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The association between blighted property remediation and domestic crime by alcohol availability

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ABSTRACT

There is increasing evidence that place-based interventions reduce crime and interpersonal violence in urban settings. However, evidence concerning the impacts of these neighborhood interventions on domestic crime (crime between intimate partners, family, or household members) is inconclusive. We used data from a New Orleans, Louisiana, place-based blighted property remediation intervention to test the hypothesis that the intervention was associated with changes in domestic crime. Because there is evidence that alcohol availability is related to domestic crime, we also assessed whether this association was moderated by alcohol outlet density. We assessed overall associations using a difference-in-difference approach and assessed moderation using a triple-difference approach. The analytic sample consisted of 204 remediated lots and 612 non-remediated matched control lots over 84 months (2011–2017), for a total of 68,544 lot-months. In difference-in-differences analyses, the place-based intervention was associated with additional domestic crime incidence ($\beta = 0.311$, 95% CI: 0.016, 0.605; $p = 0.039$). In triple-difference analyses, on-premise bar density modified this association ($\beta = -0.119$, 95%CI: −0.147, −0.092; $p < 0.001$): in areas with higher bar density, increases in domestic crime were lower near remediated lots compared with control lots. Place-based interventions to reduce blighted properties may have contributed to fewer domestic crime incidents in areas with more bars.

1. Introduction

1.1. Domestic violence and place

Domestic violence is of growing public health concern, impacting the health and safety of up to 1 in 3 men and more than 1 in 3 women in the US (Smith et al., 2019). Domestic violence is a leading cause of severe physical injury and death, and can result in long-term chronic health consequences including depression, gastrointestinal disorders, reproductive disorders, heart disease, and post-traumatic stress disorder (Campbell, 2002). Domestic violence crime, which can take many forms including physical violence, sexual violence, psychological abuse, stalking, and more, represents 21% of all violent crime (Truman, 2014). Furthermore, domestic crime has been declining at a far slower rate than total violent crime over the past few decades (Catalano, 2012) and, in fact, rates of intimate partner homicide have increased in the US in recent years (Fridel and Fox, 2019). Preventive interventions for domestic violence with the potential for population-wide effects are needed. Despite the fact that domestic violence often occurs behind closed doors, theoretical and empirical evidence suggests that domestic violence is driven, in part, by environmental factors (Beyer et al., 2015; Pinchevsky and Wright, 2012; Voith, 2019).

Informed by social disorganization and other theories, prior research demonstrates that key environmental factors contribute to concentrated neighborhood disadvantage as well as to social norms that promote or condone violence and aggression, such as open air drug markets, alcohol

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availability, and littering (Branas et al., 2018; Cunradi et al., 2014; Keizer et al., 2008; Pinchevsky and Wright, 2012; Voith, 2019). Studies have suggested a link between neighborhood socioeconomic status and domestic violence (Beyer et al., 2015; Coulton et al., 2007; Cunradi et al., 2000; Grisso et al., 1999; Li et al., 2010; Nadan et al., 2015), including intimate partner violence (IPV) and child maltreatment, and have also revealed protective environmental factors in the neighborhood such as collective efficacy (Browning, 2002). IPV is associated with neighborhood conditions such as unemployment (O'Campo et al., 1995), deprivation/disadvantage (DeJong et al., 2011; Li et al., 2010), and poverty (Cunradi et al., 2000; Pearlman et al., 2003). Neighborhood disorder may weaken ties among residents (Kim, 2010; Packard et al., 2013; Shaw and McKay, 1942), potentially leaving survivors more vulnerable to violence from their partners (Stets, 1991; Wright and Skubak Tillyer, 2017) or leading to less intervention on their behalf by neighbors (Browning, 2002). It may also intensify stress among couples (Ross and Mirowsky, 2009), which may increase the likelihood of violence within the partnership (Wright and Benson, 2011). Socially disordered neighborhoods, including those with poor housing quality or vacant housing, have also been linked to higher rates of child injuries due to accidents (Reading et al., 2005) and higher rates of child maltreatment (Coulton et al., 1999; Freisthler, 2004; Freisthler et al., 2005). With respect to child maltreatment, parents living in disordered or disadvantaged neighborhoods may have less opportunities to develop social networks and work together to enforce shared norms (Sampson et al., 1999).

