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The Impact of Neighborhood Context on Spatiotemporal Patterns of Burglary

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Abstract

Objectives: Examine how neighborhoods vary in the degree to which they experience repeat/near repeat crime patterns and whether theoretical constructs representing neighborhood-level context, including social ecology and structural attributes, can explain variation in single incidents and those linked in space and time. *Methods:* Examine social, structural, and environmental design covariates from the American Community Survey to assess the context of near repeat burglary at the block group level. Spatially lagged negative binomial regression models were estimated to assess the relative contribution of these covariates on single and repeat/near repeat burglary counts. *Results:* Positive and consistent association between concentrated disadvantage and racial heterogeneity and all types of burglaries was evident, although the effects for other indicators,

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including residential instability, family disruption, and population density, varied across classifications of single and repeat/near repeat burglaries. *Conclusions:* Repeat/near repeat burglary patterns are conditional on the overall level and specific dimensions of disorganization, holding implications for offender-focused as well as community-focused explanations. This study contributes greater integration between the study of empirically observed patterns of repeats and community-based theories of crime, including collective efficacy.

Keywords
burglary, repeat, near repeat, spatiotemporal crime patterns, social disorganization

Introduction

Criminal events consistently demonstrate a nonrandom temporal and spatial pattern (Grubesic and Mack 2008; S. D. Johnson, Bowers, and Hirschfield 1997; Pease 1998; Townsley, Homel, and Chaseling 2003; Youstin et al. 2011). Burglary incidents, in particular, occur at specific times and places that conform to identifiable patterns (S. D. Johnson et al. 1997; Sagovsky and Johnson 2007). They also disproportionately occur in locations that are close to originating events but not at the exact same location (S. D. Johnson and Bowers 2004a, 2004b; S. D. Johnson et al. 2007; Townsley et al. 2003). Commonly referred to as the "near repeat" phenomenon (Morgan 2001), knowledge of this form of patterning has contributed to the broader understanding of crime.

Explanations for patterns of repeat burglary (and other crimes) frequently focus on incident characteristics or the situational attributes of locations (Bowers and Johnson 2005). In particular, persistent differences between these factors across locations are often referred to as risk heterogeneity and are argued to "flag" a location as suitable for crime (Pease 1998). Alternatively, the "boost" hypothesis suggests that past victimization increases the risk of future crime, a state dependence process (Bowers and Johnson 2004). The boost process is likened to foraging strategies in which offenders become aware of opportunities for future crime in some locales during the process of the initial event (Bernasco 2008). While these two explanations have received empirical validation, scholars have noted that "[g]iven the observed heterogeneity of (re)victimisation risk, one question which needs addressing is whether the congruence observed for the time of day that events in a series are committed varies according to *neighbourhood characteristics*" (Sagovsky and Johnson 2007:21, italics added). Pitcher and Johnson (2011:103) further suggest that "determining whether there are regularities in the *types of places* that are most likely to encourage space–time clustering would be a logical next step" (italics added).

References to "neighborhood characteristics" and "types of places" are relatively ambiguous, but at least two theoretical perspectives can help to frame these research questions. In the first, neighborhood characteristics represent dimensions of social ecology, including the demographics of residents and the presumed utility of social institutions such as jobs and families. This perspective is predominant in criminology, given its Chicago School heritage, and is consistent with social disorganization theory specifically. In the second perspective, physical features define the "type of places," and neighborhoods can be differentiated according to geographic attributes such as street networks, connecting nodes, and the empirical evidence for crime patterning theory (Brantingham and Brantingham 1981, 1993, 1995). In this perspective, the evidence for patterning is inductively interpreted in order to identify specific locations that facilitate criminal mischief.

The current study assesses whether neighborhood characteristics similarly or differentially influence the occurrence of residential burglaries not connected in space–time and those that are linked by spatiotemporal proximity. Specifically, we draw from social disorganization and crime pattern theory frameworks to examine whether structural characteristics of neighborhoods influence the patterns of all, single, and repeat/near repeat burglaries. Disentangling burglary patterns also broadly adheres to recent calls for improved specificity in measurement (Sullivan and McGloin 2014). Data to test these relationships are drawn from official police records in Jacksonville, Florida, with burglary patterns identified using Near Repeat Calculator software. Additional data sets from the American Community Survey (ACS) are employed to provide sociodemographic indicators representing structural disadvantage and instability, and Geographic Information Systems (GIS) layers representing street centerlines are used to measure physical features of neighborhoods, such as street connectivity and proximity to major highways. A series of negative binomial spatial regression models are then estimated to specify the context in which different types of burglaries occur and to identify the correlates of these temporal–spatial patterns. Results will inform our empirical understanding of burglary patterns, present evidence regarding associations between structural characteristics and spatiotemporal burglary clusters, and impact policy decisions regarding police and community responses to burglary incidents that are contingent on the neighborhood context.

Burglary Patterns

Burglary incidents often demonstrate a temporal–spatial pattern. Sometimes referred to as the repeat victimization phenomenon, these patterns are documented throughout the literature (Farrell and Pease 1993) and can be traced to the influential work of Sparks, Genn, and Dodd (1977), Sparks (1981), and Hindelang, Gottfredson, and Garafalo (1978). Initial empirical support for such patterns is offered by Gottfredson (1984) who used data from the British Crime Survey to demonstrate that roughly 15 percent of crime victims accounted for approximately 70 percent of crime incidents (also see Farrell and Pease 1993).

A critical component to understanding burglary patterns was contributed by Polvi and colleagues (1990, 1991) who empirically demonstrated a temporal component to these processes. They document the heightened risk of a second burglary occurring at the same residence as an initial event in the period of time immediately after the initiating event. In short, the risk of a repeat is inversely, and nonlinearly, proportional to time. Farrell and Pease (1993) summarize some of the empirical evidence regarding this phenomenon in school crime (Burquest, Farrell, and Pease 1992), racial attacks (A. Sampson and Phillips 1992), and domestic violence (Farrell, Clarke, and Pease 1993). Spelman (1995) also uses call for service data to document the steep reduction in the risk of future crime as time elapses.[1] Sherman and colleagues (1989) further specified a spatial element of this process, commonly known as "hot spots," for a variety of crimes, such that incidents are more likely to occur in some locations compared to others, and these patterns are empirically identifiable. Collectively, these findings spurred work on the intersection between space and time in understanding crime patterns, including burglary. S. D. Johnson and colleagues (1997), for example, demonstrated the spatial patterning of burglaries, the elevated risk of repeat burglaries, and the exponential rate of risk reduction over time (see also Bowers, Hirschfield, and Johnson 1998; Sagovsky and Johnson 2007).

