses

Spatial regression techniques have been used in recent studies of suicide and homicide in order to account for spatial dependence in the data, which posits that observations across space are not independent from one another (Baller, et al. 2001; Baller and Richardson 2002; Congdon 2010; Wasserman and Stack 1995). Baller et al. (2001:563) note, "Spatial autocorrelation refers

to a situation in which values on a variable of interest are systematically related to geographic location." Due to the social nature of suicide and because "county boundaries within the contiguous United States are not concrete delineations of space" (Doucet 2011:43), it was important to consider whether suicides in one county had an effect on the suicides that occurred in neighboring counties.

In order to determine if spatial autocorrelation existed within the data, the data were analyzed using the spatial program GeoDa. The data were merged with a shape file representing the counties in the 48 contiguous United States using FIPS codes. After recoding independent cities into their respective counties to match the shape file, the data were opened in GeoDa, and a LISA (Local Indicators of Spatial Association) cluster map and Moran's I were constructed based on the dependent variable, age-adjusted suicide rate (2001-2010). Anselin (1988) states that a Moran's I greater than 0.20 indicates significant autocorrelation in the data and thus justifies the use of spatial analysis techniques. Using a rook contiguity first order[9] weight matrix, the Moran's I for age-adjusted suicide (2001-2010) was 0.2597. Because the Moran's I was above the 0.20 threshold, a spatial weight variable was created and used in later regression analyses to capture and control for the spatial autocorrelation of the dependent variable. This finding of spatial autocorrelation suggested that similar suicide rates clustered in space and were not randomly distributed.

This spatial autocorrelation can also be visualized as seen in Figure 1. This LISA cluster map displays four types of significant clusters between counties: counties that have high rates of suicide near other counties with high rates of suicide (dark red: high-high), low rates of suicide near counties with low rates of suicide (dark blue: low-low), or those where the suicide rate of a

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[9] A rook contiguity first order weight matrix uses only common boundaries (not vertices) to define neighbors.

county is opposite from the suicide rates in surrounding counties (light red: high-low or light blue: low-high).
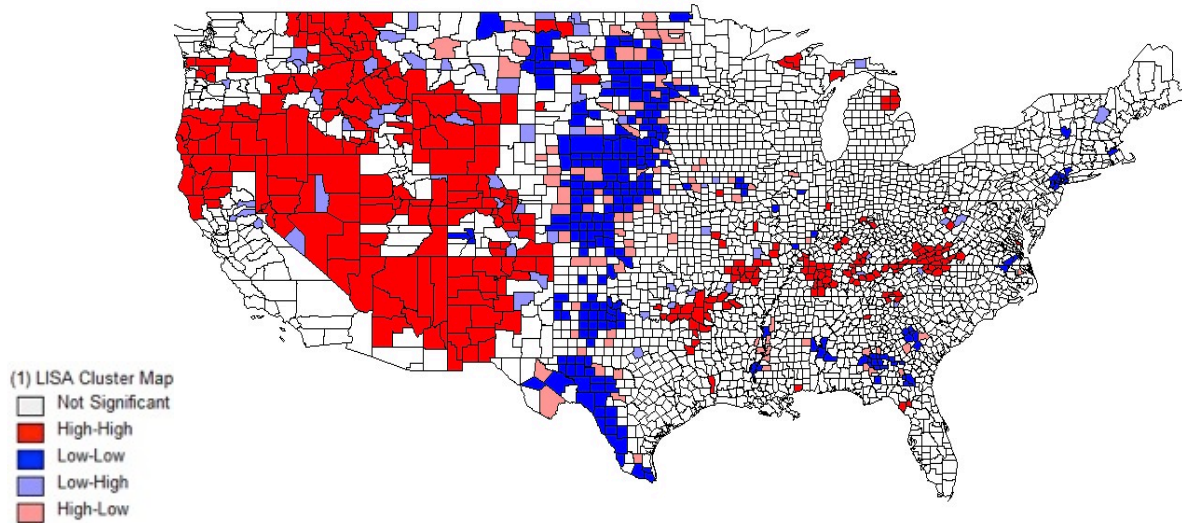
Figure 1: Univariate LISA Cluster Map for Age-Adjusted Suicide Rates (2001-2010)

As Baller et al. (2001:566) state, "If spatial dependence persists even in the presence of controls for spatial heterogeneity, the next step is to contrast a spatial error model and spatial lag model." A spatial error model "evaluates the extent to which the clustering of [suicide] rates not explained by measured independent variables can be accounted for with reference to the clustering of error terms" (Baller et al. 2001:567) The spatial lag model, on the other hand, "incorporates the spatial influence of unmeasured independent variables but also stipulates an additional effect of neighbors' [suicide] rates, i.e., the lagged dependent variable" (Baller et al. 2001:567). In order to determine which model (spatial error or spatial lag) should be used, ordinary least squares (OLS) regression was run in the GeoDa program using the dependent, explanatory, and control variables[10] in the equation. Results included diagnostics for spatial dependence, which were used to determine which model (spatial error or spatial lag) should be

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[10] The indexes for civic engagement, social isolation and transience were used.

used. "We determine the presence of lag and error processes empirically. Lagrange Multiplier and Robust Lagrange Multiplier tests are used to distinguish spatial error and spatial lag processes" (Baller and Richardson 2002:880). Whichever model, the spatial lag or the spatial error, produces the higher Lagrange Multiplier and Robust Lagrange Multiplier, that model is used in the spatial regression (Baller and Richardson 2002). In the current study, the values for the spatial lag model were higher than the spatial error model, indicating the use of a spatial lag model. The spatial lag model for this study indicated that suicide rates in one county actually increased the likelihood of suicides in nearby counties.

Once it was determined that a spatial lag model was to be used, a spatial lag model was run in GeoDa and the residuals were saved as a variable in order to determine if the lag model in fact resolved the spatial dependence problem. With the lag residual variable added to the regression analysis, the Moran's I value decreased to -0.014 indicating that the lag model did in fact adequately address spatial autocorrelation in the model. This reduction in spatial autocorrelation can be visualized in the accompanying LISA cluster map (Figure 2). This map shows a dramatic decrease in spatial autocorrelation as compared to the previous LISA cluster map (Figure 1) which did not control for spatial autocorrelation. Therefore, a spatial lag weight variable was created and was used in all subsequent regression analyses in order to control for the spatial autocorrelation of suicide rates between counties in the US.

