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ALCOHOL OUTLET DENSITY AND INTIMATE PARTNER VIOLENCE-RELATED EMERGENCY DEPARTMENT VISITS

Carol B. Cunradi, MPH, PhD[1], **Christina Mair, MPH, PhD**[1,2], **William Ponicki, MA**[1], and **Lillian Remer, MA**[1]

[1]Prevention Research Center, Pacific Institute for Research and Evaluation, Berkeley, CA 94704

[2]School of Public Health, University of California, Berkeley, 94720

Abstract

Background—Previous research has identified risk factors for intimate partner violence (IPV) severity, injury, and Emergency Department (ED) visits. These risk factors have been shown at both the individual level (heavy drinking and other substance use on the part of one or both partners) and the neighborhood level (residence in an area characterized by poverty and social disadvantage). Alcohol outlet density has been linked with assaultive violence in community settings, but has not been analyzed in relation to IPV-related ED visits. This study examined the effects of outlet densities on IPV-related ED visits throughout California between July 2005 and December 2008.

Methods—Half-yearly counts of ED visits related to IPV (E-code 967.3) were computed for each zip code from patient-level public datasets. Alcohol outlet density measures, calculated separately for bars, off-premise outlets, and restaurants, were derived from California Alcohol Beverage Control records. Census-based neighborhood demographic characteristics previously shown to be related to health disparities and IPV (percent Black, percent Hispanic, percent below 150% of poverty line, percent unemployed) were included in models. This study used Bayesian space-time models that allow longitudinal analysis at the zip code level despite frequent boundary redefinitions. These spatial misalignment models control for spatial variation in geographic unit definitions over time and account for spatial autocorrelation using conditional autoregressive (CAR) priors. The model incorporated data from between 1,686 (2005) and 1,693 (2008) zip codes across California for 7 half-year time periods from 2005 through 2008 (n = 11,836).

Results—Density of bars was positively associated with IPV-related ED visits. Density of off-premise outlets was negatively associated with IPV-related ED visits; this association was weaker and smaller than the bar association. There was no association between density of restaurants and IPV-related ED visits.

Conclusion—Further research is needed to understand the mechanisms by which environmental factors, such as alcohol outlet density, affect IPV behaviors resulting in ED visits.

Keywords

Intimate partner violence; alcohol outlet density; Emergency Department; injury

Intimate partner violence (IPV) is a widespread public health problem that can result in significant physical and mental health sequelae for one or both partners in the couple (Coker et al., 2002; Fletcher, 2010; Reid et al., 2008; Rhodes et al., 2009; Straus et al., 2009). For

Corresponding Author: Carol Cunradi, Prevention Research Center, Pacific Institute for Research and Evaluation, 1995 University Avenue, Suite450, Berkeley, CA 94704 510-883-5771, Cunradi@prev.org.

example, IPV is estimated to result in 8 million lost days of paid work among women, and cost $4.1 billion for direct medical and mental health care services (National Center for Injury Prevention and Control, 2003). Based on a sample of married or cohabiting couples in the general household population, annual prevalence estimates for any partner-to-partner violence (i.e., male-to-female or female-to-male) range from 7.8% to 21.5% (Schafer et al., 1998). In terms of demographic risk factors, younger couples are more likely to engage in physically aggressive behavior towards each other than older couples (Cunradi, 2007; Suitor et al., 1990). Rates of IPV also appear to be higher among racial/ethnic minorities and among households characterized by indicators of lower socioeconomic status (Caetano et al., 2000; Cunradi, 2007; Field and Caetano, 2004; Sorenson et al., 1996). Regarding personal characteristics, impulsivity has emerged as an important attribute that may result in or facilitate aggressive behavior in response to couple conflict (Cunradi et al., 2002; Cunradi et al., 2009; Shorey et al., 2011). Cumulative adverse childhood experiences, such as exposure to physical, sexual, or emotional abuse, and other forms of household dysfunction, have also been linked with increased likelihood of IPV in adulthood (Anda et al., 2006).