1.2. Place-based interventions and blighted property remediation

In recent years, there has been increased recognition of the widespread public health benefits of place-based violence interventions (Hohl et al., 2019). Place-based interventions move beyond individual-level drivers of violence and crime to address the underlying environmental and social contexts that foster violence. One class of place-based interventions are those focused on urban blighted property remediation. Blighted properties are abandoned structures or vacant lots that result from systematic disinvestment in specific neighborhoods, often reflecting historical and ongoing racist and discriminatory practices such as redlining and other racialized patterns of structural neighborhood disinvestment (Bieretz and Schilling, 2019). The presence of these properties results from disinvestment and contributes to ongoing cycles of disinvestment wherein a lack of future investment is justified by the presence of blighted properties (Bieretz and Schilling, 2019). Additionally, research shows that a high density of blighted properties is associated with increased neighborhood crime (Curtis and Mills, 2011). Blighted property remediation interventions are interventions that aim to interrupt such cycles of disinvestment and prevent crime through a variety of strategies such as property maintenance and rehabilitation, demolition and greening, and/or partnerships with government land banks to increase local ownership of rehabilitated properties (Carpenter et al., 2015).

There is an expanding body of evidence demonstrating that blighted property remediation interventions can reduce neighborhood crime. Observational studies have been complemented by recent quasi-experimental studies and randomized controlled trials in urban areas across the United States that have demonstrated consistent evidence of the causal effects of blighted property remediation on crime (Branas et al., 2011, 2016; 2018; Garvin et al., 2013; Kondo et al., 2018a; Moyer et al., 2018). Blighted property remediation is hypothesized to reduce crime and contribute to improved public health through a number of different social, economic, and biological pathways, including strengthening of social cohesion and social ties; reducing strain on local economies, property values, and social services systems; and removing place-based chronic stressors like environmental disorder (Hohl et al., 2019). Notably, the majority of research concerning the role of blighted property remediation in reducing crime has been focused on firearm violence, drug crime, and property crime. To date, the evidence concerning the impacts of neighborhood intervention on domestic crime is inconclusive (Hohl et al., 2019; Kondo et al., 2018a).

While blighted properties are strongly correlated with socioeconomic conditions as well as neighborhood disorder and collective efficacy, studies examining their relationship with domestic crime are limited. Blighted properties may have an impact on domestic crime, such as child maltreatment risk (Freisthler et al., 2006) and IPV (Browning, 2002), potentially through social cohesion and control. Neighborhoods with fewer boarded up and abandoned buildings have been correlated with lower child maltreatment rates (McDonell and Skosireva, 2009). Studies linking child maltreatment with a diminished social ecology, including a scarcity of neighborhood resources, run-down housing, and parents' own perceptions of their neighborhood being a poor environment for raising children, are not new (Garbarino and Sherman, 1980), but such studies are rare. In this way, the link between blighted properties in a neighborhood and domestic violence, particularly IPV, is inconsistent (Waller et al., 2012) and the studies that have been conducted to date are cross-sectional and unable to disentangle the interdependence between the emergence of the blighted properties and abandonment and the occurrence of domestic violence. It is very possible that an increase in neighborhood domestic violence may have led to a cascade of family disruption, relocation, and eventual property abandonment and blight, the opposite temporal direction of what prior cross-sectional studies have assumed. New research that better measures and accounts for the temporal direction of these associations is needed.

1.3. Alcohol availability as place-based predictor of domestic violence

One of the more commonly studied environmental factors related to domestic violence is alcohol availability. Alcohol consumption is a strong predictor of domestic violence and aggression at the individual level (Graham et al., 2011; McKinney et al., 2010). Substance use, including alcohol, is strongly associated with more physically severe incidents of IPV and is highly predictive of the likelihood that incidents will be reported to law enforcement (Novisky and Peralta, 2015). Emerging research assessing the neighborhood-level drivers of domestic crime has documented associations between neighborhood alcohol outlet density and domestic crime (Cunradi et al., 2014), with much of the existing research focused on IPV. Specifically, higher alcohol outlet density is associated with increased IPV-related police phone calls, IPV-related crime reports, IPV-related emergency department visits, and self-reported IPV perpetration (Cunradi et al., 2012, 2011; Waller et al., 2013). Of note, studies demonstrated distinct effects by type of alcohol outlet: namely, off-premise outlets and bars demonstrated more consistent relationships with domestic crime as compared with other on-premise outlets, such as restaurants and hotels (Cunradi et al., 2012, 2011; Livingston, 2010; McKinney et al., 2009; Roman and Reid, 2012; Waller et al., 2013). The relationship between off-premise alcohol outlet density and domestic crime has been shown to peak during weekends and lessen during weekdays, suggesting that the impact of office-premise alcohol availability may depend on patterns of social engagement and routine activity (Roman and Reid, 2012). Together, these associations are consistent with the hypothesis that alcohol availability contributes to increased alcohol consumption and increased alcohol-related harm (Babor et al., 2010).

