A Multilevel Analysis of Registered Sex Offender Violation Status: The Role of Neighborhood Disadvantage and Social Services

Donna M. Snow[1], George Kikuchi[2,*] and Jason Kissner[2]

[1]*California School of Professional Psychology, Alliant International University, Fresno, 5130 E. Clinton Way, Fresno, CA 93727, USA*

[2]*California State University, Fresno, Department of Criminology, 2576 E San Ramon Ave., Fresno, CA 93740-8029, USA*

Abstract: This research attempted to clarify the determinants of registered sex offender violations using individual-level and contextual characteristics under social disorganization theory. Data on registered sex offenders in Fresno County, CA and census data were analyzed to examine the influences of offender characteristics, neighborhood disadvantage, and accessibility to social services on violation risks. Multilevel logistic regression models indicated that those offenders living in disadvantaged neighborhoods faced a higher risk of registration violations, while such an effect was mitigated by the accessibility to social services. Based on the findings, policy implications of social services as a protective factor and strategic management of the registration policies were discussed.

INTRODUCTION

Sexual crimes create fear in the community resulting in legislative actions that tax resources in criminal justice and social service agencies. Continued enforcement of such actions, especially registration laws, is costly as law enforcement officers often must track down offenders who are noncompliant. Even with these laws costing time and money, they are widely supported by the public because of the fear that the public feels pertaining to sex offenders. Numerous studies have demonstrated the support that these laws receive from the public, including two Gallup Polls (Carroll 2005; Saad 2005) and several other studies that have reported that over three-quarters of their respondents were in support of the registration laws (Kernsmith, Craun, and Foster 2009; Levenson, Brannon, Fortney, and Barker 2007; Schiavone and Jeglic 2009). Despite the popularity of registration laws, however, it is unclear if they are effective in preventing recidivism or commission of new sexual crimes. Empirical research on risk and protective factors for registered sex offenders would be useful for the effective management of these policies. To the extent that the policies are implemented in a community setting, such empirical studies in particular should examine both individual and contextual factors simultaneously.

According to a meta-analysis by Hanson and Morton-Bourgon (2005), the typical sexual recidivism rate is 10-15% after five years from prison release. Although what causes sexual recidivism has often been researched, the majority of the previous studies on sex offenders and their re-offending risk focused on individual characteristics; very few examined the effects of neighborhood characteristics on recidivism.

Although the role of neighborhood characteristics in generating crime incidents has been extensively examined since the classic study of Shaw and McKay (1942), a recent multilevel study of recidivism (Kubrin and Stewart 2006) pointed out that prior empirical studies failed to consider how both neighborhood conditions and individual characteristics simultaneously affect criminal behaviors. Based on a thorough statistical analysis, Kubrin and Stewart contended that even after controlling for individual characteristics, neighborhood characteristics significantly affected the rates of re-offending, implying that individual characteristics provided only half of the picture. In particular, they argued that neighborhood characteristics such as low socio-economic characteristics and ethnic heterogeneity may affect the offender's ability to successfully re-integrate back into society, as offenders released into disadvantaged areas face many demanding challenges related to re-entry.

Many offenders are released into disadvantaged areas simply because they have nowhere else to go. When released from prison, they may not have the financial resources necessary to move into a less disadvantaged area (Hipp, Turner, and Janetta 2010). If neighborhood disadvantage is related to recidivism, this becomes a substantial concern. Furthermore, while many neighborhood studies tend to be grounded upon

*Address correspondence to this author at the California State University, Fresno, Department of Criminology, 2576 E San Ramon Ave., Fresno, CA 93740-8029, USA; Tel: (559) 278-4223; Fax: (559) 278-7265;
E-mail: gkikuchi@csufresno.edu

social disorganization theory focusing on risk factors, it is equally pertinent to investigate the role of protective factors that reduce the likelihood of criminal behaviors. With research on these essential items missing, there is a need for new policy-relevant research that examines the role of neighborhood characteristics on the violation status of sex offenders. If neighborhood context influences re-offending, this needs to be taken into account when creating policies dealing with recidivism, especially when it comes to registered sex offenders. "Get tough" policies and strict registration and notification laws may not be the answer for effective community-based corrections. Targeting neighborhood disadvantage and strategically placing protective resources may present a more efficacious start to battling recidivism (Pratt and Cullen 2005). Evidence-based policy recommendations need to be established by analyzing both risk and protective factors with an appropriate statistical model that incorporates individual characteristics of offenders and neighborhood conditions simultaneously.

In general, more crimes take place in less organized areas where residents have fewer resources and weaker social ties with each other. It should follow that this is true for sex offenders as well (Tewksbury, Ehrhardt Mustain, and Covington 2010), but this has rarely been studied and remains as a deficiency in the literature. Socially disorganized neighborhoods may attract registered sex offenders since the offenders lack resources and employment, or simply because these areas tend to be more anonymous (Hipp *et al.* 2010; Levenson, Letourneau, Armstrong, and Zgoba 2010). In fact, several studies on registered sex offenders have found that they commonly live in more disadvantaged neighborhoods (Duwe, Donnay, and Tewksbury 2008; Socia and Stamatel 2011; Tewksbury *et al.* 2010). Based on the evidence that sex offenders live in more disorganized areas and that these disorganized areas may contribute to a higher likelihood of recidivism, the next step is to examine the role of neighborhood characteristics and the violation status of registered sex offenders.

Although much of the research in the extant literature uses recidivism, this study focuses on the violation status of the sex offenders because of the specialized laws that sex offenders have to abide by and the financial burden that ensues. Maintaining and enforcing the registration laws are costly and violations can lead to further increased expenses for law enforcement. For example, if an offender is in violation for not registering on time (or at all), law enforcement

officials have the burden of tracking the offender down. In addition to this, some violations may lead to costly arrest and incarceration that further stretch limited resources of the criminal justice system. In fact, in many jurisdictions, violations of registration conditions are treated as a substantial and serious problem (Franklin Police Department, 2009).

