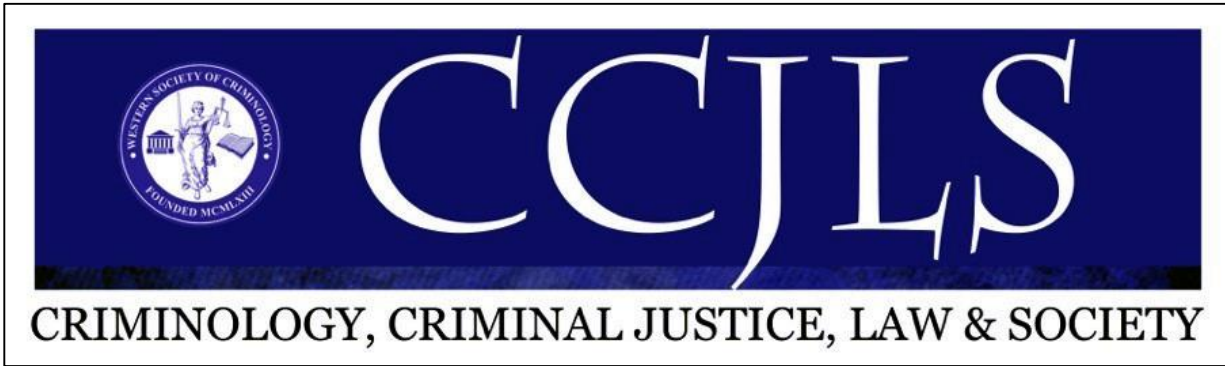




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Mental Illness as an Ecological Factor of Neighborhood Crime

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ABSTRACT AND ARTICLE INFORMATION

Based on prior research, the presence of more residents diagnosed with mental illness in a neighborhood may indicate the presence of more offenders or more targets. We suggest that it may also indicate reduced guardianship and lower informal social control. Using data from blocks in 108 cities in Southern California, we examined the association between two types of mental disorders (affective disorders and substance use disorders) and crime rates. Even after controlling for more traditional predictors of neighborhood crime, we found a strong positive relationship between certain mental disorders and aggravated assault and motor vehicle theft rates. We also tested nonlinear interactions with economic disadvantage and found that a higher proportion of mentally ill residents in a zip code was associated with higher block-level crime rates in zip codes with *lower* levels of concentrated economic disadvantage. The findings suggest that mental illness is a unique ecological factor by which to understand neighborhood crime.

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In recent years, numerous studies have explored whether individuals with mental illness are more likely to be involved in crime. Findings from such studies are mixed; in some cases, individuals with mental illness are more likely to be offenders (Arseneault, Moffitt, Caspi, Taylor, & Silva, 2000; Daff & Thomas, 2014; Graz, Etschel, Schoech, & Soyka, 2009) whereas other times they are more likely to be targets or victims (Silver, Arseneault, Langley, Caspi, & Moffitt, 2005; Teplin, McClelland, Abram, & Weiner, 2005). In the context of the neighborhood, this evidence suggests that resident mental illness may have an ecological effect on crime, such that neighborhoods with more residents diagnosed with mental illnesses will have higher levels of crime given that such persons are more likely to be offenders or targets. However, an additional possibility not previously considered in the literature exists, in that the presence of more residents diagnosed with mental illnesses may have an ecological effect on crime by impacting the social networks and cohesion within the neighborhood, effectively hindering a neighborhood's ability to provide informal social control (Sampson & Groves, 1989). Both of these speculations suggest that resident mental illness may carry important consequences for the level of crime in neighborhoods.

Due to the obstacles that mentally ill persons face, they are considered a socially-excluded, disadvantaged group (Boardman, 2011). Socially-excluded persons are people who do not actively participate in the society in which they live or are in some way deprived of their basic rights as citizens (Curran, Burchardt, Knapp, McDaid, & Li, 2007). Mental illness can compromise an individual's ability to fight discriminatory practices, secure stable employment, and interact with other community members, creating and *reinforcing* a state of social exclusion that is only compounded by other disadvantaged realities such as poverty, physical illness, and ethnic minority status (Rankin, 2005). The multiple and varied forms of disadvantage and hardships experienced by such persons can impact their likelihood of being crime offenders or targets. Moreover, with some forms of mental illness placing such residents on the 'fringe' of the neighborhood with few social contacts and untrustworthy guardianship capacities, the neighborhood may be unable to engage in effective or high-quality informal social control. In the absence of informal social control, neighborhood crime can flourish (Bursik, 1988; Sampson & Groves, 1989). Despite the connection between mental illness and disadvantage,

neighborhood crime studies have failed to include mental illness rates as a predictor of crime.

We believe it is useful to consider the presence of a higher proportion of neighborhood residents diagnosed with mental illnesses as a structural characteristic that may have consequences for neighborhood crime. We do not hypothesize that the relationship between residents with mental illnesses and crime will be homogeneous but rather that the relationship may differ based on the type of mental illness. We incorporate insights from social disorganization and routine activities theories and posit that different types of mental illnesses will likely have differential effects on the presence of offenders, targets, and guardians in neighborhoods, and therefore, the relationship with crime rates for residents with these different mental illnesses will differ. It is also possible that these relationships may vary across different types of crime. Finally, we will test whether the impact of residents with mental illnesses differs between neighborhoods with high versus low levels of concentrated economic disadvantage.

Theories of Neighborhood Crime

Two key theories that explain why some neighborhoods have more crime than others are social disorganization theory and routine activities theory. In social disorganization theory, the focus is on the level of social disorganization in a neighborhood and how this can impact the ability of the neighborhood to impose social control that can reduce crime. Social control is hypothesized to allow the neighborhood to socialize residents (typically youth) to dissuade them from engaging in delinquency (Shaw & McKay, 1942). It is also hypothesized that social control allows residents to intervene in specific events where a crime might occur thereby directly impacting crime events (Sampson & Groves, 1989). In this latter instance, social control is thought to impact anyone in the neighborhood who might be an offender, not just residents who may offend. Routine activities theory, however, focuses on the "ingredients" of crime and posits that crime events will be more likely to occur when there is a co-occurrence in space and time of motivated offenders, suitable targets, and the lack of capable guardians (Cohen & Felson, 1979). These guardians are the ones providing the informal social control of social disorganization theory.

A large body of literature has tested each of these theories by using different measures of structural neighborhood characteristics that might give rise to these various constructs. Previous scholars have measured structural characteristics such as

concentrated disadvantage, residential instability, and population heterogeneity when assessing the neighborhoods most likely to suffer from social disorganization, and hence higher levels of crime (Hipp, 2007b; Krivo & Peterson, 1996; Kubrin & Weitzer, 2003). One study connecting social disorganization theory and mental illness found that discharged psychiatric patients living in neighborhoods high in “neighborhood-level social disorganization” (poverty, unemployment, housing vacancies, etc.) were more likely to engage in violence post-release compared to discharged patients living in less socially disorganized neighborhoods (Silver, 2000).

However, researchers have typically not considered the presence of residents with mental illnesses as a structural characteristic that might give rise to social disorder in a neighborhood, or how such persons might affect the proportion of offenders, targets, or guardians in a neighborhood. Mental illness by nature is a complex condition which spans racial, age, and income lines (Wang et al., 2005). So, whereas certain attributes such as “living poor” can place an individual *at risk* for developing a mental disorder (e.g., substance use disorders; Molina, Alegria, & Chen, 2012), it is in the combination and interaction of genetic and environmental factors that mental disorders manifest. Therefore, actually measuring the proportion of diagnosed mentally ill persons in a neighborhood may help inform neighborhood crime by capturing a more nuanced form of ecological vulnerability. Residents suffering from mental illness may also have differential impacts on the composition of offenders, targets, or guardians in a neighborhood, an issue to which we now turn.