Chow Tests

As is visible by the colored areas in Figure 2, some spatial autocorrelation remained in the model. In these areas, the residuals were not random and heteroskedasticity remained. In order to account for the heteroskedasticity still present in the model, a Chow test was used to determine if the model fit each of the four Census defined regions of the US (Northeast,

Midwest, South, and West) similarly. The test (using an F statistic) was used to determine if independent variables had varying impacts on different regions of the country (Chow 1960).
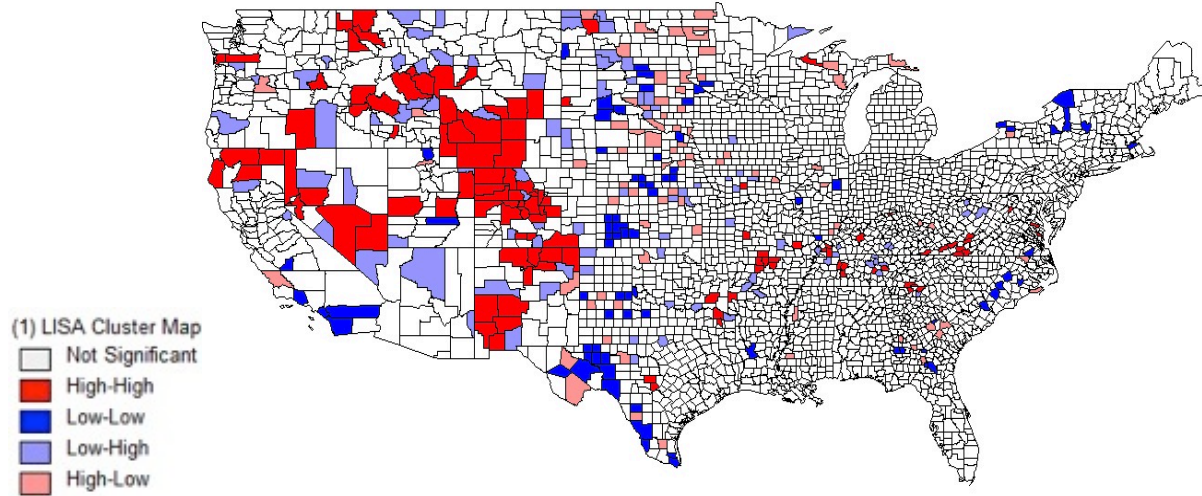
Figure 2: Univariate LISA Cluster Map of Spatial Lag Residuals for Age-Adjusted Suicide Rates (2001-2010)

The examination began by dividing the data set into Northeast/Non-Northeast, Midwest/Non-Midwest, South/Non-South, and West/Non-West data sets. Then OLS regression analyses were run for each of these region/non-region pairings including the dependent, explanatory, control, and spatial lag variables. Subsequently, the following formula was used to determine an F value for each region/non-region pairs:

$$\frac{\dfrac{SSR_{All\ counties}(SSR_1 + SSR_2)}{K}}{\dfrac{(SSR_1 + SSR_2)}{N_1 + N_2 - 2K}}$$

where *SSR* represents the sum of squares residual, *K* is the number of parameters, and *N* is the total observations in the model. Each calculation resulted in F values for each of the region/non-region pairs which were then compared to the appropriate critical value. The four Chow tests revealed that each of the four regions' obtained F values (Northeast/Non-Northeast = 3.65; Midwest/Non-Midwest = 19.60; South/Non-South = 15.51; West/Non-West = 82.19) were

greater than the critical value (p ≤ .05 = 2.01) and therefore led to the conclusion that the model

did not fit the four regions in the same manner. Therefore, separate regimes were present, and

these four Census-defined geographical areas were separated in subsequent analyses and

descriptive statistics containing the dependent, explanatory, and control variables were reported

separately for each of the four regions in Tables 4-7.

While Tables 4-7 are self-explanatory, some notable statistics regarding the dependent

variable should be addressed. The average age-adjusted suicide rate (2001-2010) for all US

counties (Table 1) was 12.28, but the means for each of the regions are divergent from this

overall mean. The Northeast and Midwest regions have means below the national average (10.69

and 10.61 respectively) while the South and West have means above the national average (12.61

and 16.29 respectively). The Midwest, however, contains at least one county with a mean suicide

rate of 82.15, well above all suicide rate averages and maximum values for the other regions.

Table 4: Descriptive Statistics for the Northeast

	Mean	Std. Dev.	Min- Max
Dependent Variable			
10 year Average, County-Level Age-Adjusted Suicides per 100,000	10.69	3.44	0.00-23.65
Explanatory Variables			
Religious Congregations 1,000	1.22	0.69	0.35-4.65
Civic and Social organizations per 1,000	1.20	0.35	0.58-2.48
Population Density per square mile	771.0	2674.48	3.1-31709.3
Percent Living Alone	10.49	1.60	6.0-15.0
Percent Not Married	42.14	3.94	33.0-62.0
Median Household Income (ln)	10.61	0.23	10.16-11.29
Control Variables			
Median age	38.05	2.28	28.6-45.4
Percent Male	49.04	1.21	46.47-55.32
Percent Turnover	37.93	4.87	26.0-58.0
Percent Racial Homogeneity	85.15	13.52	34.0-99.0
Percent Urban	54.70	29.59	0.00-1.00
Population Size (ln)	11.63	1.19	8.51-14.23

N = 211

Table 5: Descriptive Statistics for the Midwest

	Mean	Std. Dev.	Min- Max
Dependent Variable			
10 year Average, County-Level Age-Adjusted Suicides per 100,000	10.61	7.71	0.00-82.15
Explanatory Variables			
Religious Congregations per 1,000	2.42	1.43	0.38-9.37
Civic and Social organizations per 1,000	1.64	0.65	0.40-5.49
Population Density per square mile	120.27	390.86	0.5-5685.6
Percent Living Alone	10.72	1.97	3.0-18.0
Percent Not Married	38.79	4.77	25.0-67.0
Median Household Income (ln)	10.48	0.20	9.45-11.17
Control Variables			
Median age	38.19	3.88	20.6-51.0
Percent Male	49.54	1.40	45.50-63.65
Percent Turnover	39.19	6.53	19.0-69.0
Percent Racial Homogeneity	89.55	10.19	42.0-1.0
Percent Urban	36.14	29.61	0.00-1.00
Population Size (ln)	9.94	1.33	6.10-15.50

N = 1048

Table 6: Descriptive Statistics for the South

	Mean	Std. Dev.	Min- Max
Dependent Variable			
10 year Average, County-Level Age-Adjusted Suicides per 100,000	12.61	5.83	0.00-34.9
Explanatory Variables			
Religious Congregations per 1,000	2.28	1.20	0.27-7.59
Civic and Social organizations per 1,000	1.20	0.50	0.10-4.76
Population Density per square mile	182.22	588.69	0.10-9316.4
Percent Living Alone	9.76	1.97	2.0-21.0
Percent Not Married	39.82	5.79	12.0-69.0
Median Household Income (ln)	10.37	0.24	9.67-11.30
Control Variables			
Median age	36.94	5.04	20.70-48.90
Percent Male	50.53	2.01	47.55-67.62
Percent Turnover	46.49	7.90	26.0-71.0
Percent Racial Homogeneity	77.36	14.63	39.0-99.0
Percent Urban	47.03	33.16	0.00-1.00
Population Size (ln)	10.16	1.77	6.20-16.07