Further, there is evidence that supports associations between neighborhood physical disorder, neighborhood income, population size, and alcohol outlet density. Evidence suggests that the relationship between neighborhood physical disorder (e.g., blighted properties, evidence of vandalism) and alcohol availability is complex and likely cyclical, both reflecting consequences of concentrated disadvantage and disinvestment (Milam et al., 2014, 2013). Alcohol outlets are more likely to be concentrated in lower income areas, despite lower alcohol consumption in these areas (Morrison et al., 2015). Research suggests that

higher income areas have increased ability to exclude alcohol outlets through higher land and structure rents and through resistance from residents, compared to lower income areas (Morrison et al., 2015). Meanwhile, population size has a positive association with alcohol outlet density: higher population size is associated with higher alcohol outlet density, likely representing a response to market demands (Jin et al., 2018; Morrison et al., 2015). Notably, bar density is linked to market demands over a larger geographic area compared with restaurants and off-premise outlets, reflecting potential differences in alcohol outlet distribution by outlet type (Morrison et al., 2015). These varying relationships between alcohol outlet density and neighborhood income and population size suggest differences in alcohol availability in relation to the presence of blighted property.

1.4. The present study and theoretical framework

The present study builds upon the extant literature through the use of a quasi-experimental study design with clear before/after temporal measures of dependent and independent variables to answer an understudied question: the association between a place-based blighted property remediation and domestic violence. The primary theoretical framework that guides this analysis is an application of the social ecological model toward the study of domestic violence (Whitaker et al., 2009), which recognizes that while the incidence of domestic violence is shaped by an individual's behavior, it is also influenced by a number of complex, interacting social and environmental factors that can be intervened upon at the macro-level toward the prevention of domestic violence.

The aim of this study was to assess the impact of a blighted property remediation and vacant lot abatement program on the incidence of domestic crime. Given the importance of alcohol availability as a determinant of domestic crime, and the potential for alcohol outlets to be disproportionately located in lower income areas often with greater concentrations of blighted properties (Jin et al., 2018), we also assessed possible interactions between this place-based intervention and alcohol outlet density. Using data from a blighted property abatement initiative of vacant land in New Orleans following Hurricane Katrina, we employed a difference-in-differences analysis to examine the program's impact on domestic crime and a triple-difference analysis to determine if alcohol outlet density modifies the relationship between the intervention and domestic crime.

2. Materials and methods

2.1. Design and setting

This study focuses on a blighted property remediation intervention called New Orleans Chapter 66 Vacant Lot Maintenance Program, or Fight the Blight, the details of which are described elsewhere (Kondo et al., 2018b). In brief, the city of New Orleans launched the program in 2014 to remediate vacant lots across the city, many of which had become blighted as a result of the damage caused by Hurricane Katrina in 2005. Lot remediation consisted of inspection, notice, removal of debris, and mowing of vegetation. All vegetation in these lots was mowed at least once, and in some cases multiple times, with a frequency of no more than every 3 weeks. Mowing occurred with more frequency during summer months. Remediation and routine maintenance were funded by the City on behalf of property owners, with the costs of services recorded on the owner's tax bill. From October 2014 to July 2016, 1614 lots were remediated as part of the Fight the Blight program (Kondo et al., 2018b).

Of the 1614 remediated lots, we selected 204 lots that received removal of debris and mowing of vegetation under the Flight the Blight program between October 2014 and July 2016. We selected only the 204 that had violated the property ordinance for weed and plant overgrowth or for sanitation (most received citation for both) prior to remediation. Of these 204 lots, 64 lots received one treatment (i.e., debris and vegetation removal), and the remaining 140 lots received two or more treatments. These 204 remediated lots were then randomly matched in a 1:3 ratio with 612 control lots that received citations for weed and plant overgrowth or sanitation and were eligible for the Flight the Blight program but did not receive the intervention. Matched control lots were selected from the same neighborhood statistical area as their remediated counterparts but were over 250 feet away (the average length of a city block) to minimize spillover. The matching process is also described in more detail elsewhere (Kondo et al., 2018b). The matched control lots were at most 1581 feet away from each remediated lot and the average distance between a remediated lot and control lot was 476 feet.