Offenders, Targets, or Guardians?

There are reasons to suspect that the presence of more residents with mental illnesses may increase the number of potential offenders in a neighborhood. Across longitudinal studies of previously institutionalized persons (Graz et al., 2009) or community members (Arseneault et al., 2000; Daff & Thomas, 2014) clinical levels of mental illness were found to be associated with future crime. A 12 year follow-up of former inpatients with affective disorders (bipolar, manic, and major depressive disorder) revealed that manic disordered patients were the most likely subgroup to commit acts of violence (15.7%), even though most patients with affective disorders were non-delinquent post-release (Graz et al., 2009). Looking at bipolar individuals from a state based psychiatric registry, Daff and Thomas (2014) reported that people with documented

bipolar disorder had more charges, convictions, and guilty verdicts for violent, non-violent, and intermediate crimes compared to other community members. Finally, a study of the Dunedin birth cohort found that individuals who meet criteria for alcohol dependence, marijuana dependence, and schizophrenia-spectrum disorder were approximately 2 times more likely to commit a violent offense at age 21 than same-age individuals without a diagnosed mental disorder (Arseneault et al., 2000). These findings support the fact that most mentally ill people are non-violent, with the propensity for violent behavior increasing under substance misuse (Silver, 2006).

The link between mental illness and crime has also been studied in incarcerated populations. One such study looking at the predictors of violent or sexually deviant behaviors among U.S. inmates found that inmates with mental health problems before their offense were more likely than those without mental health problems to be imprisoned for physical assaults, sexual offenses, and homicide; mental health problems were also more predictive of violent assaults for female inmates compared to male inmates (Silver, Felson, & Vaneseltine, 2008). A second study employing a case-linking design reported that male inmates in Australia were more likely to be convicted of violent, homicide, property, and sexual offenses if they had a history of schizophrenia, affective disorders, affective psychosis (except in the case of property offenses), personality disorders, or substance misuse; similar patterns were indicated for female inmates (Wallace et al., 1998). While these findings link mental illness and crime at the individual level, they also provide possible hypotheses for how neighborhood mental illness measures are related to crime:

H1. Neighborhoods with more residents diagnosed with affective disorders will have higher violent crime rates, especially aggravated assaults.

H2. Neighborhoods with more residents diagnosed with substance disorders will have higher violent crime rates, especially aggravated assaults.

A separate body of literature finds that mentally ill persons are frequently victims of crime and therefore might form a group of more vulnerable targets in a neighborhood. In a study by Teplin and colleagues (2005), which examined 936 deinstitutionalized patients with severe mental illness, the authors concluded that just over 25% of patients with severe mental illness were victims of a violent crime in the last 12 months – a statistic that is

more than 11 times that of the general population (2.79%). The differences in victimization rates between deinstitutionalized persons and the general population were most pronounced when considering personal theft (59.7 times higher for deinstitutionalized patients) but present for other types of crime, such as rape, aggravated assault, and robbery. Using the Dunedin birth cohort data, it was similarly found that young adults with diagnosed mental disorders were more likely to be victims of completed or attempted sexual and or physical assaults than young adults with no disorders over a one-year period. In particular, there were significantly higher rates of sexual assaults experienced by young adults with anxiety disorders and higher rates of physical assaults, completed or attempted, experienced by young adults with alcohol dependence and marijuana dependence disorders, respectively, compared to young adults with no disorders. Young adults with schizophreniform disorders reported more threatened and completed acts of physical assault as well (Silver et al., 2005). These findings reinforce Hypothesis 1 and 2 above. They also imply the following hypothesis:

H3. Neighborhoods with more residents diagnosed with affective disorders will have higher property crime rates, especially larcenies (personal theft).

Another possibility, though less considered in the existing literature, is that the presence of a large number of residents with mental illnesses might reduce the number of capable guardians in a neighborhood and hence the ability to enact informal social control. At a basic level, mental illness can compromise the health of an individual and the socioeconomic prospects of a neighborhood. Many individuals with mental illness regularly face difficulties acquiring financial resources, employment, social support, and political clout (Huxley & Thornicroft, 2003). For example, in a study looking at the job outcomes of employees with depression (dysthymia, major depressive disorder, or both), depressed employees were more likely to be unemployed 6 months later or more likely to miss work, experience job turnover, and report poorer at-work productivity if still employed than non-depressed employees (Lerner et al., 2004). These employment challenges, along with the other aforementioned challenges, exemplify the sorts of functional impairments that are a hallmark of mental illness. Functional impairment is so critical to mental disorders that the *Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition* (DSM-5) includes functional impairment as a necessary criterion for mental disorder diagnoses (American Psychiatric

Association, 2013). In terms of the neighborhood, having residents with such functional impairments can undermine the ability of such persons to act as capable guardians and, in time, over-tax fellow residents with effective guardianship capacities. This imbalance can strain a neighborhood's ability to engage in informal social control thereby decreasing guardianship and increasing crime.

Functional impairments in social and occupational domains can also mean fewer social contacts within and outside the neighborhood and less consistent interactions with others. As a result, residents with mental illnesses such as post-traumatic stress disorder, major depressive disorder, and social anxiety disorder, may be less able or willing to interact with their fellow residents. Even though it is believed that one's mental illness first and foremost bears on his or her more intimate relationships (e.g., spouses), mental illness is also thought to affect a person's participation within a community and his or her ability to develop social ties, factors that provide a sense of belongingness or social identity (Kawachi & Berkman, 2001). Studies exploring how mental illness affects belongingness find that ties to community members called 'distal supports' are important predictors of both social integration (Granerud & Severinsson, 2006) and recovery from mental illness (Townley, Miller, & Kloos, 2013). And the more social integration and sense of belonging that exists in the neighborhood, the more cohesive the social network of the neighborhood. Fostering this cohesion among neighbors is a necessary aspect for engaging in social control activity (Warner, 2007; Wickes, Hipp, Sargeant, & Homel, 2013) and suggest the following additional hypotheses:

H4. Neighborhoods with more residents diagnosed with affective disorders will have less informal social control capability and therefore higher rates of all types of crime.

H5. Neighborhoods with more residents diagnosed with substance disorders will have less informal social control capability and therefore higher rates of all types of crime.

Neighborhood Economic Disadvantage as a Moderator of Mental Illness

Though we have suggested that the presence of residents with diagnosed mental illnesses may have consequences for neighborhood crime by increasing the number of offenders or targets or by decreasing the number of guardians, it may also be that the economic context of the neighborhood moderates these processes. There are two main competing

perspectives on what this moderating process might look like.