N = 1405

Table 7: Descriptive Statistics for the West

	Mean	Std. Dev.	Min- Max
Dependent Variable			
10 year Average, County-Level Age-Adjusted Suicides per 100,000	16.29	9.07	0.00-44.05
Explanatory Variables			
Religious Congregations per 1,000	1.95	1.34	0.35-9.88
Civic and Social organizations per 1,000	1.12	0.64	0.04-5.06
Population Density per square mile	141.44	888.93	0.30-16634.4
Percent Living Alone	9.75	2.56	3.0-18.0
Percent Not Married	39.40	5.23	26.0-59.0
Median Household Income (ln)	10.49	0.23	9.88-11.33
Control Variables			
Median age	36.94	5.04	20.70-48.90
Percent Male	50.53	2.01	47.55-67.62
Percent Turnover	46.49	7.90	26.0-71.0
Percent Racial Homogeneity	77.36	14.63	39.0-99.0
Percent Urban	47.03	33.16	0.00-1.00
Population Size (ln)	10.16	1.77	6.20-16.07

N = 394

Ordinary Least Squares Regression Analysis

Ordinary Least Squares (OLS) regression techniques were used to assess the relationship between age-adjusted suicide rates and the explanatory variables for each of the four Census-defined regions of the US separately. For each region, five separate models were reported in order to assist in explaining the difference each of the explanatory variables had in explaining the age-adjusted suicide rate of the region as well as the simultaneous impact of all three of explanatory variables by having them all in one model. The models for each of the regions included: 1) a baseline model containing only the control variables, 2) a model containing the control variables and the civic engagement index variable, 3) a model containing the control variables and the social isolation index variable, 4) a model containing the control variables and median household income (ln), and finally, 5) a model containing all control variables, the civic engagement index, the social isolation index, and median household income (ln).

CHAPTER 5: RESULTS

As previously stated, the OLS regression analyses were conducted using a 5-model step method where each explanatory variable was looked at separately and then together in a final full model. This allowed for increased analyses of the impact of the explanatory variables. In addition, each 5-model step analysis was run separately for each of the four Census-defined regions: Northeast, Midwest, South, and West. Each model contained at least the control variables and the spatial lag variable.[11] The results for each region are presented in separate tables.

Northeast

Table 8 included the results for the models predicting the 10-year average age-adjusted suicide rate in Northeast counties. Model 1 is the baseline model which contained only the control variables and the spatial lag variable. All but the spatial lag control variable were negatively related to the 10-year age-adjusted suicide rate, but only the variable transience was significantly related. The model explained 55.1% of the county-level variance in age-adjusted suicide rates according to the adjusted R^2 statistic[12].

Model 2 extended the baseline model by adding the civic engagement index variable in the model and tested hypothesis 1. This measure was significantly and negatively related to the age-adjusted suicide rate. According to the unstandardized coefficient (β= 1.045), an increase of one religious or civic organization per 1,000 residents was associated with a decrease of 1.045 suicides per 100,000 residents. This was in line with hypothesis 1 which stated that counties with higher civic engagement would have lower suicide rates. In addition, the inclusion of the civic

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[11] By adding the spatial lag variable in the models, it not only controlled for spatial autocorrelation, but it also made the models more conservative. It is more difficult to reach statistical significance when a spatial lag variable is included.
[12] The adjusted R^2 statistic is preferred to R^2 when there are multiple independent variables.

engagement index in this model increased the adjusted R^2 statistic by 1.5% to 56.5% variance explained.

Table 8: OLS Regression Analysis Predicting Age-Adjusted Suicide Rates in the Northeast

	Model 1	Model 2	Model 3	Model 4	Model 5
Civic Engagement Index		-1.045**			-1.174**
		(.370)			(.403)
		[-.182]			[-.205]
Social Isolation Index			.035		.090
			(.110)		(.124)
			[.017]		[.044]
Median Household Income (ln)				.380	-.390
				(.956)	(1.139)
				[-.025]	[-.026]
Transience Index	-.811*	-1.10**	-.850*	-.821*	-1.227**
	(.356)	(.365)	(.378)	(.358)	(.399)
	[-.185]	[-.251]	[-.194]	[-.187]	[-.280]
Proportion Male	-8.17	-9.29	-7.16	-8.54	-6.46
	(15.00)	(14.76)	(15.36)	(15.06)	(15.13)
	[-.029]	[-.033]	[-.025]	[-.030]	[-.023]
Population (ln)	-.268	-.405†	-.263	-.294	-.381
	(.243)	(.244)	(.244)	(.252)	(.250)
	[-.093	[-.140]	[-.091]	[-.102]	[-.132]
Spatial Lag	.794***	.842***	.794***	.807***	.835***
	(.083)	(.084)	(.084)	(.090)	(.090)
	[.561]	[.595]	[.561]	[.570]	[.590]
Adjusted R^2	.551	.565	.549	.549	.564

N = 211
Unstandardized coefficients reported with standard error in parentheses and standardized coefficients in brackets
† $p \le .10$; *$p \le .05$; **$p \le .01$; ***$p \le .001$

To further investigate the relationship between the civic engagement variables and suicide, additional models were run which separated out the religious congregations' access rate and civic organizations' access rate in order to determine which had more impact on the suicide rate of the region. In models not shown here, both the religious congregation access rate and the civic organization access rate were significant. Although the unstandardized coefficients were almost identical (religious congregations β = -1.215; civic organizations β= -1.213), the adjusted R^2 for the religious congregations model was slightly higher indicating it explained more variance (56.5% and 55.5% respectively).

Model 3 extended the baseline model by adding the social isolation index variable to the model and tested hypothesis 2. While this variable was in the expected direction, there was not a significant relationship, and the model explained less variance than the baseline model (54.9% of variance explained). Model 4 included the variable median household income (ln) with the control variables and tested hypothesis 3. While this variable was not in the expected direction, it was also not significant and the model explained only 54.9% of the variance. Therefore, in the Northeast, social isolation and median household income (ln) were not found to be significantly associated with the suicide rate of that region.

Sensitivity analyses were conducted using the variables median household income (ln), poverty, and GINI to determine which of these economic variables best suited the data. Median household income was operationalized as the median household income (ln) for each county as reported in summary file 3 of the 2000 Census. The proportion in poverty was operationalized as the number of males and females whose income was reported below the poverty level in the 2000 Census (summary file 3) divided by the total population for which the poverty status is determined. The GINI statistic[13], based on data from the 2000 Census, captured the income inequality of a county. GINI and poverty were each substituted into the model in place of the median household income (ln) variable (Appendix C, models 6 and 7), but like the model here, neither were significantly associated with the suicide rate of the region.

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[13] The GINI statistic is calculated using a Lorenz curve, which "plots the cumulative percentages of total income received against the cumulative number of recipients and measures the area between the Lorenz curve and a hypothetical line of absolute inequality." (World Bank 2013). The single statistic which emerges, ranging from zero to one, "summarizes the dispersion of income shares across the population with zero indicating perfect equality and one indicating perfect inequality where all the income is received by only one person." (US Department of Commerce, 2010). Data containing the GINI variable came from the Arizona State University GeoDa Center website, which provided county-level GINI coefficients for each county in the US (GeoDa Center for Geospatial Analysis and Consumption 2013).