The unit of analysis was the lot-month over a 7-year study period (2011–2017), resulting in a total of 68,544 lot-months for analysis.

2.2. Data and measures

2.2.1. Domestic crime

The outcome of interest in the present study was the density of domestic crime 911 calls (calls per square mile) for each lot-month. Domestic crime reflects aggravated assault, aggravated battery, domestic disturbance, simple assault, and simple battery that occurred between intimate partners, family, or household members as identified by the New Orleans Police Department (New Orleans Police Department, 2015). While these data are reviewed and supplied by the police department, they are initially based on preliminary information and may be updated at a later date following additional investigation. We used 911 calls to the New Orleans Police Department for a domestic crime between January 2011 and December 2017 to build a density measure. These data were provided by the New Orleans Police Department and only domestic crime calls that were designated as report-to-follow were included, which indicated that the perceived credibility of the report was high enough for the police officer to file an official report. We disaggregated these domestic crime call data by month for each month in the 7-year period. X–Y coordinate data were available for 99.9% of domestic crime calls over the study period; 78 calls (0.1%) with missing coordinate data were excluded from analysis. We used these point locations from the domestic crime calls in a given month and, through kernel density estimation, fit a smoothed surface of density values over all points in the city. The primary advantage to

Table 1
Socio-demographic characteristics of remediated lots and control lots as part of the Fight the Blight program, New Orleans.

Demographic characteristic	All lots (N = 816)	Remediated lots (n = 204)	Control lots (n = 612)
Total alcohol outlet density (per mi^2)	14.9 (5.5–32.1)	15.3 (6.6–32.0)	14.9 (5.3–33.0)
On-premise bar density (per mi^2)	4.2 (0.0–10.4)	4.9 (0.2–10.6)	3.6 (0.0–10.3)
Off-premise outlet density (per mi^2)	8.9 (4.5–15.1)	8.7 (4.8–14.7)	8.9 (4.4–15.1)
Median household income ($)	23,906 (19,617–28,411)	22,470 (18,633–27,209)	24,166 (19,727–28,942)
Poverty (%)	37.8 (35.0–42.8)	39.0 (36.2–46.6)	37.5 (34.3–41.8)
Unemployed (%)	15.3 (13.0–17.5)	16.4 (13.7–18.9)	14.9 (12.7–17.0)
High school diploma (%)	30.3 (26.7–32.4)	30.5 (27.4–32.3)	30.0 (26.2–32.4)
Vacant neighborhood properties (%)	24.9 (22.3–27.2)	25.5 (23.3–28.3)	24.7 (22.2–26.9)
Population density (per km^2)	3000 (1681–4356)	2806 (1764–4132)	3094 (1620–4427)

Median (IQR).

kernel density estimation is that it allows us to create estimates across a continuous surface so that the density of interest can be calculated from any specific point location (Thornton et al., 2012, 2011). Additionally, it is advantageous to traditional density measures because it assigns more weight based on geographic proximity to the variable of interest (Thornton et al., 2011). A disadvantage of this approach is that it does not account for potential travel barriers such as highways or bodies of water (Thornton et al., 2012). However, because we are estimating localized effects within a neighborhood statistical area, it is unlikely that such barriers would impact remediated lots differently than control lots. We then extracted the density value corresponding to the centroid of each lot to obtain a month-specific estimate of the density of domestic crime for each lot.

2.2.2. Alcohol outlet density

Density of alcohol outlets was calculated using the same method used to calculate the density of domestic crime calls. Point locations of all alcohol beverage outlets with active licenses in New Orleans in 2019 were provided by the New Orleans Bureau of Revenue via the New Orleans Open Data portal (City of New Orleans, 2019a). We used the most recent data available on alcohol beverage outlets because the geographic distribution of these outlets has remained stable since 2014 and the accuracy and completeness of the point location data has improved over time. Using kernel density estimation, we fit these point locations to a smoothed surface of density values. We then extracted the alcohol outlet density value corresponding to the centroid of each lot to obtain the density of alcohol outlets per square mile for the triple-difference term. Given the distinct mechanisms through which different types of alcohol outlets impact domestic crime (Cunradi et al., 2014, 2012; 2011; McKinney et al., 2009; Snowden, 2016; Snowden et al., 2017), we also used this method to create the following sub-measures of alcohol outlet density based on the type of business: 1) on-premise bar density and 2) off-premise alcohol outlet density (which includes liquor stores and convenience stores).