PURPOSE OF THE STUDY

The present study analyzes registered sex offenders in Fresno County, CA, using a social disorganization perspective with multilevel models that simultaneously consider both neighborhood and individual characteristics (Raudenbush and Bryk 2001). Social disorganization theory (Shaw and McKay 1942) asserts that neighborhoods with increased poverty, residential mobility, and ethnic heterogeneity have higher crime rates; the current study examines how these neighborhood conditions affect the likelihood of violations for sex offenders specifically. While existing social disorganization literature tend to focus on neighborhood disadvantage as risk factors, this research also examines how neighborhood resources act as protective factors that reduce the likelihood of violations. For example, the proximity to and availability of social services may influence offenders' success of re-entry into the community (Hipp *et al.* 2010). Hence, in order to achieve this research objective, the following three hypotheses are examined:

> *Hypothesis 1: Registered sex offenders are likely to live in disadvantaged neigh-borhoods.*
>
> *Hypothesis 2: Registered sex offenders living in disadvantaged neighborhoods are more likely to be in violation than those in less disadvantaged neighborhoods.*
>
> *Hypothesis 3: The effect of neighborhood disadvantage on violations is mitigated by social services available in neighbor-hoods.*

By analyzing both risk and protective factors, this research intends to make a policy recommendation for a strategic and effective management of registered offenders in the community.

REVIEW OF LITERATURE

Registration Laws

Specialized laws for sex offenders have been around since the 1930s. Between 1937 and 1955, 26

states enacted "sexual psychopath" laws requiring certain offenders who were found guilty of a sex offense to be committed to a psychiatric facility. Over time, the courts struck down some of these laws based on their unfairness while at the same time the focus shifted from commitment to a mental facility to incarceration in a prison and punishment (Cole, 2000; Velasquez 2008). Early sex offender lists were solely used by law enforcement officials to keep track of offenders and the lists were not released to the public (Velasquez 2008). It was not until more recently that sex offender registries became available for the public to view.

Federal law comprehends three types of laws that target sex offenders specifically: mandatory registration laws, community notification laws, and residence restriction laws (Socia and Stamatel 2011). In 1994, the Jacob Wetterling Crimes Against Children and Sexually Violent Offender Registration Act was enacted which required all convicted child molesters to register their addresses with local law enforcement for up to ten years after they were released from prison (Bartol and Bartol 2008; Levenson *et al.* 2010). With the passing of this law, communities were given permission to notify community residents if a sexually violent predator was moving in, but this was not a mandatory action until two years later when Megan's Law was passed (Bartol and Bartol 2008; Levenson *et al.* 2010). Megan's Law categorized offenders into one of three groups based on their re-offending risk level. The risk level determined what type of community notification is required for the offender. For example, the community must be notified of all level III offenders who pose the greatest risk, whereas only certain agencies (schools, daycare centers, etc.) must be notified of level II offenders and there is no mandatory notification of level I offenders (Bartol and Bartol 2008).

Also in 1996, the Pam Lyncher Sexual Offender Tracking and Identification Act was passed which requires lifetime registration for certain offenders, namely, those who recidivate and those who commit certain aggravated offenses (Bartol and Bartol 2008; Velasquez, 2008). In addition to this lifetime registration, this law made it mandatory for the FBI to keep a national offender database for all registered sex offenders (Bartol and Bartol 2008). In 2005, more modifications to the registration laws came following the murder of a young girl in the state of Florida. Referred to as Jessica's Law, this law increased mandatory minimum sentences for offenses against children as well as regulated where sex offenders could

live by limiting the areas around schools, parks, daycare centers, and places where children are known to congregate (Velasquez 2008). In 2005, along with many other states, California passed their own version of Jessica's Law. Still, one year later, the laws were revised yet again when Congress passed the Sex Offender Registration and Notification Act (SORNA), also known as the Adam Walsh Child Protection and Safety Act (Velasquez 2008). This act extended registration periods and increased penalties for offenders who failed to fully comply with the registration laws. It also required offenders to update their information with law enforcement more often (Levenson *et al.* 2010). The federal government required states to implement this new law or risk losing 10 percent of the Justice Assistance grants that they were receiving (Velasquez 2008). Similar to most other states, the state of California has implemented their own version of these laws, but has decided not to come into full compliance with the federal guidelines because it is too expensive and there is no guarantee that the laws will be effective (National Conference of State Legislatures 2013; State of California Sex Offender Management Board 2009).

Even though policies targeting sex offenders are estimated to be immensely expensive, they are enormously popular with the public (Velasquez 2008). For example, in 2005, a Gallup poll found that 94% of the sample was in favor of registration laws for offenders convicted of child molestation (Saad 2005). A similar study among Florida residents found that 76.3% of that sample thought that all sex offenders should be subject to community notification. This same sample of Florida residents estimated the recidivism rate of sex offenders to be as high as 75% (Levenson *et al.* 2007), although the actual reoffending rate of sex offenders is relatively low (Hanson, Morton, and Harris 2003; Turner and Rubin, 2002). Comparable studies done in many states throughout the United States have had similar results (Kernsmith *et al.* 2009; Schiavone and Jeglic 2009). Furthermore, residents tend to be confident that the registration laws actually reduce the rates of sexual abuse and prevent recidivism. Using a sample of Florida residents, researchers found that 68% of those surveyed thought that having access to an Internet database of registered sex offenders reduced the rates of sexual abuse (Levenson *et al.* 2007). Another study (Schiavone and Jeglic 2009), with participants from 15 states, found that 44% of the sample agreed that registration helped to prevent offending. Despite this, and contradictory to the former

study mentioned, 57% did not feel that the laws affected recidivism rates (Schiavone and Jeglic 2009).