Model 5, the full model, contained all three explanatory variables and all control variables. In this model, the only explanatory variable that was significant was the civic engagement index variable. Based on the unstandardized coefficient in this model, an increase of one religious or civic organization per 1,000 residents was associated with a decrease of 1.072 suicides per 100,000 residents. This was in the expected direction and gives support to hypothesis 1 which stated that an increase in religious and/or civic organization access (civic engagement) would result in lower suicide rates. Of the three significant variables in the model, their order of importance (based on their standardized coefficients) in explaining the age-adjusted suicide rate is: spatial lag (beta = .590), transience (beta = -.280), and then civic engagement (beta = -.205). As a whole, model 5 explained 56.4% of the variance, approximately the same as model 2 which contained only the civic engagement index variable.

Midwest

Table 9 included the results for the models predicting the 10-year average age-adjusted suicide rate in Midwest counties. Model 1 was the baseline model which contained only the control variables and the spatial lag variable. Each of the control variables was positively related to the 10-year age-adjusted suicide rate, but the variable proportion male was not significantly related. The model explained 12.7% of the variance in age-adjusted suicide rates according to the adjusted R^2 statistic.

Model 2 extended the baseline model by adding the civic engagement index variable in the model and tested hypothesis 1. This measure was significantly and negatively related to the age-adjusted suicide rate. According to the unstandardized coefficient, an increase of one religious or civic organization per 1,000 residents was associated with a decrease of .957 suicides per 100,000 residents. This is in line with hypothesis 1 which stated that counties with higher

civic engagement have lower suicide rates. In addition, the inclusion of the civic engagement index in this model increased the adjusted R^2 statistic by 2.7% to 15.4% variance explained.

Table 9: OLS Regression Analysis Predicting Age-Adjusted Suicide Rates in the Midwest

	Model 1	Model 2	Model 3	Model 4	Model 5
Civic Engagement Index		-.957***			-1.091***
		(.299)			(.305)
		[-.146]			[-.166]
Social Isolation Index			.282		-1.181**
			(.320)		(.372)
			[.027]		[-.120]
Median Household Income (ln)				-12.272***	-13.93***
				(1.466)	(1.72)
				[-.313]	[-.366]
Transience Index	1.208***	.632†	1.134**	.786*	.478
	(.356)	(.347)	(.366)	(.349)	(.353)
	[.149]	[.081]	[.140]	[.097]	[.062]
Proportion Male	11.687	.608	14.256	40.938**	22.462
	(16.287)	(15.603)	(16.547)	(16.158)	(15.425)
	[.021]	[.001]	[.026]	[.074]	[.043]
Population (ln)	.745**	.525†	.746**	2.233***	2.115***
	(.268)	(.288)	(.268)	(.314)	(.349)
	[.129]	[.094]	[.129]	[.386]	[.378]
Spatial Lag	.368***	.345***	.370***	.288***	.233***
	(.055)	(.055)	(.056)	(.055)	(.055)
	[.203]	[.198]	[.204]	[.159]	[.133]
Adjusted R^2	.127	.154	.127	.181	.205

N = 1048
Unstandardized coefficients reported with standard error in parentheses and standardized coefficients in brackets
† $p \leq .10$; *$p \leq .05$; **$p \leq .01$; ***$p \leq .001$

Additional models were run which separated out the religious congregations' access rate and civic organizations' access rate. In models not shown here, the religious congregation access rate was significantly related to the suicide rate but the civic organization access rate was not significant. In fact, the model containing only the religious congregation access rate had a higher unstandardized coefficient ($\beta = -1.36$) and higher adjusted R^2 (20.2%) than the model containing the civic engagement index variable suggesting that religious congregation access was driving the significance of the civic engagement index variable.

Model 3 extended the baseline model by adding the social isolation index variable to the model and tested hypothesis 2. While this variable was in the expected direction, there was not a significant relationship, and the model explained the same amount of variance as the baseline model (12.7% of variance explained).

Model 4 included the variable median household income (ln) with the control variables and tested hypothesis 3. This variable was in the expected direction and was a significant predictor of the suicide rate. A 1% increase in median household income decreased the suicide rate by 0.122 suicides (β/100) per 100,000 residents. While this association did not decrease the suicide rate by much, it was a significant relationship and in the expected direction as stated in hypothesis 4. The model explained 18.1% of the variance. GINI and poverty were each substituted into the model in place of the median household income (ln) variable (Appendix C, Models 6 and 7). GINI was not found to be significantly associated with the suicide rate of that region. Poverty was found to be significantly associated with the suicide rate of the region, but according to the adjusted R^2, with the inclusion of poverty, the model predicted slightly less variance (18%) than the model containing median household income (ln).

Model 5 was the full model which contained all three explanatory variables and all control variables. In this model, all three explanatory variables were significant. Based on the unstandardized coefficient in this model, an increase of one religious or civic organization per 1,000 residents decreased suicide by 1.09 suicides per 100,000 residents. This significant association confirmed hypothesis 1, which stated that an increase in civic engagement (religious congregations and civic organizations) would decrease suicide rates.

Based on the unstandardized coefficient in model 5, a one-unit increase in social isolation was associated with an decrease of 1.181 suicides per 100,000 residents. This is in contrast to

what is hypothesized in hypothesis 2. Further analyses were conducted to ascertain which of the three variables in the social isolation index was causing the negative relationship. It was found that the variable live alone was negatively and significantly associated with the suicide rate (Appendix C, Model 2). As proportion live alone in a county increased by 1 unit, suicide decreased by 71.18 per 100,000 residents. This contradicts hypothesis 2 which stated that as social isolation increased suicide would also increase. The variables population density and proportion not married were also significantly associated with the suicide rate of the region, but according to the standardized coefficients, these variables were not as important in predicting suicide as proportion living alone (beta = -.182, .184, -.190 respectively) and were generally in the expected direction. Based on the unstandardized coefficients, a one-unit increase in the proportion not married resulted in an increase of 28.85 suicides for every 100,000 residents. In addition, a one-unit increase in population density resulted in a decrease in .003 suicides per 100,000 residents. Although not in the expected direction, this is a very minor decrease.

Based on the unstandardized coefficient for median household income (ln), a 1% increase in median household income was associated with a decrease of 0.139 suicides per 100,000 residents. While this association did not decrease the suicide rate by much, it was a significant decrease and in the expected direction as stated in hypothesis 3. Of the five significant variables in the model, their order of importance (based on their standardized coefficients) in explaining the age-adjusted suicide rate was: log of the population (beta = .378), median household income (ln) (beta = -.366), civic engagement (beta = -.166), spatial lag (beta = .133) and then social isolation index (beta = -.120). As a whole, model 5 explained 20.5% of the variance, which was the most variance explained by any of the models.