One perspective is that the impact on crime due to the presence of residents with more mental health problems will be accentuated when residing in economically disadvantaged neighborhoods. This might occur if economically disadvantaged neighborhood contexts are spaces with more crime and are more likely to bring about manifestations of mental illness in persons or amplify underlying symptoms in residents. Support for this perspective comes from work on neighborhood crime given that economically disadvantaged neighborhoods often experience higher rates of crime which in turn affects resident mental illness rates. Acting as a contextual stressor, neighborhood crime is believed to heighten resident vulnerability to develop mental disorders. This relationship has been demonstrated by Stockdale and colleagues (2007) who found that adults living in high crime areas and who saw someone being beaten, abused, or killed in the past 12 months were more likely to develop anxiety or depressive disorders than adults living in lower crime areas (Stockdale et al., 2007). Similar findings have also been reported for substance use behaviors such that for acculturated Latino adolescents, living in areas of high violent crime was associated with increased alcohol use (Kulis, Marsiglia, Sicotte, & Nieri, 2007). Although these results suggest that exposure to neighborhood crime can carry mental consequences for residents, this may in part occur because of a confluence of ecological conditions (mental and economic) that underscores a more deep-rooted structural problem within the neighborhood (Silver, 2000, 2001; Silver, Mulvey, & Monahan, 1999). Parallel to the notion of the truly disadvantaged noted by William Julius Wilson (1987), the confluence of mental illness and economic disadvantage would have particularly deleterious consequences for neighborhoods.

H6. Neighborhoods with more residents diagnosed with affective or substance use disorders and more economic disadvantage will have higher rates of all types of crime.

A second possibility is that the confluence of mental and economic disadvantage in neighborhoods leads to a sort of saturation effect. This builds on literature focusing entirely on economic disadvantage, in which studies have found that crime does not increase exponentially in highly disadvantaged neighborhoods, but instead exhibits a satiation effect in which crime rates level off in the most economically disadvantaged neighborhoods (Hannon, 2002; Hipp & Yates, 2011). Following this

logic, it may be that the presence of mentally ill persons has the strongest impact on crime rates in neighborhoods with relatively low levels of economic disadvantage. In neighborhoods with high levels of economic disadvantage, the presence of mentally ill persons may not further impact the neighborhood negatively because the economic condition of the neighborhood is so overwhelmingly punitive.

H7. Neighborhoods with more residents diagnosed with affective or substance use disorders and lower economic disadvantage will have higher rates of all types of crime.

We explore these competing perspectives here.

Present Study

The inclusion of mentally ill persons in ecological models of crime not only accounts for a traditionally missed group of disadvantaged persons but it reinforces the fluidity of neighborhoods. Neighborhoods are physical spaces subject to the influx of people – at times mentally ill people – and it is the presence of such people that bear on neighborhood welfare and dynamics, including neighborhood crime. To our knowledge, no other studies have examined mental illness as a source of ecological strain or a contextual stressor informing neighborhood crime. In the present study, we use Southern California crime data and mental disorder hospital data from 2009 to 2011 to determine if aggregate measures of mental illness are associated with crime rates. We will also examine whether the effect of zip code mental illness on crime varies by level of economic disadvantage. Two types of mental disorders, substance use disorders and affective (mood/anxiety) disorders, will function as our measures of mental illness as they have been regularly used in individual level studies of crime and mental health (e.g., Graz et al., 2009; Wallace et al., 1998). We assess whether the relationships differ over five major crime types: aggravated assault (which represents a pure violent crime), robberies (which represent a violent acquisitive crime), burglaries and motor vehicle thefts (which represent property crimes requiring a fair amount of skill), and larcenies (which represent a property crime requiring little criminal skill).

Method

Data

The data used in the present study come from local police departments, the California Office of

Statewide Health Planning and Development, and the U.S. Census. Although our key mental health variables were measured at the zip code level, we constructed the crime and socio-demographic variables at the block level to capture micro-processes, as well as at the zip code level to capture broader spatial effects. Although some researchers use street segments as the micro unit of interest, recent research demonstrates that the results are extremely similar when using census blocks instead as the micro unit (Kim, 2016). We therefore do not simply aggregate all of our data to the larger units of zip codes, but rather adopt this approach because 1) utilizing the greater spatial precision of our crime data minimizes the possibility of aggregation bias by assuming zip codes are homogeneous units (which they are not) and 2) some zip codes cross city boundaries, which would cause problems in cases where we do not have crime data for one of the zip codes. This approach allows us to test whether our mental health variables—even measured at the more spatially crude level of zip codes—are associated with levels of crime in blocks. This approach of using a micro scale while accounting for the larger area is a common approach (Boessen & Hipp, 2015) and accounts for various possible spatial scales (Hipp, 2007a). Our estimated models account for the broader context and appropriately corrects the standard errors of the zip code-level measures, given that blocks are nested in zip codes. The crime data come from the Southern California Crime Study and were collected from 2009 to 2011 for 108 cities in southern California. Table A1 in the Appendix lists the cities with crime data included in the analyses.

Mental disorder hospitalization data combined information from all Southern California hospitals licensed by the California Department of Public Health using the following hospital file sources: (1) ambulatory surgery files, (2) emergency department files, and (3) patient discharge files. To ensure patient anonymity, all data were aggregated to the zip code level, and only information on the total number of person based records with first and secondary diagnosis codes from the International Classification of Diseases, 9th Revision, Clinical Modification (ICD-9-CM) manual were reported. Mental health diagnosis codes ranging from 290-319 (National Center for Health Statistics, 1980) were combined across hospital file sources to generate zip code based counts of the proportion of the population treated in state hospitals with an affective or substance use disorder, our key predictor variables. Lastly, U.S. Census information from the American Community Survey (2007-11 five year estimates) was used to generate study control variables, measured at both the block (2010) and zip code (2009) level. The final

dataset includes information from 156,104 blocks and 522 unique zip codes.

Data

Outcome Variables.

Crime. Part 1 crime events were geocoded and aggregated to the block level. Events were used to construct measures of aggravated assault, robbery, burglary, motor vehicle theft, and larceny.¹ We computed totals over the three years (2009-11) to smooth year-to-year fluctuations in crime rates.

Key Predictor Variables.

Affective disorders. We measured four types of affective disorders by computing the proportion of residents in the zip code who have been classified based on the ICD-9-CM codes for affective psychosis (296), neurotic disorders (300), acute reaction to stress (308), and adjustment reactions (309). For each measure, we computed the average disorder rate by combining zip code disorder totals from 2009–2011 (after dividing by zip code population) and multiplying by 100.² *Affective psychoses* are mood disorders where there exists at least one of the following symptoms: delusions, disturbed attitude of self, perplexity, and disorder of perception and behavior. Examples of affective psychosis disorders include bipolar affective disorders, manic disorders, major depressive disorders, and manic-depressive psychosis unspecified. *Neurotic disorders* are mental disorders characterized by neurosis, an impaired state without an organic cause in which one's fantasies and experiences are not mistaken as reality. Most neurotic disorders are characterized by extreme anxiety, hysterical symptoms, obsessive and compulsive behaviors, depression, and phobias. Examples of neurotic disorders are generalized anxiety disorder, hysteria, and panic disorder. *Acute reactions to stress* include disorders such as catastrophic stress, combat fatigue, and gross stress reactions; these are more transient disorders that arise due to extreme physical or mental stress and subside often within hours or days. *Adjustment reactions* are transient disorders that last longer than acute stress reactions and are usually a "situation-specific" response to a stressful or traumatic experience (e.g., the death of a loved one). Adjustment reactions last more than a few days or a few months. Examples of adjustment reaction disorders include prolonged depressive reaction and prolonged posttraumatic stress disorder (National Center for Health Statistics, 1980).