Couples in which the male engages in heavy or hazardous drinking are more likely to experience IPV compared to couples in which the male does not engage in heavy or hazardous drinking (Cunradi, 2007; Leonard, 1993; Leonard, 2005). The evidence is less clear concerning the contribution of the female partner's drinking to the occurrence of IPV. For example, findings from an analysis based on a national sample of couples in the general household population showed that those in which the female partner reported alcohol-related problems (i.e., social consequences of drinking and/or alcohol dependence symptoms) were at significantly greater risk for IPV compared to couples in which the female partner did not report alcohol-related problems, even after accounting for the male partner's alcohol-related problems (Cunradi et al., 2002). Among a sample of men and women arrested for domestic violence, alcohol problems in male and female perpetrators and their partners were shown to directly contribute to physical abuse (Stuart et al., 2006). Klostermann and Fals-Stewart (Klostermann and Fals-Stewart, 2006) reviewed the evidence for three proposed mechanisms underlying the alcohol-IPV association. They propose that the proximal effects model, in which alcohol intoxication is a proximal agent of IPV via the psychopharmacologic effects of alcohol on cognitive processing or through alcohol-related expectancies, is the most well supported. Alcohol involvement on the part of one or both partners in the couple may also increase the risk of IPV severity (Mckinney et al., 2010).

Survey research indicates that severe partner aggression (e.g., beating up; kicking; punching) accounts for a minority of all IPV incidents (Schafer et al., 1998; Sorenson et al., 1996; Straus and Gelles, 1990); however, it is much more likely than moderate partner aggression (e.g., pushing, shoving, grabbing) to cause injury requiring medical attention. Although women are as likely as men to engage in physically aggressive behavior towards their partner, they are more likely than men to be injured as a result of IPV (Archer, 2000; Capaldi et al., 2009; Whitaker et al., 2007). Approximately 1% to 7% of all female patients who present to the Emergency Department (ED) do so on account of an acute episode of physical abuse by their intimate partner (Anglin and Sachs, 2003). Not surprisingly, ED-based studies have found alcohol misuse and heavy drinking (on the part of the victim and/or perpetrator) to be strong predictors of IPV (Walton et al., 2009) and injury (Grisso et al., 1999; Kyriacou et al., 1999). Few ED studies of IPV, however, have analyzed how aspects of the neighborhood environment may increase risk for injury (e.g., Grisso et al., 1999), and none have considered the contribution of alcohol outlet density. Environmental factors are important to consider for several reasons. For example, empirical evidence suggests that couples who live in neighborhood characterized by higher levels of objectively measured (i.e., Census-based) poverty or unemployment are at increased risk for IPV compared to couples residing in non-impoverished or low-unemployment neighborhoods, net individual and couple-level factors, such as household income or employment status (Cunradi et al., 2000; Cunradi et al., 2002; Fox and Benson, 2006; O'Campo et al., 1995). In addition, several ecological studies link alcohol outlet density with police-reported IPV (Cunradi et al., 2011; Livingston, 2010; Livingston, 2011). Greater numbers of alcohol outlets in a community may be a sign of loosened normative constraints against violence, promote problem drinking among at-risk couples, and provide environments where groups of persons at risk for IPV may form and mutually reinforce IPV-related attitudes, norms, and problem behaviors (Cunradi, 2010). Moreover, alcohol outlet density has been linked with assaultive violence in community settings (Gruenewald and Remer, 2006; Livingston, 2008; Zhu et al., 2004), but has not been analyzed in relation to IPV-related ED visits. The purpose of this study is to examine the effects of outlet densities on IPV-related ED visits throughout California between July 2005 and December 2008.

METHODS

Data Sources

IPV-Related Emergency Department Visits—Counts of IPV-related emergency department (ED) visits were computed from public data available from the California Office of Statewide Health Planning and Development (OSHPD). These public datasets include all ED encounters from hospitals licensed to provide emergency medical services, excluding cases that were ultimately admitted to the hospital or where the patient left before being seen. Public ED data is subject to masking of demographics when necessary to protect patient confidentiality. Masking begins with age and ends with zip code to insure no records are unique for a combination of age, ethnicity, race, gender, quarter of service, and zip code, and affects only about 2% of zip codes. IPV-related emergency visits were identified by cause-of-injury event code (E-code) 967.3 (ICD-9-CM, 1991). This code indicates that injuries were sustained through alleged abuse by a domestic partner. Emergency department encounter records for domestic violence were aggregated to the residential zip code of the patient for each half calendar year of data. Data were available from the second half of 2005 through the end of 2008 (seven time points).