South

Table 10 included the results for the models predicting the 10-year average age-adjusted suicide rate in Southern counties. In model 1, both transience and proportion male were negatively related to the 10-year age-adjusted suicide rate, but only the variable transience was significantly related. The model explained 28.2% of the variance in age-adjusted suicide rates according to the adjusted R^2 statistic.

Model 2 extended the baseline model by adding the civic engagement index variable in the model and tested hypothesis 1. This measure was not significantly related to the age- adjusted suicide rate. In fact, the inclusion of the civic engagement index in this model decreased the adjusted R^2 statistic by 0.4% to 27.8% variance explained.

Table 10: OLS Regression Analysis Predicting Age-Adjusted Suicide Rates in the South

	Model 1	Model 2	Model 3	Model 4	Model 5
Civic Engagement Index		.064			.208
		(.199)			(.208)
		[.009]			[.030]
Social Isolation Index			-.280*		-.424**
			(.147)		(.173)
			[-.047]		[-.069]
Median Household Income (ln)				-.858	-1.336†
				(.647)	(.708)
				[-.035]	[-.054]
Transience Index	-1.280***	-1.234***	-1.179***	-1.269***	-1.046***
	(.197)	(.200)	(.204)	(.197)	(.213)
	[-.206]	[-.199]	[-.190]	[-.204]	[-.169]
Proportion Male	-2.017	-2.859	-5.355	-1.079	-5.329
	(6.149)	(6.286)	(6.389)	(6.188)	(6.459)
	[-.008]	[-.011]	[-.020]	[-.004]	[-.020]
Population (ln)	1.176***	1.142***	1.170***	1.225***	1.307***
	(.152)	(.170)	(.152)	(.164)	(.186)
	[.244]	[.234]	[.243]	[.261]	[.268]
Spatial Lag	.657***	.660***	.657***	.656***	.657***
	(.041)	(.041)	(.041)	(.041)	(.041)
	[.411]	[.413]	[.411]	[.410]	[.412]
Adjusted R^2	.282	.278	.284	.283	.280

N = 1405
Unstandardized coefficients reported with standard error in parentheses and standardized coefficients in brackets
† p ≤ .10; *p ≤ .05; **p ≤ .01; ***p ≤ .001

Model 3 extended the baseline model by adding the social isolation index variable to the model and tested hypothesis 2. While this variable was significant, it was not in the expected direction. Based on the unstandardized coefficient for the social isolation index in model 3, a one-unit increase in social isolation is associated with a decrease of .280 suicides per 100,000 residents. This finding is in contrast to what is hypothesized in hypothesis 2.

Model 4 included the variable median household income (ln) with the control variables and tested hypothesis 3. While this variable was in the expected direction, it was not significant. GINI and poverty were each substituted into the model in place of the median household income (ln) variable (Appendix C, Models 6 and 7). The GINI variable was significant with a β = -8.622 but poverty was not significant. The model with the GINI variable explained less variance (adjusted R^2 = .281) than the model with median household income (ln).

Model 5 was the full model which contained all three explanatory variables and all control variables. In this model, the explanatory variables social isolation index and median household income (ln) were significantly related to the age-adjusted suicide rate. Based on the unstandardized coefficient in this model, a one-unit increase in social isolation was associated with a decrease of .424 suicides per 100,000 residents, which is contrary to the expectations presented in hypothesis 2. Further analyses were conducted to ascertain which of the three variables in the social isolation index was causing the negative correlation. It was found that the variable not married was negatively and significantly associated with the suicide rate (Appendix C, Model 2). As proportion not married in a county increased by one unit, suicide decreased by 10.7 per 100,000 residents. This is in contrast to hypothesis 2 which stated that as social isolation increased suicide would also increase. The variable population density was not significantly associated with the suicide rate of the region. Proportion live alone was also significantly

associated with the suicide rate of the region, but was in the expected direction. According to the standardized coefficients (not shown here), the variable not married was the most important in predicting the suicide rate followed by population density and live alone (beta = -.069, - .065, .051 respectively). This model explained slightly more variance than the baseline model (28.3% of variance explained).

Based on the unstandardized coefficient for median household income (ln), a 1% increase in median household income was associated with a decrease of 0.01 (β/100) suicides per 100,000 residents. While this association does not decrease the suicide rate by much, it was a significant decrease and in the expected direction as stated in hypothesis 3. Of the five significant variables in the model, their order of importance (based on their standardized coefficients) in explaining the age-adjusted suicide rate is: spatial lag (beta = .412), log of the population (beta = .268), transience (beta = -.169), social isolation (beta = -.069) and then median household income (ln) (beta = -.054). As a whole, model 5 explained 28.0% of the variance, which was slightly less than the variance explained in model 4.

West

Table 11 included the results for the models predicting the 10-year average age-adjusted suicide rate in Western counties. In model 1, only the spatial lag variable and the log of the population were significantly related to the age-adjusted suicide rate. The model explained 11.5% of the county-level variance in age-adjusted suicide rates according to the adjusted R^2 statistic.

Model 2 extended the baseline model by adding the civic engagement index variable in the model and tested hypothesis 1. This measure was significantly and negatively related to the age-adjusted suicide rate. According to the unstandardized coefficient (β = -2.782), an increase of one religious or civic organization per 1,000 residents was associated with a decrease of 2.782

suicides per 100,000 residents. This was in line with hypothesis 1 which stated that counties with

higher civic engagement would have lower suicide rates. In addition, the inclusion of the civic

engagement index in this model increased the adjusted R^2 statistic by 4.5% to 16.0% variance

explained.

Table 11: OLS Regression Analysis Predicting Age-Adjusted Suicide Rates in the West

	Model 1	Model 2	Model 3	Model 4	Model 5
Civic Engagement Index		-2.782***			-3.367***
		(.612)			(.653)
		[-.312]			[-.377]
Social Isolation Index			.082		.880*
			(.416)		(.428)
			[.009]		[.105]
Median Household				-6.010**	-5.375***
Income (ln)				(2.235)	(2.113)
				[-.151]	[-.141]
Transience Index	.012	-.600	.028	.076	-.511
	(.655)	(.632)	(.661)	(.651)	(.625)
	[.001]	[-.074]	[.003]	[.009]	[-.063]
Proportion Male	-28.162	-32.170	-28.275	-15.694	-24.038
	(22.948)	(21.809)	(22.982)	(23.240)	(22.036)
	[-.063]	[-.075]	[-.063]	[-.035]	[-.056]
Population (ln)	.744†	-.579	.727†	1.147**	-.571
	(.415)	(.439)	(.424)	(.438)	(.489)
	[.145]	[-.114]	[.142]	[.223]	[-.112]
Spatial Lag	.599***	.498***	.599***	.572***	.456***
	(.087)	(.088)	(.087)	(.087)	(.087)
	[.323]	[.279]	[.323]	[.308]	[.256]
Adjusted R^2	.115	.160	.113	.129	.182

N = 394
Unstandardized coefficients reported with standard error in parentheses and standardized coefficients in brackets
† $p \le .10$; *$p \le .05$; **$p \le .01$; ***$p \le .001$

To further investigate the relationship between the civic engagement variables and

suicide, additional models were run which separated out the religious congregations access rate

and civic organizations access rate in order to determine which had more impact on the suicide

rate of the region. In models not shown here, both the religious congregation access rate and the

civic organization access rate were significant. Although the unstandardized coefficients were

similar (religious congregations β = -2.636; civic organizations β = -2.353), religious

congregation access was associated with a slightly larger decrease in the number of suicides per 100,000 residents. Also, the adjusted R^2 for the religious congregations model was higher indicating it explained more variance (18.2% and 14.6% respectively).