Substance use disorders. We also measured the proportion of residents in the zip code with various substance use disorders. We used the alcohol and drug ICD-9-CM codes for alcohol psychosis (291),

alcohol dependence (303), drug psychosis (292), drug dependence (304), and nondependent abuse of drugs (305). *Alcohol and drug dependence disorders* are characterized by psychic and often times physical states that arise from alcohol consumption or drug use that creates a compulsive need for the substance. By contrast, *alcohol and drug psychosis disorders* are organic psychotic states or mental syndromes that arise from consuming alcohol or drugs and can be marked by hallucinations, delirium, and paranoia. Nondependent abuse of drugs is a code used for people who cannot be classified by any other code but are under medical care due to the negative effects of a drug they took, upon which they are not dependent, and which is not used to improve their health or well-being. Examples of nondependent abuse of drug disorders are cannabis abuse, opioid abuse, and cocaine abuse. The misuse or non-mandated use of prescription drugs would also be classified as a nondependent abuse of drugs disorder (National Center for Health Statistics, 1980). As with affective disorders, an average disorder rate was created for each code, and then codes were combined based on substance similarity. This meant that alcohol dependence and psychosis codes were summed to create an *alcohol* variable, and similarly, drug dependence and psychosis were summed to create the *drugs* variable. The nondependent abuse of drugs code was renamed as the *non-specific drugs* variable.

Although we refer to these measures as capturing the “proportion” of diagnosed residents, diagnosed residents can be counted more than once if a person is repeatedly admitted to a hospital (as they will be counted each time), or if a person is diagnosed with several disorders (as each disorder will be counted). We argue that this is not completely undesirable, as our measures roughly approximate the “severity” of mental disorders in a community: persons repeatedly admitted to hospitals arguably suffer from more problems, on average, than those who are admitted only once. Likewise, those diagnosed with multiple disorders may represent more severe cases. This highlights the challenge of any measure that attempts to classify persons as “mentally disordered” or not.

Neighborhood Demographics

To minimize the possibility of spurious effects, we also included several measures that likely impact the level of crime in neighborhoods and may also be correlated with the presence of residents with mental illnesses. These measures were constructed at both the block level to capture micro effects as well as the zip code level to capture meso effects (Boessen & Hipp, 2015). We capture the possible effect of

economic disadvantage with a measure that combines four variables using factor analysis to create factor scores: the percent at or below 125% of the poverty level, the percent single parent households, the average household income, and the percent with at least a bachelor’s degree (the latter two are reverse coded). To account for the importance of residential stability, we included a measure of the *percent owners*. We account for the presence of racial minorities with the *percent Black* and the *percent Latino* residents. We account for *racial/ethnic heterogeneity* based on the Herfindahl Index combining five racial/ethnic groups (Asian, Black, Latino, White, and other race). Given that vacant units can be crime attractors, we include a measure of the *percent occupancy*. Also, we account for the prime offending ages by including a measure of the *percent aged between 15 and 29* and block-level population using a measure of *logged population*. An alternative approach would include logged population as an offset variable in the negative binomial regression models (with the parameter constrained to 1); estimating a parameter for the logged population variable relaxes the assumption of a one-to-one relationship between population and crime.³

Analytic Plan

Cross-sectional negative binomial regression models were estimated exploring the associations between aggregate mental illness measures and crime events, controlling for relevant neighborhood covariates at the block and zip code level. All standard errors adjusted for nesting at the zip code level using the cluster command in STATA. To test whether economic disadvantage operates as a moderator of mental illness, interaction terms were created between level of economic disadvantage in the zip code and each mental illness variable. Testing interactions of such neighborhood structural measures follows the spirit of other research (Warner & Pierce, 1993; Warner & Rountree, 1997). Models were then re-estimated with the added interaction terms. Given that the relationship between mental illness and crime may differ between high and low concentrated disadvantaged areas, we also tested the assumption of a linear interaction by estimating spline models: For these models, we constructed a low concentrated disadvantage variable, which has the value of the concentrated disadvantage variable for cases below the mean in concentrated disadvantage but then has the mean disadvantage value for cases above the mean, and we constructed a high concentrated disadvantage variable, which has the value of the concentrated disadvantage variable for cases above the mean in concentrated

disadvantage but then has the mean disadvantage value for cases below the mean. We substituted these two variables for the concentrated disadvantage variable and then constructed interaction variables of each of these with the measure of interest. Since our spline models often suggested nonlinear interactions, we present these results.

The means and standard deviations of all study variables are presented in Table 1. Neurotic disorders were the most common type of affective disorder experienced by patients at the zip code level, with an average of 1.4% of residents in zip codes having this diagnosis. Non-specific drug disorders were the most common type of substance use disorder category experienced by patients at the zip

code level, as an average of 3.2% of residents in zip codes had this diagnosis. Of the measures capturing the four types of affective disorders, the only high correlations were between the proportion of residents with affective psychosis diagnoses and those with neurotic disorders at .76 and also those with adjustment reactions at .66. The measures of alcohol or drug diagnoses were correlated .82. Because of these high correlations, we present models that include these variables one at a time.

Table 1: Sample Descriptives

	Mean (SD)
Crime events (block)	
Assault	.144(.651)
Robbery	.136(.640)
Burglary	.393(1.094)
Motor Vehicle Theft	.306(1.036)
Larceny	.995(4.832)
Affective disorders (zip code)	
Affective Psychosis	.935(.443)
Neurotic Disorders	1.368(.456)
Acute Reactions to Stress	.059(.031)
Adjustment Reactions	.111(.066)
Substance disorders (zip code)	
Alcohol	.624(.398)
Drugs	.421(.237)
Non-specific drugs	3.209(2.049)
Controls (block)	
Logged Population	2.8(2.2)
Age 15-29	20.1(11.9)
Home Ownership	64.5(32.1)
Occupancy	92.9(13.4)
Ethnic Heterogeneity	0.4(0.2)
Black	6.1(14.3)
Latino	37.2(31.8)
Disadvantage	-0.8(11.9)

Controls (zip code)	
Age 15-29	22.6(7.0)
Home Ownership	58.0(18.9)
Occupancy	91.4(8.1)
Ethnic Heterogeneity	50.9(14.4)
Black	6.2(9.6)
Latino	39.3(24.8)
Disadvantage	0.2(8.2)

Results

Mental Health Disorder Measures Separately and Crime

Our initial models included all of our control variables and entered our mental health disorder variables one at a time. In the aggravated assault models (models in the first column of Table 2), we find that zip codes with a higher proportion of persons with any of these diagnoses (except neurotic disorders) have more aggravated assaults in their blocks. To place these measures in a similar metric, the last five columns on the right side of Table 2 show the incidence rate ratio of expected change for

the crime type given a one standard deviation increase in the presence of residents with that mental health diagnosis. We see that a one standard deviation increase in the proportion of residents with adjustment reactions diagnoses is associated with 29.7% more aggravated assaults, which is the strongest effect. The other significant effects range between 10.5% and 17.9% factor increases in aggravated assaults for a one standard deviation increase in the measure. The only other crime type with strong effects is motor vehicle theft, which is higher in zip codes with more residents with any of these diagnoses. The size of this effect for a one standard deviation change in these measures ranges from 7.8% to 15.1%.