Alcohol Outlet Density—Three types of retail alcohol outlets were measured within the state of California. These included off-premise establishments (license type 20 and 21), restaurants (license type 41 and 47) and bars/pubs (license types 23, 40, 42, 48, 61 and 75). License data were obtained from the California Department of Alcohol Beverage Control (ABC), geocoded to the premise address and spatially joined to zipcode polygons for each year. Estimates used in models were measures of the density of outlets of each type per square mile within a given zip code in a specific year. As the data points for the outcome variable, ED visits for IPV, were measured in 6-month units, the same outlet density was assigned to the first and second half of each calendar year. As expected, correlations between each type of outlet were positive, ranging from 0.794 to 0.855. The three types of outlets were kept separate in analyses, as the direction and strength of associations between outlet types were hypothesized to differ.

Census-Based Data—Estimates of annual (intercensus) zip code-level demographic data were collected from the America Sourcebook (CACI Marketing systems and ESRI BIS). Variables used included percent Hispanic and percent black. Measures of the percent of the population below 150% of the poverty line and the unemployment rate were available at the Census Block Group level from GeoLytic Premium Annual Estimates. To create measures of these variables at the zip code level, we created an average percent for each variable based on population weighting of percent values for all block groups with centroids within the zip code polygons for each year. Zip codes without values for total population were assigned a minimal population value of 5. Census-based rate variables (e.g., percent black or below 150% of the poverty threshold) were missing in 2.6% of zip-code observations, with most of these being for “synthetic” zip codes (unpopulated areas such as national forests that are not covered by official postal system routes but provided in some data sets to assure statewide coverage); these were assigned the California state average for the year. Since the outcome measure, IPV-related emergency department visit counts, was aggregated for 6-month periods, we used the same value for all Census-based measures for the first and second half of each year. For example, both halves of 2006 would be assigned the same unemployment rate for a given zip code. Correlations between Census-based variables were examined; most were weak (0.1226 to 0.2983). Moderate correlations were observed between percent below 150% of the poverty threshold and percent Hispanic (0.5439), and between percent below 150% of the poverty threshold and percent unemployed (0.6395). Bivariate associations between each Census-based variable and the outcome variable were positive and significant, except for percent unemployment (p=0.388).

The zip-code misalignment model described below accounts for changes in zip code boundaries over time. The approach assumes that zip code boundary shifts are not causally related to IPV. This assumption was tested using an estimate of the geographic instability of a zip code’s population due to changes in the zip code boundaries between the current and prior year. An instability measure is calculated based on the year 2000 Census Block population whose centroids fall within a given year’s zip code boundaries. It measures the percentage of year-2000 block populations within the current zip code definition that would not have fallen within the boundaries of the best-matched zip code from the prior year.

Data Analysis

Analyses relied on a spatial misalignment variant of a standard Bayesian hierarchical model. Bayesian spatial models were used for two key reasons. First, crude models of local problem rates typically involve large outlying risk estimates in sparsely-populated areas, where a single IPV-related ED visit could result in very high local rates. Second, simple analyses fail to account for the similarity of local risks between adjacent or nearby geographic areas (spatial autocorrelation) that may remain after accounting for modeled exogenous variables, violating the typical statistical assumption that model residuals are independently distributed. Bayesian methods for small area and disease mapping address both of these issues by providing precise model-based estimates of local rates utilizing both local and neighboring observations. Conditional Autoregressive (CAR) random effects account for spatial autocorrelation and reduce the influence of outlying local rates by allowing each spatial area to “borrow strength” from its neighbors (Waller and Gotway, 2004). Bayesian hierarchical models extend this framework to examine relative risks of problems over both space and time. These approaches typically include CAR random effects that account for certain geographic areas tending to have higher or lower problem risks than others, plus an additional random effect that models residual variation in risks that is not spatially autocorrelated (Carlin and Louis, 2000).

Standard Bayesian hierarchical models assume that geographic units are consistent across time, which is not the case for zip codes. The statewide count of California zip codes increased from 1,686 in 2005 to 1,693 in 2008, and nearly 4% of these zip codes in any given year experienced boundary changes affecting at least 1% of their population (as estimated using Census 2000 block centroid capture). Zhu and coauthors (Zhu et al., in press) introduced a spatial misalignment variant of a Bayesian hierarchical model that allows the use of zip-code data for longitudinal analysis despite frequent changes in these geographic units. This misalignment approach introduces a separate CAR random effect for each time-period-specific map of spatial adjacencies. These CAR random effects are assumed to have mean zero and share a common standard deviation. The model also allows for a separate random effect that is not spatially autocorrelated.