Model 3 extended the baseline model by adding the social isolation index variable to the model and tested hypothesis 2. While this variable is in the expected direction, there was not a significant relationship, and the model explains less variance than the baseline model (11.3% of variance explained).

Model 4 included the variable median household income (ln) with the control variables and tested hypothesis 3. This variable was in the expected direction and was a significant predictor of the suicide rate. A 1% increase in median household income decreased the suicide rate by 0.06 suicides per 100,000 residents. While this association did not decrease the suicide rate by much, it was a significant decrease and in the expected direction, supporting hypothesis 3. The model explained 12.9% of the variance. GINI and poverty were each substituted into the model in place of the median household income (ln) variable, but neither were significantly associated with the suicide rate of the region (Appendix C, Models 6 and 7).

Model 5 was the full model which contained all three explanatory variables and all control variables. In this model, all three explanatory variables were significant. Based on the unstandardized coefficient in this model, an increase of one religious or civic organization per 1,000 residents decreased suicide by 3.367 suicides per 100,000 residents. This significant association confirms hypothesis 1, which stated that an increase in civic engagement (religious congregations and civic organizations) should decrease suicide rates.

Based on the unstandardized coefficient in model 5, a one-unit increase in social isolation is associated with an increase of .880 suicides per 100,000 residents. This was in the expected

direction as predicted in hypothesis 2, which stated that as social isolation increased, the suicide

rate would increase as well. Based on the unstandardized coefficient for median household

income (ln), a 1% increase in median household income was associated with a decrease of 0.054

(β/100) suicides per 100,000 residents. While this association did not decrease the suicide rate by

much, it was a significant decrease and in the expected direction as stated in hypothesis 3. Of the

four significant variables in the model, their order of importance (based on their standardized

coefficients) in explaining the age-adjusted suicide rate was: civic engagement (beta = -.377),

spatial lag (beta = .256), median household income (ln) (beta = -.141), and then social isolation

index (beta = .105). As a whole, model 5 explained 18.2% of the variance, which was the most

variance explained by any of the models.

CHAPTER 6: DISCUSSIONS AND CONCLUSIONS

Introduction

Beginning in the late 19th century, the analysis of suicide migrated from psychological to sociological investigations. Theorists like Durkheim ([1897] 1951), Masaryk (1881), and Tarde (1903), introduced the scientific community to the social study of suicide. Since this time, researchers have sought to build upon and improve the classic theories of suicide in order to develop a comprehensive theory and analysis of suicide for modern times.

As demonstrated in classic and contemporary studies of suicide, social integration is a key aspect in explaining the social patterning of suicide rates (for examples, see Baller and Richardson 2002; Breault 1986; Durkheim [1897] 1951; Pescosolido and Georgianna 1989). The present study incorporated social integration into an ecological analysis of suicide rates in the US. The argument from this point of view was that the social integration of a community had a direct impact on the social context of the community thereby affecting the mortality rate of the community. Based on the civic and moral community perspectives, communities which had religious and civic organizations available to residents and residents who were engaged with their community through these institutions had increased collective norms and community trust which were central to the production of collective well-being in the community, better health outcomes, positive psychological states, and lower levels of mortality (Berkman 2000; House, Landis, and Umberson 1988; Kawachi and Berkman 2001; Putnam 2000).

In the present study, the presence of religious congregations and civic community organizations in communities represented a strong, civically engaged community. Communities with high levels of one or both of these measures were expected to have increased community cohesion and trust which should have helped to lower overall mortality, including suicide rates.

Inversely, measures of social isolation and economic deprivation depress a community's ability to produce civic engagement, which should lower levels of trust and cohesion within the community. Therefore, communities with high levels of one or both of these measures were likely to have a weak community infrastructure, worse health outcomes, and higher levels of suicide (Berkman 2000; Blanchard et al. 2008; House et al. 1988; Kawachi and Berkman 2001; Lee 2010; Putnam 2000; Tolbert et al. 1998). The argument from the ecological standpoint stated that participation in religious or civic organizations was not necessary to provide a protective effect from suicide. Rather, living in a religious community or a community with an abundance of religious and civic organizations (moral community) created an environment within the community which cultivated a distinct social context that was rich with social capital. This environment was not present in communities that lacked religiosity or religious and civic organizations (Blanchard et al. 2008; Lee 2010; Tolbert et al. 1998).

To date, no study had simultaneously considered multiple indicators of social integration, focused on the contextual environment these social integration variables create within communities, nor considered each of the US regions separately in regards to the patterning of suicide rates in the United States. The present study aimed to test the hypothesis that well integrated, civically engaged communities, with low isolation and low economic troubles produced a community environment that diminished suicide rates. Alternatively, it was hypothesized that communities that did not/could not offer enhanced levels of social integration due to increased levels of social isolation and/or economic deprivation would have higher suicide rates.

Summary of Major Findings

In an attempt to expand the research base and knowledge of the ecological analysis of suicide, this study first considered the spatial patterning of suicide rates in the US based on Baller and Richardson's (2002) finding that suicide rates clustered in the same geographical areas where measures of social integration were also present. It was determined that spatial regimes were present in the US and therefore each Census-defined region of the US should be studied independently of one another due to their varying social contexts. While Baller and Richardson (2002) only considered the West/Non-West regions of the US, this study focused on four distinct regions in the US: Northeast, Midwest, South, and West. Just as suicide rates varied across the US, each region/regime had a unique social context that helped to explain that region's suicide rate. Because the models suggested treating each US region differently, it was argued that the three Non-West regions should not be combined into one regime.

Overall, in a sample of 3,058 US counties, the ten-year age-adjusted suicide rate was lowest in the Midwest and Northeast (10.61 and 10.69 respectively) and highest in the South and West (12.61 and 16.29 respectively). In addition, it was found that each of the explanatory variables (civic engagement, social isolation, and economic deprivation) affected the social context of that region in very different ways, which lead to the divergent suicide rates in each area. Therefore, each region is discussed separately.