2.2.3. Potential confounders

We selected potential confounders based on their hypothesized relationships with the intervention, alcohol outlet density, and domestic crime. We obtained census tract-level estimates of median household income, percentage of households at the federal poverty level, percentage of people with a high school diploma, percentage of unemployed civilians, and percentage of housing units that were vacant from the 2011–2015 American Community Survey (US Census Bureau, 2015). Theoretical and empirical evidence suggest that these census measures of neighborhood socioeconomic status (i.e., income, education, employment, and vacancies) may have influenced the likelihood that a lot was selected by the city for remediation (Kondo et al., 2018b) and also the incidence of domestic crime in that neighborhood (Beyer et al., 2015; Coulton et al., 2007; Cunradi et al., 2000; Grisso et al., 1999; Li et al., 2010; Nadan et al., 2015). In addition, we obtained block-level estimates of population density (per square kilometer) from the 2010 Census (US Census Bureau, 2010) compiled by the New Orleans Regional Planning Commission (City of New Orleans, 2019b), given its association with alcohol outlet density (Jin et al., 2018; Morrison et al., 2015). Finally, we used kernel density estimation to create a density measure of entertainment venue and retail locations using point data from the New Orleans Open Data portal (City of New Orleans, 2019c), given that the location of these commercial properties are likely associated with the location of alcohol outlets. This measure primarily reflects the disproportionate distribution of live music venues and concert halls in areas of New Orleans that are popular among tourists.

2.3. Statistical analyses

To assess whether the blighted property abatement intervention impacted rates of domestic crime, we conducted a quasi-experimental difference-in-differences analysis (Model 1) using Tobit regression. Tobit models were used to account for zero truncation at the lower bound (Greene, 2003; Grogan-Kaylor and Otis, 2003; Tobin, 1958). Model 1 served as a test for consistency with previously published findings using these data, which demonstrated no significant effect of the intervention on domestic crime (Kondo et al., 2018b). In the present analysis, compared with the prior analysis, we additionally adjusted for population density and entertainment venue density, and employed a longer study period (2011–2017 vs. 2014–2016). Model 1 was specified as in Equation (1).

$$\begin{aligned} Y(\textit{Domestic crime}) = {} & \beta_0 + \beta_1 \cdot \textit{Treat} + \beta_2 \cdot \textit{Post} + \beta_3 \cdot \textit{Treat} \cdot \textit{Post} + \beta_4 \cdot \textit{Income} + \beta_5 \cdot \textit{Poverty rate} + \beta_6 \cdot \textit{Education} \\ & + \beta_7 \cdot \textit{Unemployment rate} + \beta_8 \cdot \textit{Vacancy} + \beta_9 \cdot \textit{Pop density} + \beta_{10} \cdot \textit{Entertainment density} + \varepsilon \end{aligned} \tag{1}$$

To assess whether alcohol outlet density modified the effectiveness of the blighted property abatement intervention, we conducted a quasi-experimental triple-difference analysis, also using Tobit regression models. In these models, the independent variable of interest was the triple-difference term indicating, for each lot-month: 1) whether the lot was a remediated lot or a control lot; 2) whether the month was before or after the intervention date for remediated lots and their matched control lots; and 3) the density of alcohol outlets (per square mile) at the centroid of each lot. The first of these models included the density of all alcohol outlets (Model 2), the second included bars only (Model 3), and the final model including off-premise alcohol outlets only (Model 4). These models were specified as in Equation (2). We did not include both bar density and off-premise alcohol outlet density in the same model due to their collinearity.

$$\begin{aligned} Y(\textit{Domestic crime}) = {} & \beta_0 + \beta_1 \cdot \textit{Treat} + \beta_2 \cdot \textit{Post} + \beta_3 \cdot \textit{Alcohol} + \beta_4 \cdot \textit{Treat} \cdot \textit{Post} + \beta_5 \cdot \textit{Treat} \cdot \textit{Alcohol} + \beta_6 \cdot \textit{Post} \cdot \textit{Alcohol} + \beta_7 \cdot \textit{Post} \cdot \textit{Treat} \cdot \textit{Alcohol} \\ & + \beta_8 \cdot \textit{Income} + \beta_9 \cdot \textit{Poverty rate} + \beta_{10} \cdot \textit{Education} + \beta_{11} \cdot \textit{Unemployment rate} + \beta_{12} \cdot \textit{Vacancy} + \beta_{13} \cdot \textit{Pop density} \\ & + \beta_{14} \cdot \textit{Entertainment density} + \varepsilon \end{aligned} \tag{2}$$