Table 2: Models Including Mental Illness Diagnoses Variables One at a Time (Zip code: N = 482; Block: N =102,771)^a

Incidence Rate Ratio change in crime for increase of one standard deviation in variable															
	Assault		Robbery		Burglary		Motor Vehicle Theft		Larceny		Assault	Robbery	Burglary	Motor Vehicle	Larceny
	(1)		(2)		(3)		(4)		(5)						
Affective Psychoses	0.225	*	0.087		-0.047		0.177	**	0.153	**	1.105	1.039	0.980	1.082	1.070
	(0.097)		(0.060)		(0.049)		(0.058)		(0.051)						
	(6)		(7)		(8)		(9)		(10)						
Neurotic Disorders	0.095		-0.139		-0.068		0.253	***	0.131	*	1.044	0.939	0.969	1.122	1.062
	(0.119)		(0.096)		(0.057)		(0.059)		(0.065)						
	(11)		(12)		(13)		(14)		(15)						
Acute Reactions to Stress	4.725	***	-1.054		-1.131		4.195	***	0.197		1.160	0.967	0.965	1.141	1.006
	(1.034)		(1.249)		(0.830)		(0.920)		(1.056)						
	(16)		(17)		(18)		(19)		(20)						
Adjustment Reactions	3.936	***	0.121		-0.771		2.127	***	0.088		1.297	1.008	0.950	1.151	1.006
	(0.456)		(0.767)		(0.469)		(0.394)		(0.665)						
	(21)		(22)		(23)		(24)		(25)						
Alcohol	0.401	***	0.042		-0.106		0.211	***	0.081		1.173	1.017	0.959	1.087	1.033
	(0.068)		(0.091)		(0.070)		(0.051)		(0.070)						
	(26)		(27)		(28)		(29)		(30)						
Drugs	0.594	***	0.028		-0.132		0.316	**	0.175		1.151	1.007	0.969	1.078	1.042
	(0.158)		(0.155)		(0.102)		(0.106)		(0.114)						
	(31)		(32)		(33)		(34)		(35)						
Non-specific Drugs	0.080	***	0.000		-0.027	*	0.053	***	-0.009		1.179	1.000	0.946	1.115	0.981
	(0.018)		(0.019)		(0.013)		(0.012)		(0.020)						

* Note. Negative binomial regression models with standard errors adjusted for nesting within zip codes using the cluster command. Robust standard error values are presented below coefficient values in parentheses. All models control for these block-level and zip code-level variables: concentrated disadvantage; ethnic heterogeneity; percent Black; percent Latino; percent occupancy; percent owners; percent aged 15-29. Models also control for block logged population.

^aFor burglary and larceny models (Zip code: N = 479; Block: N =101,635)

*p<.05. **p<.01. ***p<.001.

The other crime types show much weaker effects. Zip codes with one standard deviation increase in the proportion of residents diagnosed with affective psychoses or neurotic disorders have 7.0% or 6.2% more larcenies, respectively. However, none of the other measures are significantly related to larcenies, none are significantly related to robberies, and none are significantly positively related to burglaries.

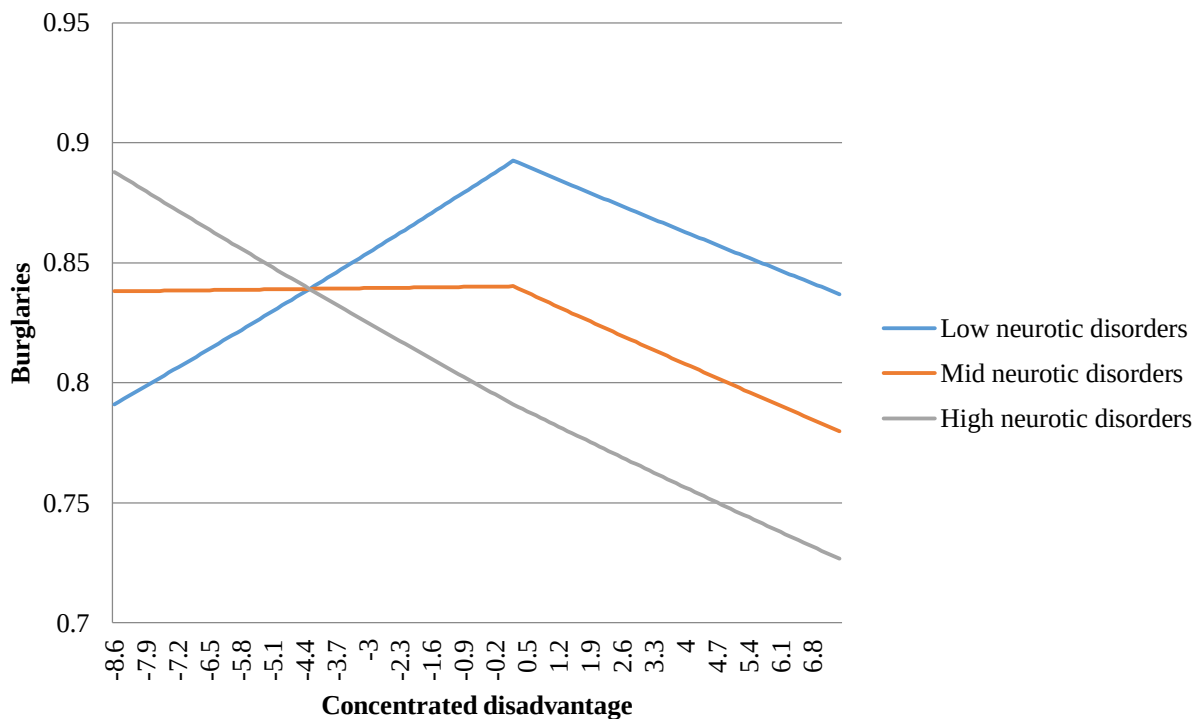
Moderating Effect of Mental Illness and Economic Disadvantage on Crime

We next turn to models that test whether the effect of residents with various mental illnesses is moderated by the level of concentrated disadvantage in the zip code. Several significant interaction effects were found when interacting both the proportion of residents with affective disorder types and substance use disorder types with concentrated disadvantage. Across all significant interactions, three main patterns emerged. For all interactions, we plot the pattern for low, mid, and high values of the mental illness variable of interest (one standard deviation below the

mean, the mean, and one standard deviation above the mean) against a range of one standard deviation below the mean to one standard deviation above the mean for concentrated disadvantage.⁴

First, the relationship between the presence of more residents diagnosed with neurotic disorders and block crime is notably different between high and low economic disadvantage zip codes. A representative plot for the burglary model is shown in Figure 1. On the one hand, burglaries occur 13% less frequently in blocks in high disadvantage zip codes with a greater proportion of residents diagnosed with neurotic disorders (the right side of Figure 1); on the other hand, burglaries occur 12% more frequently in low disadvantage zip codes with more residents diagnosed with neurotic disorders (the left side of Figure 1). The pattern was similar for the relationship between the proportion of residents diagnosed with neurotic disorders and robbery or motor vehicle theft (not shown).