Given that the outcome measure is the count of ED visits in a given zip code and time period, a Poisson regression model is used:

$$Y_{i,t}|\mu_{i,t} \sim Poisson(E_{i,t}\exp(\mu_{i,t}))$$

where Y_{ij} represents the count of IPV-related ED visits in zip code *i* during half-year *t* and E_{ij} denotes the expected number of the IPV visits (assuming statewide IPV cases are distributed in direct proportion to zip-code population). Hence $\exp(\mu_{it})$ may be interpreted as the relative risk of residing in spatial unit *i* at time point *t*: regions with $\exp(\mu_{it}) > 1$ will have greater counts than expected, and regions with $\exp(\mu_{it}) < 1$ will have fewer than expected. Following standard generalized linear models, the log-relative risk, μ_{it}, is modeled linearly as:

$$\mu_{i,t}=\alpha_i+X'_{i,t}\beta+\theta_{i,t}+\varphi_{i,t}$$

This is a linear combination of fixed covariate effects and random effects which may take account of spatial and/or temporal correlation. Vector α_t is a set of half-year-specific intercepts that control for statewide changes in IPV-ED risks that are not explained by other covariates. Martix X'_{it} contains space- and time-specific covariates and β is a vector of fixed-effects estimates of the impacts of those covariates. θ_{it} and ϕ_{it} denote the pair of random effects capturing spatially unstructured heterogeneity and CAR spatial dependence, respectively. Final models included off premise outlet, bar/pub and restaurant densities (number of outlets per square mile), percent below 150% of the poverty line, unemployment rate, % black and % Hispanic. Models were estimated using WinBUGS 1.4.3 software (Lunn et al., 2000). Uninformed priors were specified for all fixed and random effects. Models were allowed to burn-in for 50,000 Markov Chain Monte Carlo (MCMC) iterations, which were sufficient for all parameter estimates to stabilize and converge between two chains with different initial values. Posterior estimates were then sampled for an additional 70,000 MCMC iterations to provide model results. Traces of MCMC iterations demonstrated good convergence for all parameters.

RESULTS

Table 1 presents the descriptive statistics for all variables used in analyses. The data set includes one observation per half year for each zip code in the state of California from 2005 to 2008. Variables other than IPV-ED counts were only available annually and were thus assumed to have the same value in both halves of any calendar year. Means, standard deviations and ranges are displayed for all outcome and predictor variables. Zip codes in California had an average population of 22,090 from 2005 to 2008. An average zip code reported approximately one bar, three off premise outlets and five restaurants per square mile, with densities as high as 443 restaurants per square mile in one zip code. There was an average of 23.6 IPV-related ED visits per 6 month period in CA zip codes (range: 0–237). The mean unemployment rate was 7.4%, while the mean percent of individuals living below 150% of the poverty line was 22.8%.

Table 2 presents the results from the final Bayesian spatial misalignment model. The left half of this table presents the raw coefficients, which are interpretable as log relative risks. The right half of the table exponentiates these values to provide relative risks of IPV-related

ED visits associated with a one-unit change in a given covariate. Median values from the 70,000 sampled MCMC iterations provide coefficient estimates for each parameter. These estimates are followed by their 95% credible interval, defined as the 2.5th and 97.5th percentiles of the posterior distribution. Effects are considered well-supported when the credible interval excludes zero for raw coefficients, or equivalently excludes one for relative risks.

An increase of one bar per square mile was associated with a 3% increased likelihood of IPV-related ED visits in a given zip code. An additional off premise outlet per square mile was associated with a 1% reduction in the risk of IPV-related ED visits. Restaurant density was not associated with IPV-related ED visits. Increasing percentage black and percentage Hispanic were associated with increases in ED visits, as was an increase in percentage of individuals below 150% of the poverty line. Higher unemployment was associated with fewer ED visits. Higher levels of IPV-related ED visits occurred in the second half of each calendar year, with the intercept for the second half of 2005 representing the highest rate of ED visits. Interaction effects were inconsistent in preliminary analyses, so no interactions are included in the final model (data available from the authors upon request).

The bottom section of Table 2 displays the extent of spatial autocorrelation in the model results. The CAR spatial proportion of the total error variance was almost 78%, with the remaining variance coming from the spatially unstructured random effect. The CAR random effect exhibited strongly-positive spatial autocorrelation (Moran's I =0.94, $p < 0.0001$).