Even with the tremendous amount of public support for these laws, there is still much controversy over them. Numerous studies have found that registration and notification laws have no effect on sex offense recidivism or on preventing new sex crimes from taking place (Duwe *et al*. 2008; Letourneau Bandyopadhyay, Armstrong, and Sinha 2010; Levenson *et al*. 2007; Tewksbury *et al*. 2010; Zandbergen, Levenson, and Hart 2010; Zgoba and Bachar 2009; Zgoba, Veysey, and Dalessandro 2010). One possible explanation for this is because in many cases, the victim and offender are known to each other in some way (Zandbergen *et al*. 2010). In addition to these laws having questionable positive effects, researchers feel that they may put offenders at an increased risk for reoffending because the laws have the potential to inhibit successful re-entry into society (Levenson *et al*. 2007; Tewksbury and Ehrhardt Mustain 2006; Velasquez 2008). Not only can the laws make finding employment and housing difficult, but they can also isolate the offender from family, friends, and support, therefore creating additional stress that the offender must cope with (Levenson *et al*. 2007; Tewsbury and Ehrhardt Mustain 2006).

Even though the public is a fan of registration laws, their effectiveness is questionable, especially in disadvantaged areas where residents may not pay attention to, or may not have easy access to, the registries. As one Gallup poll pointed out, only 23% of its sample admitted to even checking a list of registered sex offenders in total but members of families making less than $30,000 a year checked even less (Saad 2005). Not only did these individuals in disadvantaged areas check the registries less, but even if they did check, the individuals in those communities with less formal and informal controls may not have the means to use the registration information as intended and protect themselves and their significant others (Socia and Stamatel 2011).

Patterns of Sex Offending and Offenders

According to a 2005 Gallup poll, 66% of Americans surveyed were 'very concerned' over the sexual molestation of a child (Carroll 2005). Another study by Kernsmith *et al*. (2009) found that over 80% of their respondents were afraid of a pedophile living in their neighborhood. According to the National Center for Missing and Exploited Children, as of January 2012,

there were 747,408 registered sex offenders in the United States, which is a substantial increase from the 2010 count. Almost 73,000 of these offenders were living in the state of California, which equates to approximately 195 registered sex offenders per every 100,000 residents (National Center for Missing and Exploited Children 2012).

In comparison with other offenses, the recidivism rate of sex offenses is relatively low, which commonly contradicts the public's perception; research suggests that between 10% and 20% of sex offenders will reoffend with another sexual offense within five years of being released from prison (Hanson *et al*. 2003; Turner and Rubin 2002). Rates of reoffending are thought to be influenced by contextual factors as Kubrin and Stewart's multilevel study (2006) illustrated for general recidivism, although such empirical analyses are rare in sex offender research.

Studies at the neighborhood level have found that registered sex offenders are likely to be found clustered in certain neighborhoods which are usually plagued by social disorganization (Duwe *et al*. 2008; Socia and Stamatel 2011; Tewksbury *et al*. 2010; Zandbergen *et al*. 2010). There are many assumptions as to why there may be increased rates of sex offenders in certain neighborhoods. The sex offenders may be attracted to the area due to the availability of low cost rental housing (Grubesic 2010). When the offenders leave prison, it is likely that they will not have many resources, and areas with low rental prices and a high number of available units may be the easiest place for the offenders to go (Tewksbury *et al*. 2010). It has also been hypothesized that sex offenders are attracted to these areas because they can remain anonymous, which makes it easier to commit additional offenses (Socia and Stamatel 2011). Finally, they may simply have nowhere else to live due to the residential restriction laws in place in many areas (Grubesic 2010). Living in these areas may be more stressful for the offenders, due to a lack of resources and support, access to suitable targets, and increased opportunities to commit a crime. A lack of social relationships combined with more social disorganization may create an environment that allows offenders to move about more freely and unnoticed, which in turn allows them to commit additional crimes more easily than if they knew they were being watched (Tewksbury *et al*. 2010). In more disadvantaged neighborhoods, there also tend to be increased incidences of both physical abuse and neglect of children (Tewksbury *et al*. 2010), which could mean more potential victims for the offender.

Theoretical Framework

Social disorganization theory provides a basic framework of neighborhood analysis of crimes. After manually plotting the locations of juvenile delinquency as a pin map, Shaw and McKay (1942) noticed a spatial pattern of crimes in Chicago neighborhoods. Crimes were not evenly spread out across the city but clustered in certain neighborhoods. Following the early work of Park and Burgess, Shaw and McKay found that there was an increased rate of crime and delinquency in the neighborhoods surrounding the industrial and commercial areas of the city. Furthermore, they witnessed higher rates of poverty, residential mobility, and racial heterogeneity, which they stated were the cause of social disorganization by disrupting the ability of residents to create and maintain informal social controls (Krohn, Lizotte, and Penly Hall 2009; Shaw and McKay 1942). Even when the current ethnic group moved out of these areas and a new one moved in, the same increased rates of crime persisted over time (Krohn *et al.* 2009; Kubrin *et al.* 2006; Shaw and McKay 1942). This finding highlights the importance of neighborhood characteristics in explaining varying crime rates. This shows that crimes do not take place solely due to individual characteristics of offenders, but that individuals are influenced by the context in which they live as well. In conclusion, Shaw and McKay's classic study illustrated that neighborhood context could explain crimes just as well as, or even better than, individual characteristics (Kubrin, Stucky, and Krohn 2009).

The theoretical model of social disorganization was further refined by a series of studies in the late 1980s and onward (Bursik and Grasmick 1993; Kornhauser 1984; Sampson and Groves 1989; Stark 1987). In particular, social controls became a key variable linking structural characteristics of neighborhoods, including low socio-economic status, residential instability, and ethnic heterogeneity, to higher crime rates. Social controls are mechanisms in which residents of a neighborhood form to maintain order (Sampson, Raudenbush, and Earls 1997) and to control the behavior of people in the neighborhood (Kubrin *et al.* 2009). Moreover, in 1997, the theory was further extended when collective efficacy was introduced (Sampson *et al.* 1997). This concept is comprised of two inter-related factors: the ability of neighborhood residents to realize common goals and values, and the willingness of the residents to take action for the common good of the neighborhood (Sampson *et al.* 1997). It was found that neighborhoods with higher levels of collective efficacy lowered violent crime rates in Chicago and other cities.