Moreover, not only do burglaries coalesce in space and time, but also there is considerable evidence to suggest that homes near the original incident experience an elevated risk of burglary. Termed the near repeat phenomenon (Morgan 2001), several studies demonstrate that the risk of burglary rises in the spatial and temporal proximity of an originating event (S. D. Johnson and Bowers 2004a, 2004b; S. D. Johnson et al. 2007; Rey, Mack, and Koschinsky 2012). Townsley and colleagues (2003) describe the underlying assumptions of near repeat patterns as involving homogeneous areas and a contagion process. With regard to the former, risk of near repeats will increase in areas that possess similar attributes (i.e., security systems, floor plans, etc.) and will depend on the target suitability and the presence of motivated offenders. The contagion process implies that an offender observes the environment, assesses target suitability, and evaluates opportunities at not only the chosen site but also future sites based on the presence of similar site characteristics. Thus, the area may become "infected" and the risk of additional nearby burglaries is heightened. Analyses of nearly three years of burglary data confirmed the near repeat phenomena with differing risk associated with different housing environments, and to a lesser degree, target vulnerability (Townsley et al. 2003).

S. D. Johnson and Bowers (2004b) similarly report that a single burglary incident heightened the likelihood of a nearby burglary within 1 to 2 months and 300 to 400 meters. A subsequent set of analyses using the same data demonstrated that short-term risk is elevated in areas with more affluent homes; for homes with similar structures, but not floor plans; those on the same side of the street; and those on straight streets with homogeneous houses (Bowers and Johnson 2005). More recent evidence for near repeat processes exists for shootings (Ratcliffe and Rengert 2008); gun assaults (Wells, Wu, and Ye 2012); shootings, robbery, and auto theft (Youstin et al. 2011); motor vehicle theft (Lockwood 2012); and arson (Grubb and Nobles 2016). Due to the temporal and spatial patterning of these events, repeat and near repeat crimes are, to some degree at least, committed by same offenders or group of offenders (Bernasco 2008; S. D. Johnson, Summers, and Pease 2009; Kleemans 2001). Offender interviews provide additional evidence of patterning processes driven by the same offender(s) (Ashton et al. 1998; Ericsson 1995). In particular, Bernasco (2008:412) reports that events closer in time and space are more likely to involve the same offender compared to pairs that are farther away from each other; he concludes "the 'boost' explanation is compatible with the possibility that a repeat offence against the same person or target involves the offender who committed the initial offence" (also see Bowers and Johnson 2004; D. Johnson 2013).

Consistent with the wealth of empirical evidence on near repeat patterning, scholars have begun to suggest that understanding the *context* in which these patterns develop is a key area in need of development (Pitcher and Johnson 2011; Sagovsky and Johnson 2007). Burglaries that form a spatio-temporal pattern, for example, may develop within environments distinct from burglary patterns that are not connected in time and space. Identifying and understanding any differences in the correlates of these patterns would provide important theoretical validation and would be helpful in aiding the deployment of resources by the community and police.

The Current Study

To begin identifying contextual factors that may impact the distribution of different forms of burglary, specific measurement of the dependent variable is crucial. Sullivan and McGloin (2014:446) recently highlighted the importance of this issue when stating, " . . . it is clear that quality measurement is central to our discipline's ability to generate a valid empirical basis with which to assess theory and gain an improved understanding of offending patterns across people, space, and time." In the current study, we utilize tools designed to identify space–time clustering of crime (see Ratcliffe 2009) beginning with an analysis of all burglary incidents, prior to disaggregating those that form a spatial and temporal cluster (repeat/near repeat burglary) from those that may concentrate in space but lack both spatial *and* temporal proximity (single burglary). Thus, the challenge becomes identifying specific contextual correlates that influence the development of each of these patterns.

Given the current study's neighborhood-level focus, we draw heavily from social disorganization theory. Social disorganization has a long and storied history built on the foundational concepts of urban ecology (Park and Burgess 1921) and the work of Shaw and McKay (1942) who tested its original conception using juvenile data from multiple time periods and data sets. Over time, it has received considerable attention and support (e.g., Bursik and Grasmick 1993; Bursik and Webb 1982; Lowenkamp, Cullen, and Pratt 2003; Veysey and Messner 1999). The theory outlines a causal model in which neighborhood social disorganization is an intervening variable between structural factors (i.e., social–economic status, racial/ethnic heterogeneity, and residential mobility) and criminal behavior (R. J. Sampson and Groves 1989). The mediation process involves community participation, friendship networks, and peer group interaction, referred to by some as informal social control (Bellair 1997; Bellair and Browning 2010; Martin 2002; Steenbeck and Hipp 2011; Warner 2007). In short, areas characterized by low levels of social–economic status, high levels of residential mobility, and racial/ethnic heterogeneity lack informal social control or social capital (Martin 2002) and experience higher levels of crime. Given the structural factors' empirical support and the exploratory nature of the current study, we examine whether concentrated disadvantage, residential instability, racial heterogeneity, and family disruption (R. J. Sampson and Groves 1989; R. J. Sampson, Raudenbush, and Earls 1997) are related to different burglary patterns as characterized by their space–time signatures.

Application of neighborhood factors to understanding burglary incidents is not novel. Miethe and McDowall (1993), for example, reported that neighborhoods characterized by poor socioeconomic status experienced higher rates of burglary, while Chenery, Henshaw, and Pease (2002) demonstrated that physical disorder was linked with repeat burglaries. Our interest in social disorganization measures, however, moves beyond the simple association between structural measures and crime. Instead, we investigate whether the structural factors *differentially* impact patterns for all burglaries, single burglaries, and repeat/near repeat burglaries net of various neighborhood-level controls.