This triple-difference analytic approach is consistent with prior literature in epidemiology and econometrics (Cornelissen and

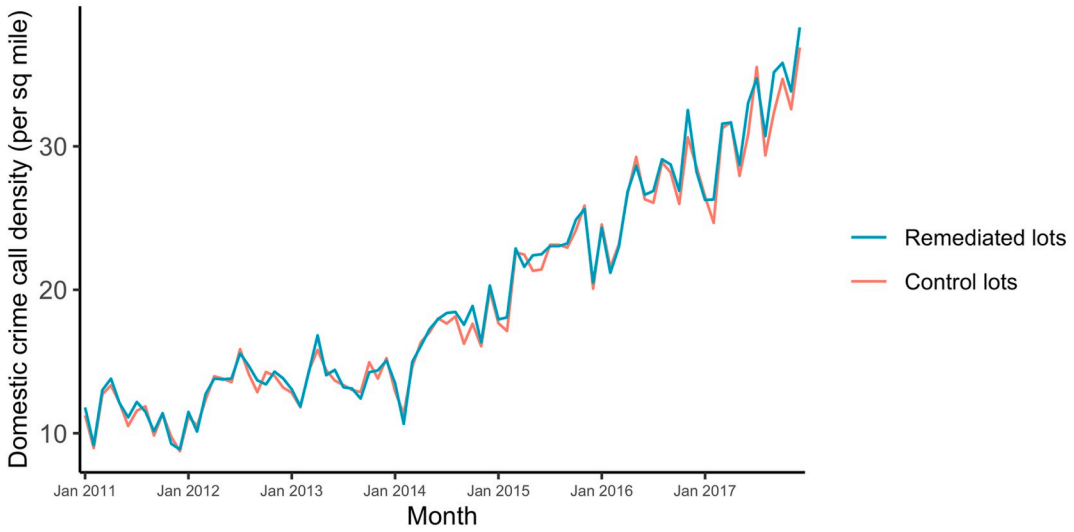

Fig. 1. Average number of domestic crime calls per square mile by month at remediated lots (n = 204) and control lots (n = 612), New Orleans, 2011–2017.

Table 2
Difference-in-difference and triple difference estimates of the impact of the Fight the Blight program on density of domestic crime calls by alcohol outlet density, New Orleans, 2011–2017.

	β for difference-in-difference term	β for triple-difference term	95% CI
Model 1	0.311		(0.016, 0.605)
Model 2: all alcohol outlets		−0.010	(-0.023, 0.002)
Model 3: bars only		−0.119	(-0.147, −0.092)
Model 4: off-premise alcohol outlets only		0.006	(-0.038, 0.051)

Sonderhof, 2009; Jaccard and Turrisi, 2003).

All regression models included all potential confounders described above. We performed all data management and analysis using R (version 3.6) and ArcMap (version 10.6).

3. Results

Table 1 displays the socio-demographic characteristics associated with remediated and control lots included in the analysis. Overall, domestic crime density increased in these 816 lots over the study period. Fig. 1 displays the average domestic crime density for remediated and control lots over the study period by month. Of note, in 2014, the New Orleans Police Department instituted a new domestic violence program in response to high rates of domestic incidents, which involved increasing the priority of domestic crime calls to decrease response time and implementing a more in-depth investigatory checklist (City of New Orleans, 2014). Thus, while crime generally increased over the study period (Kondo et al., 2018b), some portion of the pronounced increase in domestic crime from 2014 to 2017 is likely due to change in policing protocol and improved identification of domestic incidents. This is not expected to impact remediated vs. control lots differentially. Table 2 displays the findings from Model 1 testing the effect of the intervention on domestic crime. The intervention was associated with a modest increase of 0.311 domestic crime calls per square mile (β = 0.311, 95% CI: 0.016, 0.605, p = 0.039).