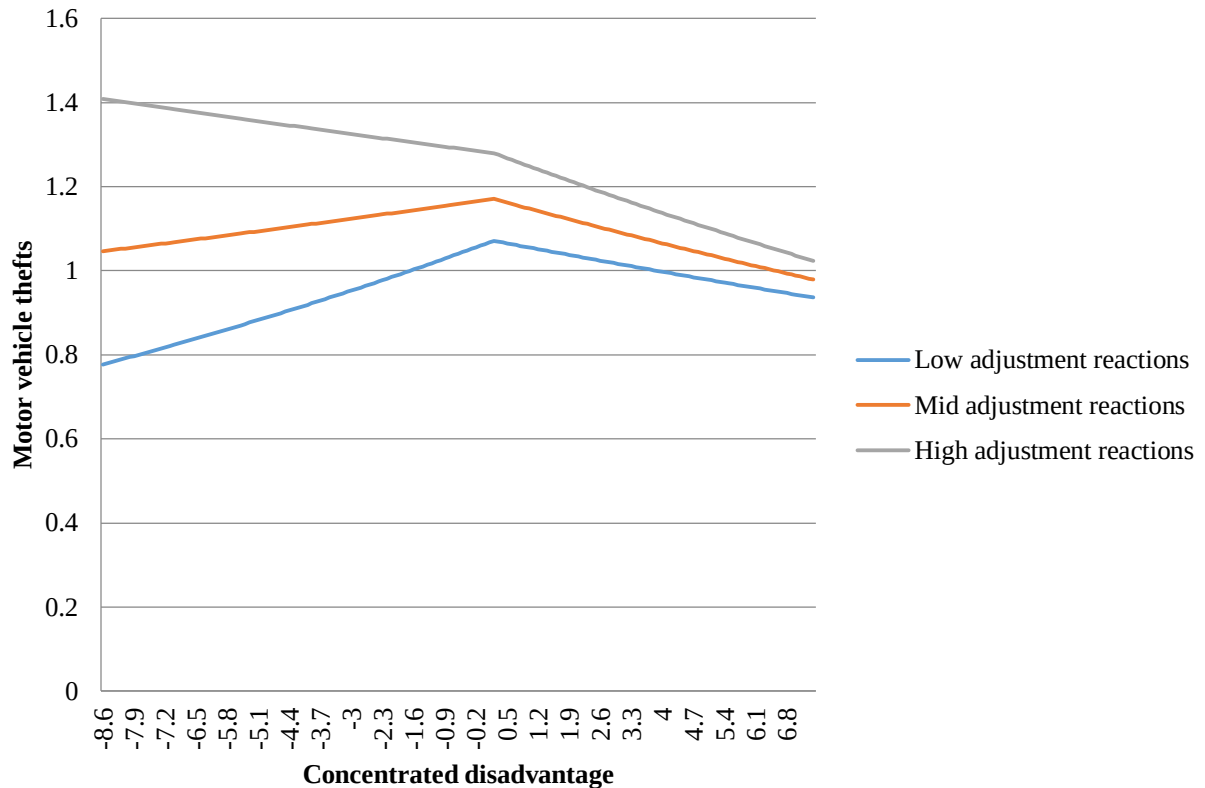
Figure 1: Effect of neurotic disorders and concentrated disadvantage on the predicted count of burglaries.



Second, for the other measures of mental illness diagnoses, zip codes with *low levels* of economic disadvantage are most impacted by the presence of these types of residents. For example, Figure 2 shows that in low concentrated disadvantage zip codes, the presence of more residents diagnosed with adjustment reactions is associated with about 80% more predicted motor vehicle thefts (the left side of

the figure). However, this interaction effect effectively disappears in high disadvantage zip codes (the right side of this figure). We also found that the presence of more residents diagnosed with adjustment reactions is associated with more robbery or aggravated assaults in zip codes with low concentrated disadvantage (not shown).

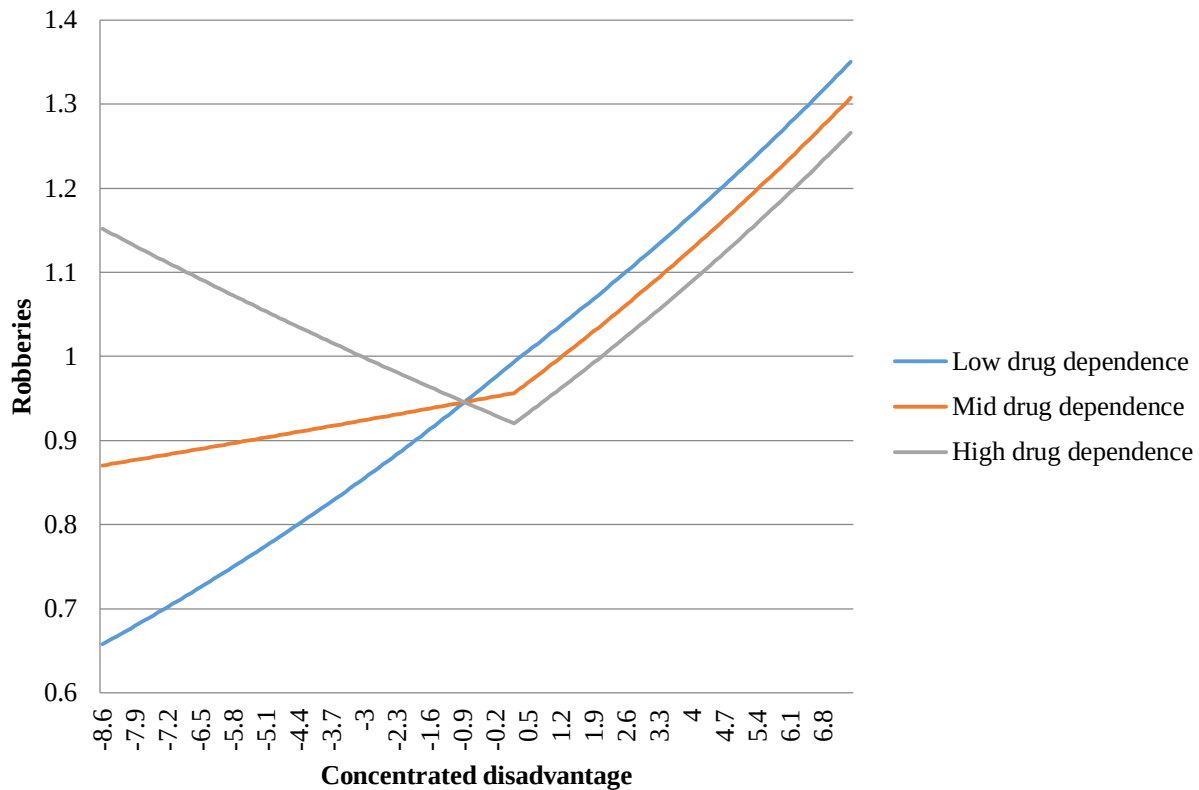
Figure 2: Effect of adjustment reactions and concentrated disadvantage on the predicted count of motor vehicle thefts.



This same pattern in which the detected effect was strongest in zip codes with low economic disadvantage was also found when considering the proportion of residents diagnosed with affective psychoses. The patterns for the relationship between the proportion of residents diagnosed with affective psychoses and burglary, robbery, and motor vehicle theft were all very similar to the plot shown in Figure 2 for adjustment reactions. Thus, in blocks in high disadvantage zip codes the relative number of residents diagnosed with affective psychoses has effectively no relationship with crime. However, burglary, robbery, and motor vehicle theft are higher in blocks in zip codes with a greater proportion of residents diagnosed with affective psychoses and low economic disadvantage.

Likewise, we found that the presence of more residents diagnosed with drug dependence or psychosis has a stronger effect in low economic disadvantage zip codes. As shown in Figure 3, in low disadvantage zip codes, the presence of a greater proportion of residents diagnosed with drug dependence or psychosis is associated with more robbery (the left side of the figure). In high disadvantage zip codes, the presence of more residents diagnosed with drug dependence or psychosis does not impact the predicted number of robberies (the right side of the figure). The plots for aggravated assault, burglary, and motor vehicle theft were similar (not shown).

Figure 3: Effect of drug dependence/psychosis and concentrated disadvantage on the predicted count of robberies.



We briefly note that the control variables typically showed results as expected. Results from one set of model are shown in Table A2 in the Appendix. Blocks with higher levels of concentrated disadvantage, ethnic heterogeneity, percent Black, percent Latino, percent renters, and vacancies had higher levels of most crime types. Zip codes with higher percent Black and percent renters had higher levels of most of these crime types. The estimated coefficients for logged population were all less than 1—ranging from .5 to .7—indicating that higher population blocks have lower crime rates than lower population blocks.