Our specific interest centers on whether these structural factors impact the occurrence of burglaries in neighborhoods which are not linked in space and time (i.e., single burglaries) and/or burglaries in neighborhoods that are linked in space and time (i.e., repeat/near repeat burglaries). We draw from the social disorganization framework to suggest that a patterning process occurs more frequently in areas that lack informal social control or an ability for the community to respond to the initial event. For example, consider a burglary occurring in a neighborhood characterized by social disorganization. In such an area, the community is either unable to muster effective crime prevention measures (e.g., neighborhood watch) due to inadequate resources or it is unaware/unwilling to respond due to a lack of community cohesion necessary to form an effective response. This scenario allows the risk of a future burglary to spread, similar to a contagion, to other targets linked in time and space (Townsley et al. 2003). In short, a repeat/near repeat process may be more likely to occur in such environments because an offender or group of offenders become aware of the low levels of informal social control during the course of the initial incident, but also because the area lacks the ability to effectively respond to the initial incident by blocking opportunities for a subsequent event.

The current study diverges from previous studies by testing whether unique burglary patterns can be predicted using neighborhood or area characteristics. In particular, this study addresses a key question posed by criminologists concerning the types of places where near repeat crime patterns are most likely to be observed (Pitcher and Johnson 2011; Sagovsky and Johnson 2007). It further complements similar work on site-specific situational attributes (e.g., Bowers and Johnson 2005) to focus on broader social ecological properties that are implicated in single versus repeat/near repeat burglaries as well as antecedent (crime prevention) and subsequent (crime response) processes. We assess the predictors of all burglaries but compare those findings against those that occur when single and repeat/near repeat burglary patterns develop.

Methodology

Data

The study site, Jacksonville, Florida, is the largest city by land area in the lower 48 states and features a merged city and county government. Taken together, these attributes provide a sizable study area with substantial social structural and geographic variability, yet ensure consistency across jurisdictions (e.g., crime recording and reporting practices). Data employed in this study originate from several sources. First, the Jacksonville Sheriff's Office (JSO) provided temporally and spatially referenced data for burglary incidents occurring between January 1, 2006, and December 31, 2007. An incident is defined here as a crime event, where an official police report was recorded by the JSO. Second, a reference street centerline provided by the JSO served as the basis for creating key variables representing the physical environment. Third, block group–level data from the U.S. Census 2007 to 2011 ACS represented social structural characteristics throughout the study area. The ACS is an ongoing data collection endeavor providing communities with annual information on demographics, education, commuting practices, income, and family structure. Fourth, the 2013 TIGER Census Block Group geographically referenced data file provided neighborhood boundaries for the study.

Measures

Dependent variables. Jacksonville experienced 14,589 total reported residential burglary incidents during the study period. These incidents were categorized into three distinct dependent variables operationalized as counts at the block group level: (a) total residential burglaries, (b) single residential burglaries, and (c) repeat/near repeat residential burglaries. Total residential burglaries encompass all incidents, single incidents represent those burglaries that were not identified as belonging to a space–time pattern, and repeat/near repeat burglaries include all offenses that were linked in space and time.

Patterns of repeat and near repeat crimes by definition involve two or more crime incidents that are associated in time and space. Identifying these patterns using Near Repeat Calculator software generates classification attributes that can be used to identify the subsets of burglaries of primary interest in the current study. Any given incident can be classified as an originator (e.g., the first incident in a pair or chain of incidents that meet the operational criteria for repeat/near repeat association based on spatial and temporal proximity), a repeat/near repeat (the second incident in a pair, or any subsequent incident in a chain of incidents that occurs after the originator), both, or neither of these—a single burglary (a standalone incident that has no complement occurring within the significant spatial and temporal bands). Like typical neighborhood-level studies predicting crime counts, our first dependent variable is a count of all burglaries at the block group level without any consideration of spatiotemporal clustering, serving as a reference before disaggregating. To achieve the goal of the current study, we use repeat/near repeats and single burglaries as dependent variables to compare and contrast factors influencing space–time patterning processes.

Independent variables. Four measures of social disorganization were created to represent concentrated disadvantage, residential instability, racial heterogeneity, and family disruption at the block group level. *Concentrated disadvantage* is an index calculated by summing the standardized scores of five constructs, including proportion of households under the federally defined poverty level, proportion of households receiving public assistance, proportion of Black residents in the neighborhood, median household income, and proportion of the civilian labor force greater than 16 years of age that is unemployed.[2] The final index was standardized, and higher scores indicate greater concentrated disadvantage ($\alpha = .82$). *Residential instability*, capturing population turnover, was calculated by summing the standardized scores of proportion of renters and proportion of short-term residents (e.g., those individuals moving into the neighborhood within the past five years). The measure was standardized, with higher scores indicating greater residential instability ($\rho = .88$).[3] *Racial heterogeneity* indicates the degree to which a block group is racially diverse. It was calculated using the formula $1-\Sigma p_i^2$, where p_i denotes the proportion of each racial group; higher scores indicate greater neighborhood racial heterogeneity (see Blau 1977; Gibbs and Martin 1962; Kubrin 2000; Sampson 1984). Finally, *family disruption* is a two-item measure tapping the degree to which neighborhoods are comprised of nontraditional family structures. Items included the proportion of single-headed families and the proportion of the population greater than 15 years of age that was ever married and subsequently separated or divorced. Measures were standardized before summation. The final measure was standardized, and higher scores indicate greater levels of family disruption ($\rho = .85$).

We also include several control variables that are relevant to the environmental design and density of neighborhood units, as well as measures that have been featured as traditional controls in other neighborhood-level analyses. *Street connectivity* was captured through the "beta" index, which was calculated by dividing the number of street segments (links) by the number of intersections or cul-de-sacs (nodes) within a census block group (Steiner, Bond, Miller, and Shad 2004; Yang 2006). The number of links and nodes were calculated using data from the street centerline file and TIGER block group layer; spatial join and related functions were executed in ArcGIS. Higher scores on this measure indicate greater street network connectivity and permeability of the block group. *Major highway* is a dichotomous indicator created using ArcGIS's buffer tool to represent whether any part of the block group is located within 1,000 feet of a major highway. *Population density* captures the number of individuals per square mile residing within a given block group. *Youth population* is a measure that taps into neighborhood variation in the age structure of the crime-prone population. It was calculated as the proportion of the population that is between the ages of 15 and 24.