Northeast

While each of the explanatory variables (civic engagement, social isolation, and median household income) was significantly correlated with the suicide rate of that region (Appendix B), only the civic engagement variable was significantly related to the suicide rate of that region as seen in Table 8, model 5. In support of hypothesis 1, civically engaged communities experienced

65

lower rates of suicide compared to communities that had weak civic engagement. This indicated the positive effect that civic engagement had upon the community's social context and therefore suicide rate. The robustness of the relationship was further demonstrated through sensitivity analyses (Appendix C), which found that religious congregations had a significant effect on decreasing the suicide rate of the region. While this region had the highest percent of not married persons and the second highest percent of persons living alone (compared to the other regions), these forms of social isolation were combated by a very high population density in the region making social isolation insignificantly related to suicide. In addition, it was found that poverty and income inequality were not significantly related to the suicide rate. Therefore, in the Northeast, civically engaged communities, particularly communities with more religious congregations present, experienced lower suicide rates.

Midwest

In contrast to the Northeast, while only civic engagement and social isolation were correlated with suicide (Appendix B), all three explanatory variables were significantly related to the suicide rate in Midwest region (Table 9, model 5). As civic engagement and median household income increased, suicides decreased in the region. This was in support of hypotheses 1and 3. Social isolation, however, had a significantly negative relationship with suicide; as social isolation increased, suicide rates decreased. This was in opposition to hypothesis 2. Through sensitivity analyses, it was found that the variable live alone was the variable in the social isolation index that was significantly and negatively related to the suicide rate (Appendix C). As the proportion living alone in the region increased, suicide decreased. It should be noted, however, that this region experienced the lowest average suicide rate in comparison to the other three regions and had the highest proportion of religious and civic organizations per 1,000

residents. Therefore, the isolation experienced by living alone may be overcome by the readily available access to religious and civic organizations and the social capital imputed into the community through these forms of civic engagement.

Additionally, it was found that median household income was acting as a suppressor variable. Median household income was not significantly correlated with suicide, but it was significantly and negatively correlated with the other predictor variables, civic engagement and social isolation (Pandey and Elliott 2010). In addition, once median household income was combined with civic engagement and social isolation in the full model (Table 9), it not only increased the adjusted R^2 of the model by 5% (in comparison to Appendix C, model 3), but it also increased the regression weight of civic engagement and social isolation, and caused social isolation to become significant and negative.[14] Based on these results, and in support of hypotheses 1 and 3 but in contrast to hypothesis 2, communities with high civic engagement, single person households, and median household income have the greatest ability to provide a buffer from suicide rates.

South

In the South, while only social isolation was correlated with suicide (Appendix B), social isolation and median household income were significantly related to suicide (Table 10). As social isolation and median household income increased, suicide decreased. This finding contradicts hypothesis 2 but supports hypothesis 3. Through sensitivity analyses, it was found that the variable not married was the variable in the social isolation index that was significantly and negatively related to the suicide rate (Appendix C). As the proportion of the county that was

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[14] Further analysis showed that poverty and GINI did not have this effect on social isolation. The inclusion of poverty in place of median household income left social isolation insignificant and the GINI coefficient made social isolation positively related to suicide.

not married increased, suicide decreased. It should be noted, however, that this region had the second highest proportion of religious congregations per 1,000 residents and a low percentage of persons living alone. Because it is not uncommon to have unmarried persons living together and based on the low proportion of persons living alone in this region, unmarried may not necessarily equate to social isolation in the South. Future analysis should include a measure of cohabitation to determine the validity of this statement.

As with the Midwest, median household income was acting as a suppressor variable in the South. Median household income was not significantly correlated with suicide (Appendix B), but in the full model it was a significant negative predictor of suicide rates (Table 10) (Pandey and Elliott 2010). In the model including civic engagement and social isolation but not median household income (Appendix C, Model 3), civic engagement was not significantly related to suicide rates. The inclusion of median household income in the model increased the variance explained by 0.1% and increased the regression weight and significance level of social isolation. Based on these results and support of hypothesis 3 but in contrast to hypothesis 2, communities with high median household income and persons not married have the greatest ability to provide a buffer from suicide rates.

West

In the West, while only civic engagement was correlated with suicide (Appendix B), all three explanatory variables were significantly related to suicide in the full model (Table 11). These findings supported all three hypotheses as the coefficients for each of the predictor variables were significant and in the expected directions. As civic engagement and median household income increased, suicide decreased, and as social isolation increased, so did suicide. Although the variance explained in the full model in the West was the lowest among the four

regions, it was the only region where all three explanatory variables were significantly related to suicide in the expected directions as hypothesized. In addition, the sensitivity analyses (Appendix C) showed that the West was the only region where both religious and civic organizations were significantly and negatively related to the suicide rate. In the West, although the proportion of religious and civic organizations per 1,000 residents is low, where these organizations are present, they provide critical social capital to the community that assists in significantly decreasing suicide rates. Therefore, in the West where the average suicide rate was the highest among the four regions, suicide rates were lower in communities where civic engagement and median household income were high, and social isolation was low.

Research Limitations and Future Research

As with any research study, there were some limitations to the current research project. One of the biggest challenges was the operationalization of the dependent variable. In order to reduce the number of counties reporting suppressed and unreliable suicide rates, a ten-year average was used. During these ten years, the suicide rate fluctuated among counties for various reasons, but potentially due to variations in levels of social integration within communities. Additionally, due to the CDC's suppression of identifying information, it was impossible to get accurate demographic information for those who committed suicide, and instead, general county-level measures were used.

In addition, better measures of social integration could be used to more accurately detect variations in suicide rates. One such measure could be the use of actual participation in religious and civic organizations rather than using access to these organizations. Also, a measure of distance from home to religious and civic organizations could be used as a measure of intensity of civic engagement. Distance to these organizations is not a problem in densely populated areas,

but it could pose a problem in remote, rural areas. Also, additional measures of social integration could be incorporated in order to capture additional types of civic engagement and community social capital, like voter participation, local entrepreneurialism, and presence of/distance to public health facilities. In addition, future analysis should include more control variables to help capture more of the variance explained. Such variables could be an index controlling for religious homogeneity in counties and separation of counties based on their urban/rural status.

Future studies could also explore the implications of using varying definitions of regions or simply study regions separately. In this study, principal components factor analyses were conducted and indices were created prior to the Chow analyses and the decision to look at the four Census regions separately in order to have regimes that were comparable. Because each region has such varying demographics, however, future research could consider the regions separately in order to best understand the social integration, social context, and suicide relationship in each region.

While this is a cross-sectional analysis, future research could also compare regional differences and changes over time. By doing so, the effect of changes in the demographic make-up of the region as well as changes in civic engagement, social isolation, and the economic situation of the region on the suicide rate can be determined.

Finally, multilevel analysis that included data on individuals and the communities they are nested in would give the best indication of how individual-level characteristics and behaviors are influenced by community context and vice versa.

Implications

One of the most important theoretical implications of this study is that civic engagement, social isolation, and economic deprivation measures significantly affect community context but

in varying ways. In general, increased civic engagement and median household income and decreased social isolation act to decrease suicide rates, but the magnitude and applicability of each of these measures varies by region. These results highlight the need to address different regions of the US with different solutions to increasing suicide rates.