METHODS

The research question analyzed in the current study is how neighborhood conditions affect the likelihood of violation status among registered sex offenders while controlling for individual offender characteristics. In order to thoroughly answer the research question, three sets of analyses were conducted that examined: 1) if registered offenders were likely to be living in certain neighborhoods; 2) if neighborhood disadvantages affected the likelihood of violation; and 3) if accessibility to social services acted as protective factors for registered sex offenders. The following sections provide descriptions of the data and analytical strategies utilized to test the research question. In particular, the first analysis used a spatial regression model to predict the aggregated count of registered offenders per neighborhoods by using neighborhood characteristics as independent variables, while the second and third analyses examined the violation status of the individual offenders using multilevel models with offender and neighborhood characteristics as predictors.

Data

Neighborhood data were obtained from the American Community Survey (ACS) completed in 2007-2011. The main unit of analysis gathered from this survey in the current research is census block groups of Fresno County, CA (a total of 589 census block groups). The ACS is an annual survey that randomly selects around three and a half million addresses each year to participate and has a response rate of 97% (United States Census Bureau 2010). The ACS is designed to replace long forms of the decennial census and provides demographic and socio-economic characteristics of neighborhoods at the micro scale.

The sex offender data utilized in this study were retrieved from the California Megan's Law website, www.meganslaw.ca.gov. This website is maintained by the California Department of Justice and was activated in 2004 (State of California Department of Justice 2009). At the time of this study in October of 2012, there were a total of 1,739 registered sex offenders in Fresno County; for the purpose of neighborhood-level analysis, 1,097 of the registrants whose address information was publicly available and whose demographic information was complete were used in

the current study. Information gathered from the Megan's Law website included: type of crime committed, ethnicity, gender, age, address of the offender, residential status, a general physical description of the offender, and violation status. Most of the registrants (373; 21.5%) for whom address information was not available were Level I offenders who pose the lowest risk. Additionally, 155 registrants (8.9%) were transients and could not be included in the analysis that took into account neighborhood contexts (as, by definition, transients' residential locations cannot be determined). Additionally, a very small fraction of the registrants were females (38; 2.2%) and other racial/ethnic groups (98; 5.6%); because of their low prevalence and a statistical estimation problem of categories with such a small number of cases, they were excluded from multivariate analyses reported in this paper. However, it should be noted that a supplemental analysis that focused on individual characteristics only and that used all cases of the registrants including the Level I offenders and transients produced a consistent result with the analysis reported in this article. The same individual characteristics were predictive of violation status as Model 1 of Table **4**. The results of the supplemental analysis are available upon request.

Dependent Variables

The dependent variable for the first research question is the number of registered offenders per census block groups, while it is violation status coded as a dichotomous variable, in violation or not in violation, in the second and third research questions. If offenders fail to register on time, fail to register at all, or provide false information to the registration authorities, they will be in violation of the law, specifically, California Penal Code section 290 (State of California Department of Justice 2009). The address information of the offenders was used to geo-code their locations and assign geographic coordinates, which in turn were used to merge the offender data with neighborhood data for spatial and multilevel analyses.

Independent Variables

Independent variables in the current research include both individual characteristics of the registered offenders and neighborhood characteristics.

Individual Characteristics

A variety of individual characteristics of the offenders were included in the study as predictors of violation status. These included demographic

information (gender, age, race/ethnicity, and body weight), crime type, and frequency of address change. Table **1** summarizes descriptive statistics of individual characteristics. The crime type variable was created based on the offenders' previous convictions and dichotomized by their target victim's age. The address change variable was created by accessing the Megan's Law website every two weeks over a period of eight weeks; the variable was coded as an interval-ratio variable and ranged from 0 (no address change) to 3 (addresses changed every two weeks).

Neighborhood Characteristics

Neighborhood characteristics as predictors of the number of registered offenders per neighborhood and predictors of individual offenders' violation status were selected from social disorganization theory. Table **2** displays the descriptive statistics of the neighborhood characteristics obtained from the ACS and included in the current research. It becomes obvious from the table that Fresno County has a very diverse population. It is also evident that neighborhood characteristics vary substantially in terms of their socio-economic characteristics. Such diversity of populations strengthens the external validity and generalizability of the current study.

One of the main neighborhood characteristics examined in this research was related to disadvantage. As part of a data reduction strategy, principal component analysis was used among a set of observed variables that were likely to tap into various aspects of neighborhood disadvantage. A neighborhood disadvantage factor (principal component) was created from five highly related characteristics that loaded on the same factor and explained 62% of the variance. These five variables and their factor loadings (in parenthesis) were: percent of residents in poverty (0.88); percent of residents on public assistance (0.71); percent of residents with at most a high school diploma (0.82); percent of single parent households (0.69); and median household income (-0.84). The neighborhood disadvantage factor is similar to disadvantage factors used in previous research (Hipp *et al.* 2010; Kubrin and Stewart 2006; Sampson *et al.* 1997; Socia and Stamatel 2011). While unemployment rates were conceptually related to disadvantage, its principal component weight did not exceed the conventional threshold of 0.7; hence, unemployment rates were included in regression models as an individual predictor.

The second important concept in social disorganization theory is residential mobility which was

Table 1: Individual Characteristics of Registered Sex Offenders (N=1,097)

		Frequency	Percent
Ethnicity			
	Caucasian	439	40.02%
	African American	134	12.22%
	Hispanic	524	47.77%
Offense Type			
	Victim 14 & under	851	77.58%
	Victim 15 & over	246	22.42%
Violation Status			
	Not in Violation	1047	95.44%
	In Violation	50	4.56%
		Mean	Std. Deviation
Age		53.2	12.82
Frequency of Address change		0.09	0.30
Body weight		198.3	42.38

Table 2: Neighborhood Characteristics (N=589)

	Mean	Std. Deviation
% Caucasian	34.97	25.37
% African-American	4.43	7.45
% Asian	7.97	9.33
% Hispanic	49.33	26.40
% Other	2.22	3.07
% Single Parent Household	34.94	12.17
% High School Education or Less	52.50	22.16
% in Poverty	22.56	18.42
Med Income	48690.50	25726.25
% Public Assistance	7.42	9.36
% Rental Housing	45.80	25.56
% Unemployed	12.02	6.06
% Moved in Last Year	15.89	8.18

created through principal component analysis for the present study. Two observed variables that tapped varying aspects of residential instability were used to create the factor (principal component). These variables explained 65.9% of the variance and exhibited principal component weights larger than 0.7. These two characteristics and their associated factor loadings were: the percent of rental housing (0.82) and the percent of residents who have changed addresses in the past year (0.82). This residential mobility factor is

similar to the one used in previous neighborhood studies including those by Socia and Stamatel (2011) and Kubrin and Herting (2003).