To account for spatial autocorrelation, we include a spatially lagged version of each specific dependent variable under investigation. In addition, we account for differences in exposure for the number of targets (houses) by including the log-transformed number of occupied housing units and fixing the loading of this variable to 1 (see Osgood 2000). Table 1 reports descriptive statistics for all dependent and independent variables.

Analytic Strategy

A multistep data preparation and analytic process was required for this study. First, we subjected Jacksonville residential burglary incidents to space–time clustering analysis using the Near Repeat Calculator v1.3 (Ratcliffe 2009). Technical details of the method have been described and discussed in considerable detail elsewhere (e.g., S. D. Johnson et al. 2009; Ratcliffe and Rengert 2008; Wells et al. 2012), as have methodological considerations such as the implications of choosing arbitrary values for spatial and temporal bands (Youstin et al. 2011). To summarize briefly,

Table 1. Descriptive Statistics for Jacksonville Block Groups.

Variable	Mean	Std. Dev.	Min.	Max.
All burglaries	31.307	21.330	0.000	139.000
Single burglaries	13.858	8.654	0.000	63.000
Repeat/near repeat burglaries	12.088	14.714	0.000	106.000
Aggregated burglaries				
All burglaries (A)	0.059	0.052	0.000	0.451
Single burglaries (A)	0.025	0.018	0.000	0.192
Repeat/near repeat burglaries (A)	0.018	0.030	0.000	0.306
Concentrated disadvantage				
Household poverty	0.162	0.140	0.000	0.697
Proportion of public assistance	0.026	0.040	0.000	0.255
Proportion Black	0.333	0.310	0.000	1.000
Household income	49,268.180	24,399.172	9,000.000	169,000.000
Proportion unemployed	0.119	0.094	0.000	0.727
Residential instability				
Proportion renting	0.373	0.242	0.000	1.000
Proportion of short-term residents	0.439	0.186	0.000	1.000
Racial heterogeneity	0.346	0.194	0.000	0.710
Family disruption				
Proportion of single headed families	0.350	0.221	0.000	1.000
Proportion separated/ divorced	0.272	0.138	0.000	0.896
Controls				
Street connectivity	1.547	0.231	1.115	2.500
Near major highway	0.378	0.485	0.000	1.000
Population density	3,194.847	2,441.704	21.985	25,761.270
Youth (15–24)	0.138	0.079	0.000	0.932

Note: $N = 466$.

the Near Repeat Calculator builds upon the Knox method (1964) to determine whether event pairs cluster in space (e.g., less than one city block) and time (e.g., zero to seven days) to a greater degree than would be expected by chance.[4] Practical significance is also important; therefore, the Near Repeat Calculator identifies repeat and near repeat patterns when cells are statistically significant and Knox ratios (observed/expected) are greater than 1.2 (Ratcliffe 2009). Following others (e.g., Ratcliffe and Rengert 2008), we selected an intuitive spatial band equivalent to the average city block length in Jacksonville (575 feet); we also specify Manhattan distances to better approximate "real-world" conditions. Temporal bands for this analysis were equal to one week.

We next utilized the Near Repeat Calculator's postestimation features, which identify how frequently, if at all, a specific event is part of a repeat or near repeat pattern as well as the position in a given chain of events in which that event occurs (i.e., initiator and/or follow-up). This information was recoded into dichotomous indicators to specify whether a given burglary incident was isolated in space/time, whether it was an initiator of subsequent burglaries, and/or whether it was a repeat/near repeat crime. These attributes were subsequently imported into ArcGIS to determine the count of total burglaries, single burglaries, and repeat/near repeat burglaries that occurred within each block group.

Third, the shape file containing the three dependent variables was exported to Open GeoDa 1.0 (Anselin, Syabri, and Kho 2006) to create the spatial weight matrix using queen continuity and, importantly, to generate spatially lagged versions of the count of total residential burglaries, single residential burglaries, and repeat/near repeat residential burglaries. Local Moran's *I* statistics and descriptive maps displaying Local Indicators of Spatial Association (LISA; Anselin 1995) provided information about the spatial distribution of near repeat burglary incidents. Subsequently, block group–level data from the ACS were merged with both key attribute data from ArcGIS, including the alternative dependent variables and specific measures created using spatial tools previously described (e.g., street connectivity), as well as the spatially lagged dependent variables created in Open GeoDa.

Finally, a series of analyses of variances (ANOVAs) were used to explore whether standardized mean scores of social disorganization variables and other area-level characteristics significantly differed across block groups characterized by low–low, high–low, low–high, and high–high single and repeat/near repeat residential burglaries, respectively.[5] Multivariate models were then estimated to assess the relative influence of the social and ecological properties on the counts of all burglaries, single burglaries, and repeat/near repeat follow-up incidents, respectively, using negative binomial regression models with block groups as the unit of analysis. We account for spatial autocorrelation and adjust for exposure by factoring in the number of households or residential burglary targets (see Osgood 2000). We report corresponding significant incidence rate ratios and conduct Wald coefficient comparison tests, the latter of which assess significant differences in a predictor's effect across the single and repeat/near repeat burglary models. All multivariate analyses were conducted in Stata v13.1.

Results

Table 2 summarizes the results of the repeat and near repeat burglary analysis. With respect to repeat victimization, the same location was placed at a significant increased risk of victimization for (at least) nine weeks following an initial burglary. The greatest risk of repeat burglary occurred within the first week after an initial victimization, when the chance of a repeat burglary was 320 percent greater than if there were no repeat pattern. The elevated risk of recently burgled sites was reduced by half during the second week (163 percent). In subsequent weeks, the risk of victimization steadily declined and then stabilized five weeks after the initial incident; later weeks exhibited burglary risk elevated by approximately 90 percent.