The triple-difference analysis that included all alcohol outlets (Model 2) showed no significant effect measure modification by alcohol outlet density (β = −0.010, 95% CI: −0.023, 0.002, p = 0.100) (Table 2). Similarly, off-premise alcohol outlet density (Model 4) did not modify the association between the intervention and domestic crime (Table 2). However, the triple-difference term for greater on-premise bar density

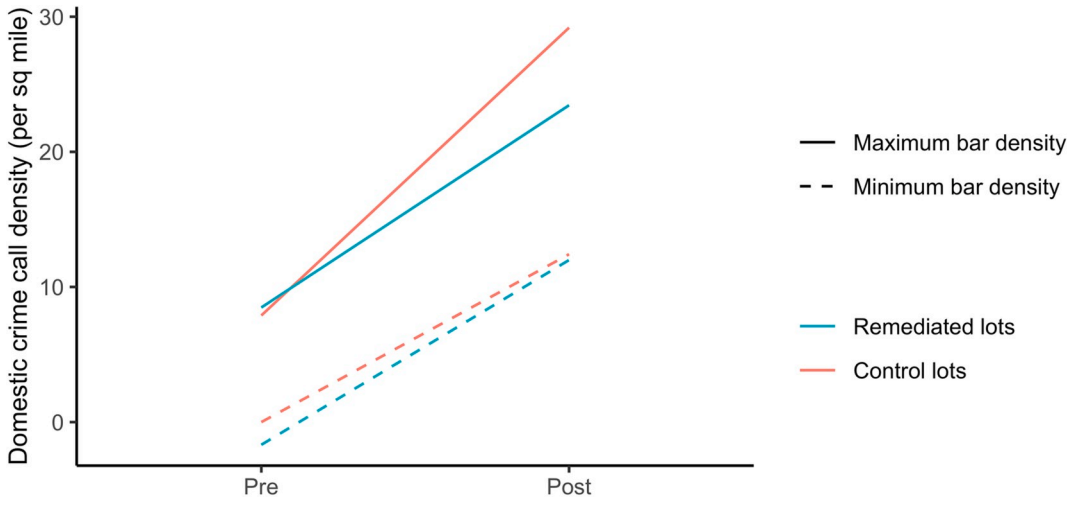

Fig. 2. Linear combinations of coefficients from Model 3 (bars only) using minimum vs. maximum bar density (0 vs. 63.5 bars/square mile).

(Model 3) was negatively associated with the outcome ($\beta = -0.119$, 95% CI: −0.147, −0.092, $p < 0.001$). This estimate suggests that in areas with higher bar density, the increases in domestic crime density over time were lower in remediated lots compared with control lots. Specifically, when the bar density in a location is one unit (bars/square mile) larger, the association between the blighted property remediation intervention and domestic crime density decreases by 0.119 calls/square mile. While the magnitude of this change is modest, it demonstrates a trend that is counter to the dramatic increases in domestic crime calls observed over the study period. Fig. 2 presents a graphical display of this finding, showing the linear combinations of coefficients from Model 3 for minimum vs. maximum bar density (0 vs. 63.5 bars/square mile).

4. Conclusions

We assessed the impact of a blighted property remediation and vacant lot abatement program on the incidence of domestic crime and explored the moderating role of the neighborhood alcohol environment. While we observed a modest positive association between the program and domestic crime density, this aggregate impact may not reflect important differences by the level of alcohol outlets in an area. Findings demonstrate that bar density is a neighborhood-level factor that may modify the effectiveness of blighted property remediation on reduction of domestic crime. Specifically, we found evidence that the Flight the Blight program may have reduced domestic crime in neighborhoods with higher bar density. These results support the hypothesis that there are neighborhood-level characteristics by which the effectiveness of neighborhood intervention in reducing domestic crime varies and highlights the need to consider additional neighborhood contexts in specific place-based interventions such as blighted property remediation. These findings may also provide insight into the inconsistency of the extant literature concerning the impact of blighted property remediation interventions on domestic crime.

Plausible mechanisms that may explain the observed associations are rooted in social ecological theory, social disorganization theory, and assortative drinking theory (Gruenewald, 2007; Pinchevsky and Wright, 2012; Voith, 2019). In neighborhoods with higher bar density, it is possible that a greater proportion of domestic crime occurs outside the home. Empirical evidence demonstrates that assault incidents, including calls for domestic violence, cluster around premises licensed to serve alcohol (Burgess and Moffatt, 2011; Roman et al., 2009). Additionally, there is an emerging research literature concerning the impact of drinking context (whether alcohol is consumed in bars, parties, or private homes) on the nature of domestic violence incidents (Cunradi et al., 2014; Mair et al., 2013). This pattern of domestic crime occurring outside the home in areas with higher bar density also aligns with the reported experiences of the New Orleans police officials with whom we have spoken. As a result, environmental factors may have a stronger impact on this type of outside-the-home domestic crime and thus, a neighborhood-based intervention may prove more effective in reducing domestic crime in these areas. However, increased domestic crime reports may in fact represent an increase in reporting rather than an increase in underlying crime. Therefore it is also plausible that in areas with lower bar density, removal of blighted property led to increased call volume for domestic events, potentially through increased social control in these areas and potential intervening or awareness on their behalf of neighbors or through increased presence of police (Browning, 2002).