It has been suggested that a lack of available resources may contribute to the likelihood of unsuccessful re-entry of offenders and a higher chance for recidivism (Hipp *et al.* 2010). Thus, social services may be an important aspect when examining the violation status of sex offenders. The flip side of this argument is that the accessibility to social services may be considered as a protective factor for registered offenders; to the extent that social disorganization literature tends to focus on risk factors of criminal behavior and crime rates while ignoring the role of protective factors, the analysis of social services in the current study offers a unique and important contribution. A total of 108 social services and their addresses were extracted from the Fresno County directory (Department of Social Services n.d.) and their addresses were geo-coded. The services included: substance abuse treatment programs, mental health facilities, and services for the homeless. By using Geographic Information System (GIS) functions, the distance to the closest available social service for each offender and the number of social services per census block group population were calculated. These two variables of the distance to the social services and the social service density per population represented proxies of the accessibility and availability of the services for an offender.

Analytical Strategies

In order to examine the first research question regarding whether or not registered offenders were likely to be living in disadvantaged neighborhoods in Fresno, negative binomial spatial regression models were employed with the aggregated count of registered offenders per census block groups as the dependent variable and neighborhood characteristics as independent variables. While traditional regression models assume the independently distributed error terms, neighborhood level analyses are likely to violate this assumption as neighborhoods are not independent observations (Anselin, *et al.* 2000; Baller, Anselin, Messner, Deane, and Hawkins 2001); instead, spatial continuity of neighborhoods is an important component that needs to be explicitly taken into account through modeling. The spatial regression models, in particular, include a spatial-lag term of the dependent variable in order to incorporate spatial processes in the modeling and to produce unbiased estimates. The spatial-lag

term was created by calculating the average number of registered offenders in surrounding neighborhoods for each neighborhood observation. While the spatial regression models are attractive from a statistical viewpoint as they overcome the assumption violation problem, the models serve a substantive interest as well; the coefficient estimate of the spatial-lag term represents the extent of clustering of registered sex offenders after controlling for other neighborhood characteristics included in the models. A positive coefficient of the spatial-lag term indicates a clustering of offenders, while a negative coefficient implies registered offenders are spatially dispersed. Finally, a negative binomial distribution was used to model the distribution of the dependent variable, as the number of registered offenders is a count variable.

As for the second and third research questions that examine the offender's violation status with individual and neighborhood characteristics as predictors, multilevel logistic regression models were used. Because the dependent variable is a dichotomous variable (in violation vs. not in violation), logistic regression is a suitable model. Furthermore, because predictors exist in two levels (individual characteristics at level 1 and neighborhood characteristics at level 2) and multiple offenders are nested in a census block groups, multilevel modeling is an appropriate statistical model to be used (Raudenbush and Bryk 2001). The multilevel models' flexibility to accommodate both neighborhood and individual characteristics while properly correcting for non-independence of observations nested within neighborhoods is ideal for the current research that emphasizes that both characteristics play an important role in affecting individual behavior.

RESULTS

Table **3** shows the results of negative binomial spatial regression models where the number of registered sex offenders per census block groups is the dependent variable. A block of neighborhood characteristics was sequentially included as independent variables; Model 1 examined demographic characteristics of neighborhoods, Model 2 added social disorganization variables, and, finally, Model 3 included the number of social services per census block group population.

The results of Model 1 indicated that racial and ethnic compositions of neighborhoods were not predictive of the number of registered sex offenders.

The only statistically significant predictors were the spatial-lag term and the total population variable included as a control variable to take into account different population sizes of neighborhoods. The positive coefficient of the spatial-lag term indicated that registered offenders were likely to be clustered in select neighborhoods.

Of the social disorganization variables included in Model 2, only the neighborhood disadvantage factor was statistically significantly related to the number of registered offenders. The direction of association was consistent with prior studies and theoretical expectations; the results indicated that a one-unit increase in the neighborhood disadvantage factor was associated with a 38% increase in the expected number of registered sex offenders.

Finally, in Model 3, the availability of social services and residential locations of registered offenders were analyzed along with other neighborhood characteristics included in the previous models. The results indicated that the social service variable was not related to the number of registered offenders per census block groups, implying the social service programs and facilities were not located where offenders were likely to be living.

In summary, based on the negative binomial spatial regression models, it was found that registered sex offenders were likely to be clustered in socio-economically disadvantaged neighborhoods where social services as a protective factor were not likely to be present. While the concentration of offenders in disadvantaged neighborhoods was consistent with existing studies, the uniqueness of the current study was its ability to examine if social service programs were located where the needs were present. The results indicated that social services were not likely to be available where offenders clustered. In the next set of analyses, data were analyzed to see if those offenders living in disadvantaged neighborhoods were at a higher risk of violations and if the availability of social services reduced the likelihood of violation even after controlling for neighborhood disadvantage.