With respect to near repeat patterns, the greatest risk for near repeat burglary occurred within one block and one week of the initial incident. Dwellings that were one block or less from the initial burglary incident were placed at a 50 percent greater risk of subsequent burglaries for one week. Significantly greater risk of burglary victimization was also identified for sites between two blocks (21 percent greater risk) and three blocks (22 percent greater risk) from the initial burglary during the first week following an incident. Beyond the first week, the analysis indicated significantly increased risk of near repeat burglary for individuals residing within one block of the initial location for the second week; while the increased risk was 50 percent in the first week, it declined to 20 percent in the second week. Collectively, these results suggest strong and consistent evidence in Jacksonville for repeat burglaries at temporal bands up to nine weeks, as well as relatively narrower near repeat burglary patterns up to three blocks and two weeks from the initiating incident.

Table 3 describes the frequency of burglary incidents evaluated in the near repeat analysis. A total of 6,458 incidents (44.3 percent) were single burglaries by virtue of being neither an originator nor a repeat/near repeat crime, while 2,498 incidents (17.1 percent) were originators of patterns and 2,518 incidents (17.3 percent) were classified as subsequent repeat/near repeat incidents only (e.g., the second point in a pair or the final point in a chain). The remainder of the burglaries, 3,115 incidents (21.4 percent), met the criteria for both originators *and* repeat/near repeats; these crimes could be conceptualized as the "middle" incidents in a chain of three or more burglaries that were spatially and temporally proximate. In order to

Table 2. Knox Ratios (Observed/Expected Counts) for Repeat and Near Repeat Burglary Pairs.

	0–7 Days	8–14 Days	15–21 Days	22–28 Days	29–35 Days	36–42 Days	43–49 Days	50-56 days	57-63 days
Same location	4.20*	2.63*	2.38*	2.21*	1.88*	1.94*	1.96*	1.77*	1.89*
1–575 ft.	1.50*	1.20*	1.08	1.16	1.00	0.91	1.09	0.98	0.98
576–1,150 ft.	1.21*	1.09	1.06	1.07	1.04	1.04	0.97	0.94	0.97
1,151–1,725 ft.	1.22*	1.12*	1.05	1.08*	1.04	1.09*	1.02	0.98	0.99
1,726–2,300 ft.	1.17*	1.15*	1.06*	1.08*	1.07*	1.04	1.04	1.00	1.01
2,301–2,875 ft.	1.14*	1.07	1.06	1.08*	1.08*	1.01	1.02	1.04	1.04
2,876–3,450 ft.	1.04	1.07*	1.06	1.05	1.01	1.02	1.01	1.03	0.99
3,451–4,025 ft.	1.08*	1.02	1.03	1.03	1.03	1.03	1.01	1.01	1.01
4,026–4,600 ft.	1.07*	1.02	1.08*	1.04	0.98	1.02	1.02	1.03	1.02
4,601–5,175 ft.	1.09*	1.04	1.04	1.01	1.02	0.99	1.02	1.00	1.01

Note: Shaded values indicate repeat/near repeat pattern. Repeat pattern. Near repeat pattern.
$^{*}p < .001$.

Table 3. Frequency and Classification of Burglary Incident Types.

	Repeat/Near Repeat		
Originator	No	Yes	Total
No	6,458	2,518	8,976
Yes	2,498	3,115	5,613
Total	8,956	5,633	14,589

identify structural covariates associated with spatiotemporally recurrent crime, subsequent multivariate analyses focus on the subset of burglaries (N = 5,633; 38.6 percent) that met the criteria for repeat/near repeat classification.

Figure 1 displays LISA maps representing the spatial concentrations of both single burglaries and repeat/near repeat burglaries (Moran's $I = .240$, $z = 8.766$; $p < .001$). While the two maps indicate some overlap, the patterns also reveal some variability in the risk for single and repeat/near repeat burglaries, potentially influenced by the structural and social characteristics observed in different regions. The representation of spatial concentrations for both categories of burglary necessitates estimation of multivariate models that properly control for spatial autocorrelation in the dependent variable.

ANOVA examined social structural neighborhood characteristics across four different types of block groups. Each block group can be categorized as high (above median) or low (below median) in single burglary and high or low in repeat/near repeat burglary. The low/low areas (N = 144) have comparatively lower burglary rates in general, while the high/high areas (N = 144) have comparatively higher burglary rates of both types (see Table 4). The remaining categories include high single burglary rates but low repeat/near repeat rates (N = 89) and low single burglary rates but high repeat/near repeat rates (N = 89).

Several findings emerge when comparing the standardized neighborhood measures across the four different types of neighborhoods. Areas low in both single and repeat/near repeat crimes have the lowest levels of concentrated disadvantage and those high in both have the highest levels of concentrated disadvantage. Interestingly, neighborhoods classified as having low single but high repeat/near repeat burglary rates tend to have greater concentrated disadvantage (.257) than neighborhoods that are classified as high in single rates but low in repeat/near repeat burglary rates (−.328). Family disruption follows a similar pattern to concentrated disadvantage.