One overall policy implication is the importance of supporting the existence of religious and civic organizations within communities. Even though not everyone in the community participates in these organizations, their presence in communities enhances the community's ability to positively affect the social structure, social capital, and context of the community. By promoting community cohesion and trust, increased civic engagement, and decreased isolation, it not only helps to decrease suicide rates, but it helps to decrease all forms of crime and deviance in communities. The presence of these organizations is especially important in physically isolated areas and in areas with lower median household incomes. As shown in this study, communities with these characteristics tend to have higher suicide rates.

Conclusion

The present study demonstrates that suicide can and should be studied from an ecological and spatial perspective. This study provides evidence that suicide rate clusters exist in the US, there are regional variations in suicide rates' clustering, and there are regional variations in the degree to which predictor variables are able to explain these variations. There are spatial regimes within the US that require unique attention to address suicide rates. While certain measures are significantly related to suicide in one region, they are not necessarily important in other regions. In addition, certain aspects of social isolation are related to suicide rates in unexpected ways in two regions. Finally, while there is a decline in religious affiliation in the US (Hout and Fischer 2002; Pope and Danigelis 1981), it still provides the most protection from suicide, more than

civic and social organizations in most parts of the US. Future researchers should consider

regional variations in social integration variables in order to best explain how communities can

combat rising suicide rates in their region.

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APPENDIX

A: CENSUS DEFINED REGIONS FOR THE 48 CONTIGUOUS UNITED STATES

Northeast:

Connecticut	Maine
Massachusetts	New Jersey
New York	New Hampshire
Pennsylvania	Rhode Island
Vermont	

Midwest:

Indiana	Illinois
Iowa	Kansas
Michigan	Minnesota
Missouri	Nebraska
North Dakota	Ohio
South Dakota	Wisconsin

South:

Alabama	Arkansas
Delaware	District of Columbia
Florida	Georgia
Kentucky	Louisiana
Maryland	Mississippi
North Carolina	Oklahoma
South Carolina	Tennessee
Texas	Virginia
West Virginia	

West:

Arizona	California
Colorado	Idaho
Montana	Nevada
New Mexico	Oregon
Utah	Washington
Wyoming	

B: REGIONAL CORRELATION MATRICES INCLUDING THE DEPENDENT AND EXPLANATORY VARIABLES

Northeast

		1	2	3	4
1	Age-Adjusted Suicide Rate (2001-2010)	1	-	-	-
2	Civic Engagement	.392***	1	-	-
3	Social Isolation	-.268***	-.188**	1	-
4	Median Household Income (ln)	-.478***	-.666***	-.036	1

Midwest

		1	2	3	4
1	Age-Adjusted Suicide Rate (2001-2010)	1	-	-	-
2	Civic Engagement	-.341***	1	-	-
3	Social Isolation	.101***	-.005	1	-
4	Median Household Income (ln)	-.012	-.526***	-.267***	1

South

		1	2	3	4
1	Age-Adjusted Suicide Rate (2001-2010)	1	-	-	-
2	Civic Engagement	-.041	1	-	-
3	Social Isolation	-.085***	.082**	1	-
4	Median Household Income (ln)	.042	-.331***	-.191***	1

West

		1	2	3	4
1	Age-Adjusted Suicide Rate (2001-2010)	1	-	-	-
2	Civic Engagement	-.243***	1	-	-
3	Social Isolation	.028	.152**	1	-
4	Median Household Income (ln)	-.071	-.376***	-.021	1

C: SENSITIVITY ANALYSES

	Northeast	Midwest	South	West
Model 1:				
Religious Congregation Access	-1.048*	-1.346***	.002	-2.662***
	(.445)	(.259)	(.179)	(.556)
Civic Organization Access	-.578	-.131	.346	-2.408**
	(.613)	(.390)	(.304)	(.757)
Adjusted R²	.565	.215	.280	.191
Model 2:				
Population Density	.000	-.003***	.000	-.001
	(.000)	(.001)	(.000)	(.000)
Live Alone	7.751	-71.178***	17.269†	80.691***
	(15.360)	(14.018)	(10.172)	(24.267)
Not Married	-14.933†	28.852***	-10.715**	.401
	(8.415)	(6.847)	(3.412)	(11.069)
Adjusted R²	.568	.244	.283	.199
Model 3:				
Civic Engagement	-1.129**	-1.113***	.172	-3.381***
	(.380)	(.315)	(.207)	(.658)
Social Isolation	.109	.504	-.298†	1.024*
	(.111)	(.317)	(.160)	(.427)
Adjusted R²	.565	.155	.279	.170
Model 4:				
Civic Engagement	-1.161	-1.347***	.059	-2.860***
	(.402)	(.296)	(.199)	(.608)
Median Household Income (ln)	-.759	-10.867***	-.663	-5.951**
	(1.019)	(1.433)	(.311)	(2.103)
Adjusted R²	.565	.198	.278	.175
Model 5:				
Social Isolation	.074	-1.795***	-.406**	-.078
	(.126)	(.374)	(.158)	(.417)
Median Household Income (ln)	.693	-17.148***	-1.507*	-6.071**
	(1.097)	(1.771)	(.693)	(2.261)
Adjusted R²	.548	.198	.286	.126
Model 6:				
GINI	-4.356	12.166	-8.622**	-31.370*
	(8.156)	(8.712)	(4.270)	(14.404)
Adjusted R²	.564	.156	.281	.178
Model 7:				
Poverty	-3.902	30.381***	-3.202	5.462
	(5.889)	(5.102)	(2.371)	(7.776)
Adjusted R²	.564	.182	.279	.169

Unstandardized coefficients reported with standard error in parentheses for listed variables only

† p ≤ .10; *p ≤ .05; **p ≤ .01; ***p ≤ .001

Note: Models 1 and 2 contain the dependent variable, control variables, and all other predictor variables. In these models, multicollinearity is ignored and the variables that make up the indices are placed in the full model. Models 3, 4, and 5 contain the dependent variable, control variables and only the listed predictor variables. (In each model, one of the three predictor variables is omitted.) Models 6 and 7 contain the dependent variable, control variables, civic engagement and social isolation indices, and substitute the listed variable in place of median household income (ln).

VITA

Chantel Dufrene Chauvin grew up in the small coastal town of Larose, Louisiana. She received her of Bachelor of Science degree in Sociology and Psychology from Louisiana State University in 2001. She returned to Louisiana State University and received her Certificate of Completion in Paralegal Studies in 2003. Upon completion, she moved to Orlando, Florida and began working as a paralegal. During this time, she also attended the University of Central Florida where she received her Master of Arts degree in Applied Sociology in 2006. She then returned to Louisiana State University to complete her Doctoral studies. She will receive her Doctor of Philosophy degree from the Department of Sociology at Louisiana State University at the summer 2013 commencement.