Table **4** displays the results of multilevel logistic regression models with violation status as the dependent variable. Of the variables included in Model 1 that assessed the effects of individual characteristics on violation status, age, body weight and Hispanic ethnicity were statistically significant. Age of the offender was negatively associated with violation status

Table 3: Spatial Regression Models Predicting the Number of Registered Sex Offenders per Census Block Groups

	Model 1		Model 2		Model 3	
	Demographics		*Social Disorganization*		*Social Services*	
	Coef.	**IRR**	**Coef.**	**IRR**	**Coef.**	**IRR**
Spatial-lag of Sex Offender Count	0.21**	1.23**	0.20**	1.22**	0.19**	1.21**
Total Population (1000 people)	0.21**	1.23**	0.26**	1.30**	0.27**	1.31**
Caucasian (%)	0.01	1.01	0.01	1.01	-0.02	0.98
African-American (%)	0.01	1.01	0.00	1.00	-0.03	0.97
Asian (%)	0.01	1.01	0.00	1.00	-0.03	0.97
Hispanic (%)	0.01	1.01	0.01	1.01	-0.03	0.97
Other Race (%)	0.02	1.02	0.02	1.02	-0.02	0.98
Residential Mobility			-0.03	0.97	-0.04	0.96
Neighborhood Disadvantage			0.32**	1.38**	0.31**	1.37**
Unemployment (%)			0.01	1.01	0.01	1.01
Social Services (per 1000 people)					0.02	1.02
Constant	-1.34	0.26	-1.36	0.26	2.08	7.98
Log(alpha)	-0.42		-0.48		-0.50	
Alpha	0.66		0.62		0.61	

Note: *p<0.05, **p<0.01.

Table 4: Multilevel Logistic Regression Model of Violation Status Predicted by Individual and Neighborhood Characteristics

	Model 1		Model 2		Model 3	
	Individual Characteristics		*Social Disorganization*		*Social Services*	
	Coeff.	**OR**	**Coeff.**	**OR**	**Coeff.**	**OR**
Age	-0.03*	0.97*	-0.03*	0.97*	-0.03*	0.97*
Weight	-0.03**	0.97**	-0.03**	0.97**	-0.02**	0.98**
African-American[a]	0.66	1.94	0.55	1.73	0.77	2.16
Hispanic[a]	1.34*	3.83*	1.12*	3.05*	1.07*	2.91*
Address change	0.98[+]	2.67[+]	1.02[+]	2.76[+]	0.97[+]	2.64[+]
Minor Victim	-0.30	0.74	-0.31	0.73	-0.25	0.78
Population Density			-0.08	0.93	-0.02	0.98
Residential Mobility			-0.61[+]	0.54[+]	-0.45	0.64
Neighborhood Disadvantage			0.99*	2.68*	0.77*	2.16*
Unemployment Rate			0.00	1.00	0.02	1.02
Distance to Social Service					0.08**	1.08**
Social Service Density					-0.02	0.98
Constant	1.68	5.33	1.83	6.24	0.86	2.37
Random Effect	2.06**		1.85**		1.29**	
Log Likelihood	-163.77		-158.52		-152.67	
AIC	343.54		341.05		333.33	
BIC	383.38		400.81		403.07	
Df	8		12		14	

Note: [a]The reference category is Caucasian.
[+]p<0.1, *p<0.05, **p<0.01.

where an increase in age was related to a 3% decrease in the odds of being in violation (OR=0.97). Body weight was also negatively associated with violation status; a 1lb increase in body weight was associated with a 3% decrease in the odds of being in violation (OR=0.97). The odds of Hispanics in violation were 2.83 times higher than for Non-Hispanic Caucasians, after controlling for other independent variables. The effect of address change was only marginally significant (p<0.1); the direction of association was that those offenders who changed their addresses more frequently were at a higher risk of being in violation. Finally, the random effect intercept was significant, indicating the needs to control for nested observation structure and neighborhood characteristics.

Model 2 incorporated neighborhood characteristics based on social disorganization theory. Age, body weight and Hispanic ethnicity remained significant even after the neighborhood characteristics were taken into account in this model, although the coefficient size of Hispanic ethnicity became considerably smaller from 3.83 to 3.05; that is, neighborhood characteristics collectively explained away the individual effect of Hispanic ethnicity by 20% ((3.05-3.83)/3.83 = -0.203 or -20.3%). Of the social disorganization variables, the effect of neighborhood disadvantage factor on violation status was significant and positive (OR=2.68, p<0.01), while the effect of residential mobility factor was only marginally significantly related to the risk of being in violation (OR=0.54, p<0.10). The positive effect of neighborhood disadvantage indicated that as the degree of neighborhood disadvantage increased so did the likelihood of being in violation. The negative effect of residential mobility, on the other hand, indicated that as the residential mobility of a neighborhood increased, the odds of the offender being in violation decreased. That is, the offenders were more likely to be in violation in stable neighborhoods, which may not appear to be in accord with social disorganization theory. This relationship between residential stability and a higher risk of violation may occur because stable neighborhoods are high in social control and members watch out for each other; as a result of increased supervision and guardianship, violations of registration conditions in stable neighborhoods may be more likely to be noticed and reported than instable neighborhoods where informal social control is weak.

Model 3 added two variables related to social services as protective factors. The results indicated

that the closest distance to a social service for a registered offender was significantly and positively related to violation risks while other individual and neighborhood characteristics were taken into account. One mile decrease in the distance to the closest social service was related to an 8% decrease in the risk of the offender in violation (p<.01). In other words, the offenders living close to social services faced a lower risk of registration violations; the accessibility to social services indeed appeared to work as a protective factor for registered offenders. The availability of social services as measured by the number of social services per 1,000 people in a census block group of the offender's residence was not significantly related to the risk of violation. Nonetheless, the inclusion of the accessibility to and availability of social services changed the coefficient size of neighborhood disadvantage from 2.68 to 2.18. That is, these social service variables collectively explained away about 19% of the effect of neighborhood disadvantage on the risk of violation ((2.18-2.68)/2.68= -0.186, or -18.6%), indicating social services were a mitigating variable and an important protective factor.

DISCUSSION AND CONCLUSION

The empirical analysis of registered sex offenders in Fresno County in this study found that: 1) the registered offenders were likely to be living in disadvantaged neighborhoods; 2) those offenders living in disadvantaged neighborhoods faced a higher risk of being in violation; and 3) the accessibility to social services mitigated the effect of neighborhood disadvantage and lowered the risk of violation. The analyses utilized statistical models that explicitly took into account the spatial process and nested structure of observations through spatial regression models and multilevel models.