DISCUSSION

This study adds to the nascent literature that seeks to identify how environmental factors, particularly alcohol outlet density, contribute to risk for IPV. Previous ecological analyses have used police-reported IPV events as the outcome (e.g., Cunradi et al., 2011; Livingston, 2010; Livingston, 2011); this is the first study to make use of hospital records to explore the association between alcohol outlet density and IPV-related ED visits. Since, by definition, all cases in the analysis consisted of those who sustained IPV-related injuries requiring medical attention, it is reasonable to assume that our outcome measure represents a greater level of severity than police-reported IPV cases (although some of those cases also involve injury). With this in mind, our results can be compared to other ecological and multilevel studies on alcohol outlet density and IPV.

Our findings indicate that density of bars or pubs are positively associated with IPV-related ED visits throughout California over a 3.5 year period (2005–2008), even after accounting for Census-based neighborhood characteristics that have been shown to be related to health disparities (Berke et al., 2010) and IPV (Cunradi, 2010). In a multilevel study of IPV, McKinney et al. (McKinney et al., 2009) found that on-premise alcohol outlet density was significantly associated with male-to-female partner violence (but not with female-to-male partner violence) among a national sample of married/cohabiting couples. Their measure of on-premise alcohol outlets, however, included both bars and restaurants where alcohol is consumed. It should also be noted that most of the IPV reported by couples in their sample consisted of 'moderate' aggression (e.g., pushing, shoving, grabbing), and not severe IPV, which is more likely to result in injury (Cunradi et al., 2002). A cross-sectional ecological analysis by Livingston (Livingston, 2010) found that general license density (either on- or off-premise consumption; mostly pubs and taverns) was significantly associated with police-reported IPV in Melbourne, Australia; on-premise density (mostly restaurants and small bars) were negatively associated with the outcome. In contrast, based on a longitudinal analysis using ecological data from Melbourne from 1996 to 2005, Livingston (Livingston, 2011) found that neither general license density nor on-premise density were associated with police-reported IPV. Instead, packaged license density (mostly retail liquor stores) was positively related to the outcome. Finally, Cunradi et al. (Cunradi et al., 2011), based on longitudinal analysis of ecological data from Sacramento, California, reported that off-premise outlet density, but not bar or restaurant density, was significantly linked to both IPV-related police calls and IPV-related crime reports.

The absence of individual-level data in this study preclude us from determining the precise mechanisms that link an increase of one bar per square mile with a 3% increased likelihood of IPV-related ED visits in a given zip code. It is possible, for example, that men who drink in bars that have physical or social characteristics that make violence more likely (e.g., Quigley et al., 2003) may return home to their spouse/partner in a disinhibited, aggressive state in which conflict can rapidly escalate to IPV. Treno et al. (Treno et al., 2007a), in a multilevel study of bars, hostility and aggression found that bars may serve to concentrate aggressive people into selected environments, and that these environments may serve to increase levels of aggression. Individuals with increased levels of hostility and alcohol aggression are more likely to choose bars as a venue for drinking (Treno et al., 2007a). Similarly, women who are frequent bar goers may be more likely to drink heavily and use illicit drugs (Parks, 2000; Parks et al., 2009), placing them at increased risk for interpersonal aggression and victimization. The absence of individual-level characteristics in this study does not allow us to explore these hypotheses. Clearly, additional, multilevel research is needed to further investigate the mechanisms that underlie the association between bar density and IPV-related ED visits.

Our results indicate a small negative association between off-premise alcohol outlets and IPV-related ED visits, with an additional outlet per square mile reducing risks by 1%. This finding is not consistent with prior research, and should therefore be seen as preliminary. An alternative explanation is that alcohol obtained from off-premise outlets is probably consumed at home, and therefore less likely to result in physical aggression than alcohol consumed in the bar environment. Findings reported by Nyaronga et al. (Nyaronga et al., 2009) on drinking context and drinking problems appear consistent with this explanation. For example, male and female survey respondents who were primarily bar drinkers were at increased risk for arguments and fighting; those who were primarily home drinkers were not at elevated risk. Moreover, Hispanic men and women and white men categorized as primarily bar drinkers were at increased risk for reporting problems with their spouse because of drinking; none of the primarily home drinkers were at increased risk in the adjusted models. The contribution of additional (unmeasured) socioeconomic or demographic factors in relation to off-premise outlets and IPV-related ED visits needs to be evaluated in future analyses. Our results showing that restaurant density is not associated with IPV-related ED visits is consistent with findings from other studies on alcohol outlet density and assaultive violence (Gruenewald et al., 2006; Lipton and Gruenewald, 2002).