To our knowledge, the present analysis is the first to test for neighborhood-level modifiers of blighted property intervention effectiveness. As a result, more research is needed to corroborate these findings and assess if this relationship is present in other contexts. Given that only bar density was a significant modifier of the effectiveness of the intervention while densities of all alcohol outlets and off-premise outlets were not, the observed finding may be reflective of some neighborhood characteristic other than alcohol availability that we are not capturing, such as an indication of busy streets (Aiyer et al., 2014). To address this and further isolate the role of alcohol outlet density, we adjusted for population density and density of entertainment venues and retail locations. The inclusion of these variables did not lead to appreciable changes in our findings. Additionally, New Orleans has some of the least restrictive liquor laws in the country (Lombard, 2020). Beer, wine, and liquor can be sold in grocery stores, convenience stores, and some pharmacies, including on Sundays. While bars close at 2 a.m. statewide, in New Orleans they can stay open 24 h. Further, in New Orleans, it is legal to carry open street containers and purchase alcohol from drive-thru bars.

The present study has several strengths including its novel focus on neighborhood-level modifiers, the quasi-experimental approach, and the use of kernel density estimation to obtain lot-specific estimates of domestic crime density and alcohol outlet density. Additionally, the triple-difference approach is robust to stable differences between treatment and control lots and differences between the pre and post time periods. However, there are important limitations that should be considered when interpreting the study findings. First, while remediated and control lots were similar in their receipt of property ordinance citations, their eligibility for the intervention, and the neighborhood in which they were located, lots were not randomly allocated to the treatment or control conditions. Rather, the City of New Orleans selected lots to remediate based on inspection and it is likely that lots with more visible signs of neglect and overgrowth were flagged for intervention first. Thus, it is possible that remediated lots were in worse condition than control lots at baseline. However, the difference-in-difference approach that we employed is robust to baseline differences between intervention and control groups (Wing et al., 2018). Second, additional blighted property remediation projects beyond the Fight the Blight program were taking place in New Orleans during the study period and thus control lots may have received some form of blighted property remediation. We aimed to minimize contamination by selecting only lots that were part of the Fight the Blight program and selecting a strict temporal period following the intervention ending in 2017, but the risk of contamination may explain the unexpected finding that the intervention was associated with an increase in domestic crime. Third, we have interpreted domestic crime 911 calls as reflective of underlying domestic crime. However, it is possible that increases in domestic crime 911 calls reflect increases in the reporting of domestic crime (either multiple calls for the same incidents or increased calls for new incidents), rather than an increase in underlying crime. Fourth, there was some heterogeneity in the treatment that each treated lot received, with some lots receiving more comprehensive treatments than others. This may have compromised the fidelity of the intervention being tested. Fifth, validation of the remediation of treatment lots, for example through historical images from Google Street View, could not be conducted for all lots. Finally, it is possible that any changes in domestic crime were the result of geographic shifting of crime rather than changes in absolute crime, which would not be captured in this analysis. These limitations are discussed further elsewhere (Kondo et al., 2018b).

Historical research concerning the drivers of domestic violence has predominantly focused on individual-level factors; however, an emerging body of evidence has identified important ecological and environmental factors that drive domestic violence (Beyer et al., 2015; Voith, 2019). Despite this recent shift toward a more comprehensive ecological approach to the prevention of domestic violence, there has been a pronounced lack of successful neighborhood-level interventions (Voith, 2019). The need for scalable preventive interventions is particularly evidenced as domestic violence rates in the US remain generally unchanged and in some cases are increasing (Fridel and Fox, 2019). The present findings provide evidence that neighborhood-level characteristics, particularly on-premise bar density, modify the effectiveness of neighborhood-level interventions on domestic crime reduction. This nuanced understanding of how the characteristics of a neighborhood may shape the effect of neighborhood-level interventions on domestic

crime reduction can inform the development of targeted interventions that are responsive to the dynamics of different neighborhoods, with the aim of increased success in neighborhood-level prevention of domestic crime.

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Declaration of competing interest

None.

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