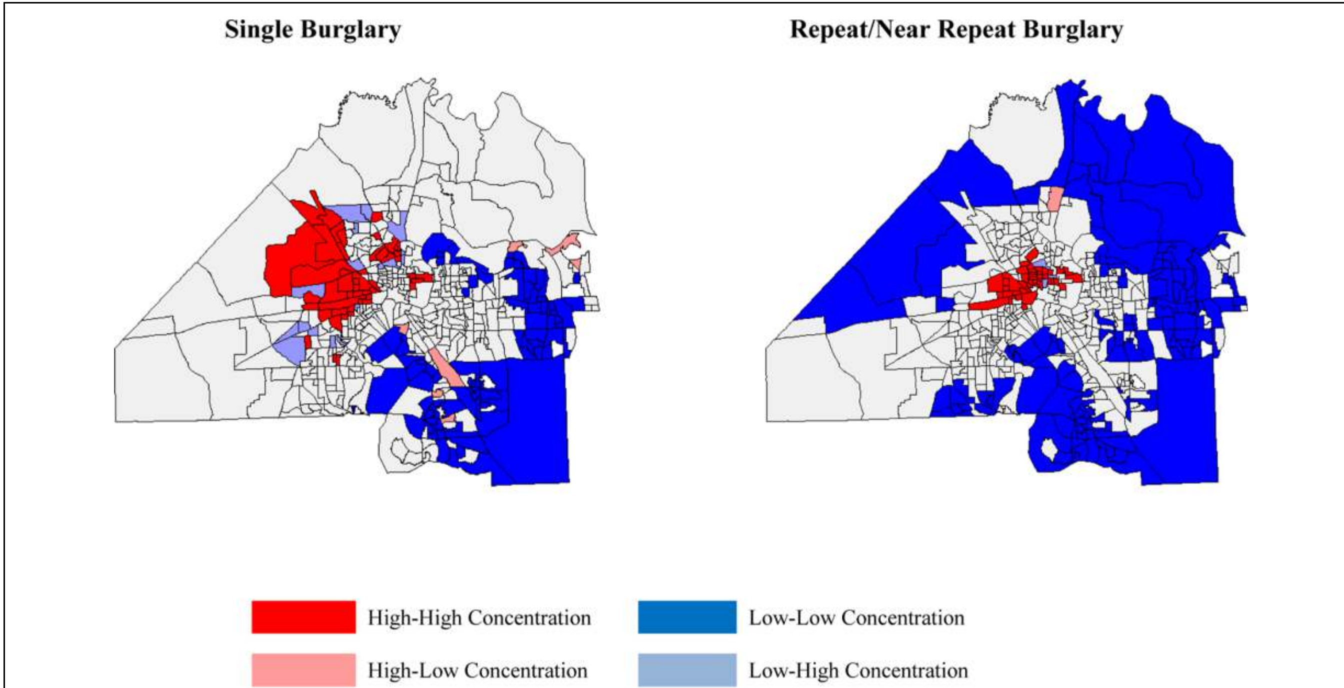

Figure 1. Local indicator of spatial association for burglary in Jacksonville.

Table 4. Analysis of Variance Comparisons for Standardized Structural Covariates across Neighborhood Types.

	Low Single, Low Repeat/ Near Repeat Burglary (n = 144)	High Single, Low Repeat and Near Repeat Burglary (n = 89)	Low Single, High Repeat and Near Repeat Burglary (n = 89)	High Single, High Repeat and Near Repeat Burglary (n = 144)
Concentrated disadvantage	−.643	−.328	.257	.686
Residential instability	−.263	−.589	.729	.176
Racial heterogeneity	−.155	−.116	.207	.098
Family disruption	−.519	−.387	.220	.622
Controls				
Street connectivity	−.487	−.131	.034	.547
Near major highway	−.077	.009	−.061	.109
Population density	−.112	−.355	.503	.021
Young (15–24)	−.187	−.140	.462	−.012

However, areas with the worst average residential instability and racial heterogeneity scores can be found in the low single and high repeat/near repeat burglary rate areas (not in the high single and high repeat/near repeat rate areas).

In short, bivariate findings indicate there may be important systematic differences in the structural/social characteristics of neighborhoods that experience patterns of repeat/near repeat burglary and, importantly, that areas with the worst social structural characteristics are not necessarily the same neighborhoods that are plagued by both high single and high repeat/near repeat burglary rates (e.g., residential instability, population density, and youth population). Instead, neighborhoods with certain structural properties may be prone to repeat/near repeat burglaries—an important distinction that goes unnoticed when considering all burglaries together.

Table 5 contains the results of the negative binomial regression models predicting block group variation in the three alternative burglary types. The first model features the count of all burglaries as the dependent variable. Concentrated disadvantage, racial heterogeneity, family disruption, and street connectivity were positively and significantly related to burglary, while population density was negatively and significantly related, net of controls. The incidence rate for all burglaries is expected to increase by 37 percent and 21 percent for a one standard deviation increase in concentrated disadvantage and street connectivity, respectively; more modest increases were associated with racial heterogeneity and family disruption (7 percent each). A standardized unit increase in population density is expected to result in a decreased incidence rate of approximately 12 percent for all burglaries.

The second model features single burglary as the outcome. Consistent with the model for all burglary, concentrated disadvantage, racial heterogeneity, family disruption, and street connectivity were positively and significantly related to single burglaries. A standardized unit increase in both concentrated disadvantage and street connectivity is expected to increase the incidence rate of single burglaries by 27 percent, while racial heterogeneity and family disruption are again both associated with more modest incidence rate increases of 8 percent each. Two variables were negatively and significantly related to single burglaries: residential instability and population density. A standardized unit increase in each of these constructs leads to an expected decrease of 18 percent and 23 percent in the incidence rate of single burglaries, respectively. In short, the model predicting single burglary is largely similar to the model for all burglary, with the notable exception of a significant negative effect for residential instability.

The final model predicts the number of repeat/near repeat burglaries in the neighborhood. Concentrated disadvantage, residential instability, racial heterogeneity, and street connectivity were positively and significantly associated with repeat/near repeat burglaries. Compared to the 27 percent increase in the incidence rate for single burglaries, a comparable unit increase in concentrated disadvantage is expected to increase the incidence rate of repeat/near repeat burglaries by 55 percent. Unlike the negative association that was observed with single burglaries, a standardized unit increase in residential instability results in a 22 percent *increase* in the repeat/near repeat incidence rate. Coefficient comparison tests show concentrated disadvantage and residential instability both have significantly different effects on single and repeat/near repeat burglaries, while a unit change in racial heterogeneity is expected to increase repeat/near repeat burglary incidence rate by 17 percent.[6] Street connectivity was associated with both single and repeat/near repeat burglaries with similar incidence

Table 5. Spatial Negative Binomial Regression Models Predicting Counts of All Burglaries, Single Burglaries, and Repeat/Near Repeat Burglaries in Jacksonville Block Groups.