Discussion

Mental illness is a complex condition that affects not only the person with the disorder but, we have suggested, it impacts the neighborhood itself, bearing importantly on crime. Contextual measures of neighborhood crime have been used to predict mental illness (e.g., Stockdale et al., 2007), and a number of studies have examined the relationship between mental illness and crime at the individual level (e.g., Daff & Thomas, 2014), yet this study is the first known study to use a contextual measure of mental illness to study crime rates. We found evidence that

including such measures showed significant relationships with ecological crime rates, even when controlling for a number of traditional predictors including race/ethnicity, home ownership, residential occupancy, age, and economic disadvantage at both the block and zip code level. That is, our results indicated that having a greater proportion of mentally ill persons with certain affective (i.e., affective psychoses, acute reactions to stress, and adjustment reactions) or substance use (i.e., alcohol and drug psychosis or dependence and non-specific drugs) disorders in the zip code was associated with higher rates of motor vehicle theft and aggravated assault at the block-level. These findings provide support for our earlier hypotheses (H1 and H3), as the more affective disorders present in the zip code, the more block-level incidents of aggravated assault (except for neurotic disorders) and property crime in terms of motor vehicle theft or larceny (for affective psychosis and neurotic disorders only) occurred. Also, just as expected (i.e., H2), the more substance use disorders in the zip code, the more aggravated assaults were reported at the block-level.

We have suggested that the presence of residents with various mental illnesses may affect local crime rates by changing the number of offenders, targets, or guardians or by acting as a structural measure, which

impacts the level of social disorganization in an area. Although our results detected relatively strong ecological patterns, it is difficult to adjudicate between these competing mechanisms. At points, our results indicate that several of these mechanisms might be at work.

The fact that we observed higher aggravated assault rates in blocks located in zip codes with a higher proportion of residents diagnosed with acute reactions to stress, adjustment reactions, or alcohol dependence and psychosis disorders is most consistent with the notion that such residents are either increasing the potential number of offenders or the number of targets. However, we are unable to assess if the mentally ill persons in the zip code are the perpetrators of violence (offenders) or the victims of violence (targets). Based on prior research (Arseneault et al., 2000; Graz et al., 2009; Silver, 2006; Silver et al., 2005; Teplin et al., 2005), it is less likely that mentally ill persons are the offenders of crime (unless under the influence of alcohol or drugs) and more likely that, if directly involved in a crime incident, they are the victims of crime. The positive relationship between the presence of residents diagnosed with mental health problems and motor vehicle theft is unlikely an issue of more offenders, as this is a crime requiring more skill.

It is difficult to determine the mechanism leading to the fact that zip codes with a greater proportion of residents with affective psychosis disorders had higher aggravated assault, motor vehicle theft, and larceny rates. The minor crime of larceny requires minimal criminal skills, and therefore persons with affective psychosis disorders experiencing a delusion or a euphoric surreal state might unknowingly engage in minor property theft. On the other hand, motor vehicle theft is a crime typically requiring more skill, and therefore it is less plausible that such individuals are likely acting as offenders. More research is needed to tease out this relationship.

We found mixed evidence for the hypothesis that the presence of more residents with mental illnesses will impact the number of capable guardians in a zip code. On the one hand, if persons with mental illnesses impact the number of guardians in an area, then we should detect higher block-level crime rates for all types of crime in zip codes with a high proportion of mentally ill persons (H4 and H5). However, we did not find such evidence. Instead, we typically found higher crime rates only for certain types of crime. Results from our spline models indicated that a positive relationship between the proportion of residents with certain types of mental illness diagnoses and crime rates was consistently present for multiple crime types in *low concentrated disadvantage zip codes* (H6). For example, zip codes

with a greater proportion of residents diagnosed with affective psychosis disorders or adjustment reaction disorders had higher levels of acquisitive crime types such as robbery, burglary (only for affective psychosis disorders), or motor vehicle theft if they were also in low concentrated disadvantage zip codes. This finding might be a consequence of mentally ill residents forming a socially-excluded group within a more economically prosperous zip code. Under such conditions, mentally ill residents would have limited exchanges with neighbors and, therefore, be unable to form neighborhood spanning social ties. One end result of this would be a more segmented neighborhood network with little social cohesion and a diminished sense of community, which, in turn, might foster a criminogenic environment by hindering effective guardianship. Nonetheless, our theorizing on how mentally ill persons may indirectly influence crime dynamics have yet to be tested and importantly rely on the interrelations between mentally ill persons and other persons in the neighborhood.

We note some limitations to the present study. First, this study examined the data cross-sectionally due to high correlations between mental disorders across the three years. Though this choice was statistically appropriate, it meant that we were unable to explore other interesting questions. For example, does the relationship between resident mental disorders and crime change over time, or in neighborhoods where there are significant changes in crime rates, are there also significant changes in the number of residents with diagnosed mental disorders? Second, we did not have any information on the people being hospitalized for mental disorders due to privacy laws. This restriction means that we did not know whether such persons were crime offenders, victims, or capable guardians; the extent that such persons were representative of our other study variables (between the ages of 15-29, Black, etc.); or how many individuals are represented in the data multiple times either due to the co-occurrence of primary disorder codes or multiple hospital admissions. To the latter point, data from the National Inpatient Sample (NIS) indicates that only 17.3% of adult inpatient hospitalization stays for mental illnesses were for co-occurring (primary or secondary) mental and substance use disorders (Heslin, Elixhauser, & Steiner, 2015). In addition, many people hospitalized for a mental disorder are not re-hospitalized again (e.g., only 13% of psychiatric inpatients were re-hospitalized over a 6-month period; Thompson, Neighbors, Munday, & Trierweiler, 2003), suggesting few redundancies. Thus, even though our measure is not a “true” count of hospitalized mentally ill persons in a zip code, it is

a good proxy that, if anything, adjusts somewhat for disorder severity or impairment by recounting people with multiple disorders and hospital visitations. Third, all mental illness information was only available at the zip code level to ensure patient anonymity. It would have been better to have data available at the block or block-group level as such geospatial precision may have illuminated additional effects otherwise occluded by the use of zip code patient data. Fourth, we only are using data from the Southern California area; therefore, it is unclear if these findings would replicate in other geographic areas of the United States. We have no reason to suspect that the spatial patterns are different in this particular setting, but this assumption should still be tested. Despite these limitations, our findings still strongly support the use of contextual mental illness measures in the study of crime.

Greater understanding is needed to address how exactly mental illness and crime relate at the neighborhood level. Even though our findings support that zip code measures of mental illness are not the same as zip code measures of economic disadvantage, or other traditional measures, one critical unanswered question is why? Future research would benefit from exploring why such aggregate resident mental illness measures are associated with crime rates. We have suggested that dynamics between offenders, victims, and guardians are different in neighborhoods with high numbers of mentally ill persons and, similarly, that having high numbers of said persons in the neighborhood might limit the social cohesion amongst neighbors, but these ideas have yet to be empirically tested. Also, as a new finding in the literature, replication studies are strongly encouraged to determine whether our findings generalize to other geographic areas. To the extent that future studies support our findings and are able to understand the mechanisms behind this association, interventions can be constructed with the two-tiered goal of reducing crime and improving the mental welfare of the neighborhood.