Of the individual characteristics, Hispanic, age, and body weight were significant predictors of violation. Interestingly, while African-Americans were not more likely to be in violation than Caucasians, Hispanics were more likely to be in violation, which is slightly different from previous research on recidivism risks for different ethnicities where African-Americans generally are rearrested and reconvicted more frequently than Hispanics or Whites (McGovern, Demuth, and Jacoby 2009). One reason for this inconsistency with prior research is simply because there is a large Hispanic population in the Fresno area which may have a unique impact on the success and failure of the sex offender. It is typical for Hispanics to have larger families and

tightknit communities; this may mean that the stigma of being a registered sex offender is even worse for them, and they may face suspicion or distrust in their family and neighborhood leading to immediate reporting of possible violations to the authorities. Alternatively, Hispanics may be more likely to be in violation simply because they do not fully understand the registration laws. For some, English may not be their primary language; thus comprehending and complying with the laws may be difficult.

Initially, body weight was simply included as a control variable. In the analysis, however, body weight turned out to be a significant and consistent predictor of violation status where those offenders weighing less were more likely to be in violation. Offenders weighing less may be living in an unhealthy and stressful lifestyle (e.g., transient and homeless), which may increase their risk of violating registration conditions and even re-offending. Alternatively, perhaps, the physical attributes of being overweight may discourage offenders from actively seeking out potential victims, or the stigma of being overweight may prevent these offenders from successfully approaching a potential victim. As previous research has found, the most common victim of a sexual crime is a family member or someone close to the victim (Mears, Wang, Hay, and Bales 2008; Sampson, Morenoff, and Gannon-Rowley 2002; Sampson *et al*. 1997; Pratt and Cullen 2005).

As for neighborhood characteristics, the effect of neighborhood disadvantage was in accord with theoretical expectations of social disorganization theory. Although it was consistent with the theory, the analysis also highlighted the troublesome reality that offenders were likely to be living in disadvantaged neighborhoods, and that those in disadvantaged neighborhoods further faced a heightened risk of violation. While the direction of association for residential mobility was consistent with an informal social control mechanism of social disorganization theory, the effect was only marginally significant. There was a tendency for offenders living in residentially instable neighborhoods to face a lower risk of violation. It may be the case in this study that residential mobility is helping the offenders to remain more anonymous and stay out of violation. For example, if the residents of the neighborhood are always in flux, no one will be closely watching the offenders and reporting them if they do anything wrong that would lead to a violation. That is, residentially unstable neighborhoods are low in informal social control, which in turn diminishes the

residents' ability to identify and report registration violations.

Perhaps, the most promising research finding in the current study was that the accessibility to social services was a significant protective factor that lowered the offenders' risk of being in violation. Although it was not a direct measure of the offenders' actual usage of these services, those offenders living closer to social services were less likely to be in violation, presumably because more help and resources for rehabilitation were available for them. However, the unfortunate reality identified in the first analysis of spatial regression models was that offenders were likely to be clustered in disadvantaged neighborhoods where such services were not likely to be present.

To a large extent, the results of the current study were supportive of the hypotheses based on existing studies and social disorganization theory. Furthermore, the results of multilevel analysis indicated that both individual and neighborhood characteristics simultaneously affected the risk of violation; although neighborhood characteristics considerably explained away some of the individual characteristic effects as indicated by the change in coefficient size, the individual effects did not disappear when the neighborhood characteristics were taken into account. So, although the neighborhood characteristics did matter, so did the individual characteristics.

POLICY IMPLICATIONS

While registration and notification laws are popular, they are resource intensive and have not been shown to prevent reoffending (Duwe *et al*. 2008; Justice Policy Institute 2008; Letourneau *et al*. 2010; Levenson *et al*. 2007; Saad 2005; Schiavone and Jeglic 2009; Tewksbury *et al*. 2010; Zandbergen *et al*. 2010; Zgoba *et al*. 2010). The public feels assured that sex offender registries afford them a sense of safety by providing them access to offender information and location (Schiavone and Jeglic 2009), but in fact, these registries may make successful re-entry more difficult for the offenders (Levenson *et al*. 2007; Tewksbury and Ehrhardt Mustain 2006; Velasquez 2008), and provide a false sense of security to the public. Being named to a sex offender registry may make finding employment and housing difficult (Levenson *et al*. 2007; Tewsbury and Ehrhardt Mustain 2006), which will prevent an offender from being able to move out of a disadvantaged area, which in turn will increase the likelihood of a violation, as shown in the current study.

It has also been stated that the registration laws may increase transience, homelessness and unemployment (Duwe *et al*. 2008; Zandbergen *et al*. 2010), and because of this, offenders may change addresses without updating the registry or they may just provide a false address which would lead to a violation if discovered by the authorities (Duwe *et al*. 2008). Increased risk of violations drain resources of the criminal justice system as law enforcement agencies need to track these offenders and incarcerate violators depending on situations. Increased incidences of violations may create a revolving door of offenders constantly moving between the community and penal institutions. Effective management of offenders in the community should give consideration to programs that lower the risk of violations and conserve the limited resources of the criminal justice system while keeping the community safe.

Rather than using this 'one size fits all' approach to the registration laws, strategic and tactical implementation of the registration policies that address the needs of individual offenders and community may be more beneficial and efficient. First, this study found that the accessibility to social services reduced the likelihood of violation, although unfortunately, these services were not likely to be located where offenders clustered. While increasing the number of available services may be difficult under a bad economy with limited resources, it is reasonable to strategically place these programs where offenders congregate. Geographic Information Systems (GIS) can be used to find suitable locations of social services by taking into account neighborhood characteristics and registered offender locations. Even if decreasing the physical distance to social services is difficult, social distance from offenders to services may be decreased by increasing the publicity of available resources in the community. Such a strategic planning of social services can ultimately lead to the conservation of financial resources of the criminal justice system. In fact, it has been argued that programs where correctional staff and community figures assist offenders in finding stable housing in less disadvantaged areas can result in fewer technical violations (Hipp *et al*. 2010).