	All Burglary		Single Burglary		Repeat/Near Repeat Burglary		CCT
	B (SE)	IRR+	*B* (SE)	IRR+	*B* (SE)	IRR+	Wald χ^2
Concentrated disadvantage[a]	0.31 (.04)**	1.37	0.24 (.03)**	1.27	0.44 (.06)**	1.55	8.52**
Residential instability[a]	0.01 (.03)	—	−0.20 (.03)**	.82	0.20 (.05)**	1.22	45.83**
Racial heterogeneity	0.07 (.02)**	1.07	0.08 (.02)**	1.08	0.15 (.04)**	1.17	2.69
Family disruption	0.07 (.03)*	1.07	0.07 (.03)*	1.08	0.10 (.06)	—	0.23
Controls							
Street connectivity	0.19 (.03)**	1.21	0.24 (.03)**	1.27	0.20 (.04)**	1.22	0.53
Near major highway	−0.03 (.02)	—	0.01 (.02)	—	−0.07 (.04)	—	3.18
Population density[a]	−0.13 (.03)**	0.88	−0.26 (.03)**	.77	−0.02 (.05)	—	12.17**
Young (15–24)	0.01 (.03)	—	−0.02 (.03)	—	. 004 (.04)	—	1.90
Constant	−3.69 (.07)**	0.03	−4.26 (.07)**	.01	−4.75 (.08)**	0.01	—
Burglary spatially lagged	0.02 (.00)**	1.02	0.03 (.00)**	1.03	0.04 (.01)**	1.04	—
Ln. Occ. Houses	1.000 (offset)	—	1.000 (offset)	—	1.000 (offset)	—	—
Ln. α	−1.61 (.08)	—	−1.94 (.10)	—	−0.64 (.08)	—	—
N	466		466		466		—
Log likelihood	−1,848.85		−1,478.62		−1,473.50		—
LR χ^2 ($df = 9$)	458.95		314.82		411.99		—
Pseudo R^2	0.11		0.10		0.12		—

Note: Values listed indicate statistical significance ($p \leq .05$). IRR = Incident Rate Ratio; LR = Likelihood ratio; Ln. = Natural log; Occ. = Occupied.
[a]Wald Coefficient Comparison Test (CCT; single burglary vs. repeat/near repeat burglary) indicates significant difference across models ($p \leq .05$).
*$p < .05$. **$p < .01$.

rate ratios (27 percent and 22 percent increases, respectively). Family disruption and population density, while significantly associated with single burglaries, were not significantly related to the count of repeat/near repeat burglaries.

Discussion

The exploration of differences in crime rates across neighborhoods has a long and rich theoretical and empirical history (e.g., Bursik 1988; R. J. Sampson et al. 1997; Shaw and McKay 1942). Researchers have specifically called for further examination of structural factors predicting space–time patterning processes, however, which appear relevant to larger patterns of burglary (see S. D. Johnson 2008). This study applied a specialized analytical technique to identify spatiotemporal crime patterns in a large city in order to disaggregate burglaries into two primary types—single burglaries and repeat/near repeat burglaries—which we hypothesized were differentially influenced by certain structural neighborhood attributes. Our results demonstrate that the spatial distribution of these subcategories of burglary vary throughout a large city, with only some overlap in concentration for both types. Indeed, the correlation between single and repeat/near repeat burglary incidence rates is significant but relatively weak ($r = .19$). In other words, many neighborhoods in the sample were not heterogeneous in burglary patterns; they tended to be characterized by high levels of either single or repeat/near repeat burglaries but not necessarily both. Failure to consider the evidence for spatiotemporal patterning might lead to misleading inferences, such as concluding that some areas are generally "high in crime" when in fact crime rates are driven predominately by single events or repeat/near repeat incidents. Conceptually speaking, neighborhoods troubled with certain aspects of social disorganization may also be particularly prone either to flag or boost processes or to other theoretical mechanisms facilitating certain manifestations of burglary—a distinction that can go unnoticed when considering all burglaries together.

Bivariate findings indicate that areas with the worst structural characteristics are not necessarily the same neighborhoods that are plagued by both high single and high repeat/near repeat burglary rates. For instance, neighborhoods with low single and high repeat/near repeat burglaries are characterized by the most problematic levels of residential instability and racial heterogeneity, which suggests that social disorganization characteristics may be particularly relevant to explaining burglaries linked by spatiotemporal proximity. Multivariate negative binomial regression models predicting repeat/near repeated burglary confirm this assertion, as three of the four social disorganization indicators were positively and significantly associated with repeat/near repeat victimizations. While we did not find evidence that family disruption was relevant to explaining repeat/near repeat burglaries, perhaps because family disruption represents more of a family-level process than a neighborhood-level process (see Bernasco and Lyukx 2003), the presence of neighborhood concentrated disadvantage, residential instability, and racial heterogeneity appears to increase the occurrence of patterning processes in neighborhoods. Contrasting these effects for repeat/near repeat crime are different significant predictors of single burglaries, including family disruption and population density, and post hoc comparisons further establish significantly greater effect magnitudes for concentrated disadvantage and residential instability. Moreover, residential instability had a significant negative effect on single burglaries, functioning opposite the relationship for repeat/near repeats. In sum, the results indicate that the structural indicators predicting repeat/near repeat burglary as opposed to single burglary reflect general consistency with expectations from social disorganization theory and that several effects of interest are obscured when examining all burglary in the aggregate.

We speculate that explanations for this finding rest partially in offender-based and community-based processes that work in a stepwise fashion. Offender-based processes include the development of *offender awareness* for opportunities that result from an initial successful criminal event and/or the sharing of this information with other motivated offenders. In the former, they proceed to engage in further burglaries within a short time period at the same or nearby location. In the latter, burglars with neighborhood-based social networks might enlist direct participation from co-offenders, or they could pass information about successful past burglaries on to their associates (e.g., Townsley et al. 2003). Both of these processes, however, would be characteristic of a boost process that leads to higher levels of repeat/near repeats burglaries within disorganized neighborhoods. Disorganized neighborhoods experience more of this type of burglary pattern because areas of concentrated economic disadvantage communicate an attractive opportunity structure to offenders. Areas that are high in residential instability seem to provide visual cues that residents are less invested in the neighborhood or fewer persons are available to intervene. From this perspective, however, offender awareness is a necessary, but insufficient, element to the patterning process in disorganized neighborhoods.