This paper has a number of strengths and limitations. Regarding the latter, the correlations of exogenous variables are a potential limitation of the analysis. A potential concern is the extent that ED staff utilizes the appropriate E-code to identify IPV-related cases (Weiss et al., 2004). The state of California mandates E-coding for ED injury cases (those with N-codes above 800), making California's coding among the best in the nation (Annest et al., 2008). At least one validity study for California ED data has been conducted (Goldman et al., 2011), although it was not focused on IPV-related cases. Any bias introduced here, however, is unrelated to alcohol availability, thus mitigating this concern.

In terms of strengths, this study used a spatial misalignment variant of the standard Bayesian spatial modeling approach that allows the use of zip code data for longitudinal analysis despite frequent changes in these geographic units. The results indicate strongly positive spatial autocorrelation in the errors, suggesting the possibility of serious bias in analyses that do not account for spatially structured errors. To our knowledge, this is the first study to make use of these modeling techniques in order to explore the relationship of alcohol outlet density to IPV-related ED visits. This represents a new and innovative approach to gaining insight into how environmental factors contribute to risk for injurious IPV. While additional research is needed to further refine the findings reported here, these results add to a growing body of literature showing that alcohol outlet density is linked to many community problems, such as underage and young adult injures (Gruenewald et al., 2010), alcohol-related car crashes (Treno et al., 2007b), suicide (Johnson et al., 2009) and child maltreatment (Freisthler et al., 2004). From a environmental standpoint, policy changes that limit alcohol availability may be a critical step to help prevent many of these community problems (Livingston, 2011; McKinney et al., 2009; Zhu et al., 2004).

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Table 1

Descriptive statistics, zip codes in California 2005–2008

	Mean	SD	Minimum	Maximum
Population	22,089.9	21,735.3	1	110,374
Area (Square Miles)	93.1	245.4	0.05	3,802.2
Bar / Pub Density	0.8	3.6	0	65.7
Off-Premise Outlet Density	2.6	6.6	0	118.5
Restaurant Density	4.8	20.1	0	442.9
% Black	4.6	8.0	0	86.7
% Hispanic	28.7	22.3	0	97.9
% below 150% poverty line	22.8	13.6	0	100.0
% unemployed	7.4	7.0	0	100.0
Number of IPV-related ER visits	23.6	28.8	0	237

Notes: Statistics are based on n=11,836 half-year zip code observations as used in the regression models.

Estimates for all measures other than IPV-related ER visits are only available annually.

Estimates are the same in the first and second half of 2006, 2007, 2008.

Outlet densities are calculated as number of alcohol licenses per square mile.

Table 2

Results of Bayesian Spatial Misalignment Model for IPV-related ED Visits

		Raw Coefficient	Relative Risk
Alcohol Outlet Density	Bars / Pubs	0.030 (0.014, 0.046)	1.030(1.015,1.047) *
	Off-Premise	−0.010 (−0.018, −0.001)	0.990(0.982,0.999) *
	Restaurants	0.000 (−0.004, 0.004)	1.000(0.996,1.004)
Census-Based Characteristics	% Black	0.016 (0.013, 0.020)	1.016(1.013,1.020) *
	% Hispanic	0.003 (0.010, 0.005)	1.003(1.001,1.005) *
	% below 150% poverty	0.019 (0.015, 0.023)	1.019(1.015,1.023) *
	% unemployed	−0.013 (−0.022, −0.004)	0.987(0.979,0.996) *
	Zip code instability	−0.015 (−0.051, 0.015)	0.986(0.951,1.016)
Period-Specific Intercepts	2005 (2nd half)	−0.589 (−0.685, −0.494)	
	2006 (1st half)	−0.730 (−0.831, −0.631)	
	2006 (2nd half)	−0.676 (−0.777, −0.576)	
	2007 (1st half)	−0.740 (−0.843, −0.637)	
	2007 (2nd half)	−0.651 (−0.752, −0.550)	
	2008 (1st half)	−0.735 (−0.837, −0.633)	
	2008 (2nd half)	−0.700 (−0.801, −0.597)	
CAR proportion of error variance		0.7756(0.7081, 0.8740)	
Spatial autocorrelation of CAR effect		0.943 (z = 60.52)	

Notes: The values presented above are median estimates from the posterior distribution, followed in parentheses by their 95% credible interval (2.5%, 97.5%). Raw coefficients are log relative risks, which were then exponentiated to produce relative risks.

* Indicates findings that are well-supported by the data as evidenced by credible intervals that exclude zero for raw coefficients or, equivalently, exclude one for relative risks.