Second, the risk of individual offenders should be thoroughly assessed prior to registration for the effective and efficient management of the registration policies. By requiring most of the offenders to register without first assessing their risk of reoffending, some low risk offenders must deal with the added strain of having their name on a registry which may impact their employment prospects and housing, which in turn could cause them to violate more often and drain resources (Levenson *et al*. 2007). The focus should be on high risk offenders, and place of residence should be taken into account when the risk assessment is completed. This increases the potential to monitor high risk offenders and their compliance with the laws. Some researchers suggest that objective measures of recidivism risk should be used to assess which offenders are high risk, and then this information should be used to focus attention and resources to these offenders (Levenson *et al*. 2007; Levenson *et al*. 2010). Researchers in Pennsylvania recently created a program that uses an advanced statistical model to classify offenders into one of three groups based on their recidivism risk (Ritter 2013). This classification helps with the effective management of resources because these three categories of offenders are monitored differently based on risk. This program uses Random Forest Modeling which allows for a large number of variables to be used in the assessment of risk without losing the predictive quality of any of them. Currently, some of the predictors used in Pennsylvania are prior jail stays, the offender's zip code, and the number of years since the last serious crime was committed (Ritter 2013). A program such as this one could be a more effective way to manage the sex offenders in Fresno County. Significant predictors of violation status as identified in the current study can be included in the risk assessment. Once a high risk offender is identified, more effort to closely monitor this offender could be undertaken to reduce the possibility of a violation or another offense.

Treatment of sex offenders may be another option to prevent recidivism and violations of the registration laws. For example, one study found that offenders who had received treatment were six times less likely to reoffend with another sexual offense when compared to a group who received no treatment and a group who received some treatment (McGrath, Cumming, Livingston, and Hoke 2003). Registration laws and treatment that focus on the highest risk offenders may have a better outcome than registration alone. Publicity and physical locations of available treatment programs should be strategically determined in order to maximize their effects.

LIMITATIONS AND DIRECTIONS FOR FUTURE RESEARCH

As with all research, there were several limitations of the current study that will guide the direction of future

research. First, although violation status was the key dependent variable of the current study because of the specialized laws that sex offenders have to abide by and the financial burden that ensues, it would have been beneficial to include actual reoffending (for both general crimes and sex crimes) in addition to violation status. This would allow for an evaluation of differences and patterns in what influences violation status as well as actual recidivism. This would also determine if individual and neighborhood characteristics affect technical violations differently than actual reoffending. Conceivably, neighborhood characteristics affect violation status because residents are watching the registrants more closely for any little violation when they may not actually be committing additional crimes. On the other hand, residents may not be watching registrants at all, especially in unstable neighborhoods lacking collective efficacy, which provides the opportunity for committing additional offenses.

Second, in order to analyze the influence of neighborhood characteristics, the current study relied on a subset of the registrants whose addresses were publicly available. Although a substantial proportion of excluded registrants in the current study were low-risk offenders (hence their address information was not disclosed) and a supplemental analysis of all cases focusing on individual characteristics showed a consistent result with similar independent variables being predictive of violation status, it is ideal for future studies to obtain confidential address information for all registrants in order to strengthen the generalizability of their conclusion.

Third, although a unique and innovative contribution of the current study was that it included the location of social services as a protective factor in spatial and multilevel modeling, the variable is a proxy at best and is not a direct measure of actual usage of social services among registrants. While the study produced a promising result regarding the role of social services, future studies should consider conducting a survey of registrants in order to directly assess the frequency of social service usage. When conducting a survey, additional information that is not readily available in a registry, such as the employment status of the offender, the victim-offender relationship of the prior offense, and the current living arrangement of the offender, should also be collected.

Finally, as stated by Zgoba and colleagues (2010), sex offender registries may increase the under-reporting of sex crimes. Family members or someone close to the offender are the most common victims of sexual abuse (Mears *et al*. 2008; Sampson *et al*. 1997; Sampson *et al*. 2002; Kubrin and Stewart 2006; Sampson and Groves 1989; Pratt and Cullen 2005), and family members or close friends of the offenders may be reluctant to report the offenders knowing that the offenders will be required to register for the rest of their life (Zgoba *et al*. 2010). So, the number of offenders listed on the Megan's Law website is most likely under-reported. In addition to the issue with under-reporting, there could be differences in who reports sex offenses across neighborhoods. The results of this study showed that more sex offenders were living in disadvantaged areas; it could be that individuals living in these areas will report sex crimes more often than those living in less disadvantaged areas. For example, there may be less reporting of sex crimes in less disadvantaged areas because of the stigma of having a registered sex offender in one's family and in the community. In addition to utilizing the official database of sex offenders, future studies may consider conducting a survey of community members in order to overcome these issues related to reporting.

The current research has explored the patterns of registrants and the determinants of registration violation by innovatively analyzing individual and neighborhood characteristics (including the accessibility to social services) simultaneously through spatial and multilevel modeling. While there are several limitations, this study paved a way for future research and a more efficient management of the registration policies. Despite the public popularity, the registration and notification laws are resource intensive to maintain and enforce. The money may be better spent in other areas, such as strategic placement of social services through the risk assessment of offender and neighborhood characteristics. Although the current study indicated a promising finding regarding the accessibility to social services as a protective factor, the study also identified the troublesome reality that registrants were likely to be clustered in disadvantaged neighborhoods where social services were lacking, and that those in disadvantaged neighborhoods faced a higher risk of violation. In order to effectively manage the limited resources, the criminal justice system should address the needs of the community by analyzing the local patterns of registrants and available resources. While many neighborhood studies tend to focus on risk factors such as socio-economic disadvantage, future studies should also consider the role of protective factors that mitigate the effects of neighborhood disadvantage.

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