Once offenders are aware of these opportunities, the risk of a repeat event is heightened when there is a failure of *community response*. Drawing from R. J. Sampson and colleagues' (1997) work on collective efficacy, a lack of community cohesion and trust and the willingness of neighbors to intervene are two distinct, yet interrelated, dimensions that are crucial to community organization and response. In disorganized neighborhoods, the ability for a community to respond is diminished due to limited or ineffectual informal social control. Areas high in concentrated disadvantage also lack the capacity to effectively mobilize community resources to offset the heightened risk of a future burglary incident. Given that the effect of concentrated disadvantage was more pronounced in repeat/near repeat compared to single burglaries, it is possible that areas characterized by higher levels of concentrated disadvantage allow virtually no community response, whereas areas possessing less severe concentrated disadvantage can formulate some community response in order to avoid longer term impacts, even if these same areas are not organized enough to prevent burglary initially. Moreover, these neighborhoods may not only be marked as good opportunities for crime, but limited economic resources make forming community ties and effecting informal social control difficult. Relatedly, joblessness may promote the formation of delinquent networks, which would explain why this factor is strongly predictive of repeat/near repeat offending.

Areas characterized by residential instability may experience heightened levels of time–space burglary clustering because offenders are drawn to the area (e.g., "for rent" and "for sale" signs), and there are fewer long-tenured residents, or residents simply present, to intervene. A preponderance of signs indicative of vacancies and population turnover invites traffic into the neighborhood, and offenders have cover for spending more time in the neighborhood, so much so that single burglaries could actually become less likely in these areas. Similarly, family disruption, with implicit difficulties related to transitions of people and property, appears only relevant to explaining single burglaries. It is possible that offenders focus less on changing patterns of partial occupancy (as compared to entire families transitioning, which implies residential instability) when selecting a target as opposed to other factors, thereby making this construct less relevant for repeat/near repeat burglaries. At the same time, family disruption could function as an indirect protective factor if other motivated parties (e.g., extended family, friends, neighbors, etc.) rally to provide social support formerly offered by a spouse; in this case, perhaps others are more willing to intervene on behalf of burglary victims such that single burglaries are prevented from becoming repeat/near repeat burglaries.

Broadly, our results indicate support for the importance of carefully considering the measurement of crime (Sullivan and McGloin 2014) to accurately understand the phenomena under study, and, in our case, the findings also identify the distinctive correlates of unique burglary patterns. We suggest that explanations for heightened repeat/near repeat burglary patterns in disadvantaged neighborhoods may occur due to increased offender awareness of crime opportunities coupled with an inability of the community to respond effectively to the heightened risk. In more organized neighborhoods, offenders may fail to recognize the crime opportunities and/or the community may be better suited to respond and limit future events. Fully disentangling this process will require greater emphasis on understanding offender assessment of neighborhoods, including how they define, formulate, and execute crime opportunities. Relatedly, the current study lays the groundwork for greater integration between the study of repeats and community-based theories of crime, including collective efficacy.

This study is accompanied by several limitations that must be considered. First, although our results provide utility in predicting isolated versus spatiotemporally patterned burglary according to neighborhood structure, it is impossible to obviate certain explanations for the presence of near repeat crime patterns. For example, many patterns could be due to individual serial or spree offenders, but burglary incident data tracking known offenders prevent a full examination of this phenomenon in the current study. Partially assuaging this concern, however, is that proximately nearer spatiotemporal burglary pairs are more likely to be the work of the same offender (Bernasco 2008). Second, our measures of social disorganization are taken from available structural covariates sourced from the ACS and represent comparatively stable, five-year estimates at the block group level. Although these indicators are appropriate for documenting neighborhood-level variation in the structural conditions that contribute to informal social control (Bursik 1988; R. J. Sampson and Groves 1989), they do not directly tap into neighbors' willingness to intervene on behalf of the greater good nor the cohesion and trust shared among those who live nearby (R. J. Sampson et al. 1997). Future research should attempt to link offender data to better disentangle space–time patterning processes and, as noted above, employ direct measures of social ties and informal social control processes.

Despite these limitations, the current study has led to insights into similar and dissimilar sources of single and repeat/near repeat burglary events at the community level, and it dovetails nicely with recent work accounting for microplace geographical variations in crime concentrations (Braga and

Clarke 2014; Weisburd, Groff, and Yang 2012). Per Weisburd and colleagues (2012), this extension could help to explain uneven distributions at the subneighborhood level. Such an extension is also consistent with findings from this study, which illustrates near repeat patterns for burglary extending out only so far as to roughly the local street segments and adjacent block. Thus, given that social disorganization processes may operate meaningfully at smaller units of analysis (Weisburd et al. 2012), and near repeat processes for burglary may unfold over short distances, a fruitful and logical extension of the current work is to examine differences in the prediction of single and repeat/near repeat burglary events at smaller units of geography, where the effects may be more pronounced due to a lack of aggregation bias. Doing so would also facilitate the blending of the strengths of the current study with those from complementary research that has focused on the situational attributes of locations (e.g., see Bowers and Johnson 2005) enabling a more complete understanding of the common and unique sources of single and repeat/near repeat crime.

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Notes

1. Most recent work discusses the appropriate "time window" (Farrell, Sousa, and Weisel 2002) for identifying temporal patterns of crime (see also Ratcliffe 2002).
2. We follow R. J. Sampson et al.'s (1997) approach to constructing a concentrated disadvantage index including proportion Black but recognize that this is not without criticism. Thus, we also created a concentrated disadvantage measure excluding proportion Black, and the empirical findings were substantively similar (results available upon request). It may be noted that the reliability of this alternative measure that excluded the item was slightly lower ($\alpha = .75$).
3. Spearman–Brown reliability estimates are reported for two-item measures (Eisinga, Grotenhuis, and Pelzer 2013).
4. Per Knox (1964), a total of $n(n - 1)/2$ event pairs are created from n incidents; actual spatial and temporal distances between each pair are recorded and placed into a spatiotemporal matrix. To compare these observed data to expected data, an iterative Monte Carlo process is utilized where time between events is

randomly assigned to actual distances between events. To gauge statistical significance of each spatiotemporal cell, a pseudo p value is used which is based upon 999 Monte Carlo iterations. At one extreme, if the observed count is greater than all of the 999 expected counts, the associated p value is .001. The p value increases .001 for each iteration, in which the observed count fails to exceed the expected count.
5. Median values were used to categorize low and high groups.
6. It should be noted, however, that the coefficient comparison test suggests this effect is not significantly different from the nonsignificant single burglary effect.

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