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APPENDIX.**Table A1. List of Cities with Crime Data**

County	City Name
Los Angeles	Agoura Hills
Los Angeles	Alhambra
Los Angeles	Artesia
Los Angeles	Avalon
Los Angeles	Azusa
Los Angeles	Baldwin Park
Los Angeles	Bellflower
Los Angeles	Bradbury
Los Angeles	Burbank
Los Angeles	Calabasas
Los Angeles	Carson
Los Angeles	Cerritos
Los Angeles	Claremont
Los Angeles	Commerce
Los Angeles	Compton
Los Angeles	Cudahy
Los Angeles	Diamond Bar
Los Angeles	Downey
Los Angeles	Duarte
Los Angeles	El Segundo
Los Angeles	Gardena
Los Angeles	Hawaiian Gardens
Los Angeles	Hidden Hills
Los Angeles	Industry
Los Angeles	La Canada Flintridge
Los Angeles	La Habra Heights
Los Angeles	La Mirada
Los Angeles	La Puente
Los Angeles	Lakewood
Los Angeles	Lancaster
Los Angeles	Lawndale
Los Angeles	Lomita
Los Angeles	Los Angeles
Los Angeles	Lynwood
Los Angeles	Malibu

Los Angeles	Manhattan Beach
Los Angeles	Montebello
Los Angeles	Norwalk
Los Angeles	Palmdale
Los Angeles	Palos Verdes Estates
Los Angeles	Paramount
Los Angeles	Pico Rivera
Los Angeles	Rancho Palos Verdes
Los Angeles	Redondo Beach
Los Angeles	Rolling Hills
Los Angeles	Rolling Hills Estates
Los Angeles	Rosemead
Los Angeles	San Dimas
Los Angeles	San Fernando
Los Angeles	Santa Clarita
Los Angeles	South El Monte
Los Angeles	Temple City
Los Angeles	Walnut
Los Angeles	West Hollywood
Los Angeles	Westlake Village
Orange	Aliso Viejo
Orange	Anaheim
Orange	Dana Point
Orange	Huntington Beach
Orange	Irvine
Orange	Laguna Hills
Orange	Laguna Niguel
Orange	Lake Forest
Orange	Mission Viejo
Orange	Rancho Santa Margarita
Orange	Rossmore
Orange	San Clemente
Orange	San Juan Capistrano
Orange	Santa Ana
Orange	Stanton
Orange	Villa Park
Riverside	Calimesa
Riverside	Canyon Lake
Riverside	Coachella

Riverside	Corona
Riverside	Hemet
Riverside	Indian Wells
Riverside	La Quinta
Riverside	Lake Elsinore
Riverside	Moreno Valley
Riverside	Norco
Riverside	Palm Desert
Riverside	Perris
Riverside	Rancho Mirage
Riverside	San Jacinto
Riverside	Temecula
San Bernardino	Colton
San Bernardino	Fontana
San Bernardino	Montclair
San Diego	Carlsbad
San Diego	Chula Vista
San Diego	Coronado
San Diego	Del Mar
San Diego	El Cajon
San Diego	Encinitas
San Diego	Escondido
San Diego	Imperial Beach
San Diego	La Mesa
San Diego	Lemon Grove
San Diego	National City
San Diego	Oceanside
San Diego	Poway
San Diego	San Diego
San Diego	San Marcos
San Diego	Santee
San Diego	Solana Beach
San Diego	Vista
Ventura	Ventura

Table A2. Affective Psychoses and Crime Events Model, Including Control Variables (Zip code: N = 482; Block: N = 102,771)^a

	Assault		Robbery		Burglary		Motor Vehicle		Larceny	
Affective Psychoses	0.225	*	0.087		-0.047		0.177	**	0.153	**
	(0.097)		(0.060)		(0.049)		(0.058)		(0.051)	
Block Controls										
Disadvantage	0.018	***	0.006	**	0.003	*	0.001		0.002	
	(0.004)		(0.002)		(0.001)		(0.001)		(0.002)	
Ethnic Heterogeneity	0.355	***	0.442	***	0.448	***	0.502	***	0.338	***
	(0.093)		(0.110)		(0.068)		(0.073)		(0.091)	
Black	0.012	***	0.009	***	0.004	***	0.007	***	0.004	*
	(0.002)		(0.002)		(0.001)		(0.001)		(0.002)	
Latino	0.006	***	0.005	***	-0.002	*	0.005	***	-0.004	***
	(0.001)		(0.001)		(0.001)		(0.001)		(0.001)	
Occupancy	-0.011	***	-0.013	***	-0.010	***	-0.007	***	-0.008	**
	(0.002)		(0.002)		(0.002)		(0.002)		(0.003)	
Ownership	-0.007	***	-0.012	***	-0.002	***	-0.007	***	-0.009	***
	(0.001)		(0.001)		(0.001)		(0.000)		(0.001)	
Age(15-29)	-0.000		0.001		0.003		0.006	***	0.002	
	(0.003)		(0.002)		(0.001)		(0.001)		(0.002)	
Logged Population	0.605	***	0.486	***	0.668	***	0.695	***	0.591	***
	(0.032)		(0.021)		(0.015)		(0.015)		(0.021)	
Zip code Controls										
Disadvantage	0.025	*	0.018		0.003		0.002		-0.012	
	(0.011)		(0.009)		(0.006)		(0.008)		(0.007)	
Ethnic Heterogeneity	-0.009	***	-0.002		0.000		-0.001		0.002	
	(0.002)		(0.003)		(0.002)		(0.002)		(0.002)	
Black	0.009	**	0.016	***	0.009	***	0.006	**	-0.002	
	(0.003)		(0.003)		(0.002)		(0.002)		(0.002)	
Latino	-0.005		0.006		0.002		0.008	**	0.003	
	(0.003)		(0.003)		(0.002)		(0.002)		(0.002)	
Occupancy	0.007		0.026	***	-0.007		0.015	*	0.000	
	(0.009)		(0.007)		(0.006)		(0.006)		(0.007)	
Ownership	-0.000		-0.019	***	-0.001		-0.005	***	-0.006	***
	(0.002)		(0.002)		(0.002)		(0.001)		(0.001)	
Age (15-29)	0.019	*	-0.008		-0.003		0.012		-0.000	
	(0.008)		(0.007)		(0.005)		(0.007)		(0.006)	

Constant	-4.469	***	-4.642	***	-2.275	***	-5.761	***	-1.481	**
	(0.789)		(0.676)		(0.465)		(0.555)		(0.536)	
Inalpha	-1.632		-0.409		-1.460		-1.775		-0.156	
	(0.383)		(0.076)		(0.131)		(0.133)		(0.054)	
Pseudo r-squared	0.199		0.215		0.138		0.219		0.113	

Note. Robust standard errors are presented in parentheses below coefficients.

^aFor burglary and larceny models (Zip code: $N = 479$; Block: $N = 101,635$)

* $p < .05$. ** $p < .01$. *** $p < .001$.

Endnotes

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- ¹ Given the low frequency counts of homicides, we did not include this crime type in the reported analyses. Over 99% of the blocks reported no homicides from 2009 to 2011.
 - ² Affective disorders were aggregated across the three years due to high year-to-year correlations. For example, the year-to-year correlations for affective psychosis after dividing by zip code population values ranged from .87 to .92.
 - ³ The results would be identical if we instead included logged population as an offset and also included logged population as a covariate in the model (except that the estimated coefficient value would be $1-\beta$, where β is the coefficient estimate for logged population in our models).
 - ⁴ All plotted points displayed in Figure 1, 2, and 3 are empirically present in our data.