ORIGINAL ARTICLE

Findings from a natural experiment on the impact of covid-19 residential quarantines on domestic violence patterns in New Orleans

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Abstract

Purpose Following the rise of the novel coronavirus, de facto residential quarantines resulted either from executive stay-at-home orders, unemployment or through remote work requirements. One question that has arisen is whether the COVID-19 quarantines led to increases in domestic violence (DV), with research findings thus far being mixed. To further this understanding, this study examined whether the frequency and geographic dispersion of DV increased during stay-at-home and phased reopening periods of the pandemic in New Orleans, Louisiana while accounting for socio-economic determinants.
Methods The study built on a natural experiment of home quarantine and examined its effects on DV using a mixed-methods approach of quantitative and geospatial analyses. Data for the analyses came from a sample of 11,502 police reported DV incidents and ArcGIS portal data of sociodemographic information across neighborhood statistical areas (NSAs).
Results While results revealed no significant increase of DV during early phases of the quarantine, a significant increase in frequency was observed in the second reopening phase compared to the same time-period in the previous year. However, the dispersion of DV incidents appeared stable with continued concentrations in pre-existing geographic 'hot spots.' Conversely, households which were greater in size exhibited significantly fewer DV incidents.
Conclusion Findings suggest that prevention programs might target residences already inflicted with domestic violence histories in advance of future pandemic or natural disaster related residential quarantines. Findings also reveal that situational factors, such as number of household residents, might be used to triage the delivery of services.

Key words Domestic violence · Crime patterns · COVID-19 · Pandemic and crime · Family violence

Introduction

Following the unprecedented rise of the novel coronavirus spread across the U.S., most state governors issued executive orders establishing a variety of protective measures ranging from social distancing to home quarantine. In addition, many Americans lost their employment due to business closures or were required to work from home indefinitely. School systems nationwide also converted to online learning which necessitated that students (and often parents

as guardians) stay at home to perform their schoolwork. According to anecdotal reports, the economic insecurity and social isolation caused by the widespread stay-at-home requirements had contributed to an apparent increase in domestic violence (DV) complaints in the U.S. and across the world (Van Gelder et al., 2020; Peterman et al., 2020; Campbell, 2020). Yet, the growing body of empirical research in this area has reported mixed results in terms of changes in domestic violence rates after the onset of COVID-19 pandemic (see Ashby, 2020; Campedelli et al., 2020; Piquero et al., 2020; Shayegh & Malpede, 2020; Piquero et al., 2021a).

The disparity of findings from emergent research suggests that the relationship between pandemic-induced changes to behavioral activities and domestic violence may be much more complicated than originally thought. While several studies hypothesized that DV incidents would be found to increase, some did not find any significant change (Ashby, 2020; Campedelli et al., 2020; Shayegh & Malpede, 2020),

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and others discovered that increases occurred only for certain periods of time surrounding the shutdown (Leslie & Wilson, 2020; Piquero et al., 2020; Silverio-Murillo et al., 2020; Jetelina et al., 2021). Even so, the first systematic review and meta-analysis of 18 studies conducted in different U.S. cities/states and in several countries around the world has found strong evidence for an increase in official DV reports following the stay-at-home and lockdown orders (Piquero et al., 2021a). As most studies in this area have focused on determining overall trends, we continue to know very little about the nuances of how the pandemic has altered DV occurrences and their reporting across communities.

Some have, however, begun to unpack these impacts and their findings add further evidence of the complexity of criminal behavior resulting from the pandemic. For instance, Ivandic et al. (2020) found that increases in DV incidents occurred for current partner relationships while decreases were observed for ex-partner relationships and that the rise in incidents was driven by an increase in third party reporting. Further, Leslie & Wilson (2020) discovered that their observed increases in DV incidents was not related to any specific demographic group but was driven by households without any prior DV history. Beyond this, little else is known.

Despite the unique features of the ongoing COVID-19 crisis, its nature and consequences may be similar to those of other natural catastrophes (Kaukinen, 2020). Existing research on interpersonal violence in the aftermath of disasters has identified several common risk factors for domestic violence. Increased exposure to an abusive partner due to inevitable change of family lifestyle combined with financial stressors caused by unemployment or reduced income put vulnerable women and children at higher risk of physical and psychological abuse (Frailing & Harper, 2017). Additionally, in the context of the COVID-19, the isolation caused by social distancing limits the opportunity to seek medical attention or legal help due to the victim's fear of retaliation. Further, potential budget shortages or human resource limitations within the law enforcement or domestic violence victim support agencies may exacerbate the problem (Usher et al., 2020). Therefore, preparedness to cope with the consequences of a public health crisis such as the COVID-19 pandemic requires an in-depth understanding of the dynamics of the problem and planning for interdisciplinary partnerships to effectively respond to those consequences.

This study furthers understanding of the impact of COVID-19 on the nature of domestic violence and contributes to the literature in three primary ways. First, the study centrally examines the impact of residential quarantine on the spatial distribution of domestic violence occurrences, in addition to deciphering changes in the volume of DV incidents surrounding residential quarantines. This makes it the first known study to examine the implications of the pandemic on geographic domestic violence crime patterns. Second, the study more broadly examines the contours of DV during the quarantine to include demographic and other circumstantial variables. This serves to better illuminate the various ways in which the pandemic may have disproportionately impacted communities. It also serves to inform theoretical frameworks used to understand the relationship between pandemic behavior and corresponding crime patterns. Third, the study examines data from a southern, predominantly minority U.S. city. Most analyses of the impact of COVID-19 on domestic violence have assessed patterns in prominent urban cities located in the north and western parts of the country.

Literature review

Domestic violence refers to an act or threat of inflicting physical, psychological, or emotional harm on a family member, current or past dating partners, or other household members (Brewster, 2002). There is an extensive body of research suggesting that domestic violence cannot be explained by a single factor. Rather, its likelihood is a function of the interplay of a variety of factors within an ecological framework (Heise, 1998, 2011). This multi-layer conceptual framework considers personal characteristics, interpersonal and family factors, neighborhood and community environment, and macro-social variables. Much of the literature on risk factors of domestic violence has focused on individual factors, relationship dynamics, and household characteristics (Stith et al., 2004; Xu et al., 2005; Abramsky et al., 2011; WHO, 2012; Gerino et al., 2018) while neighborhood- and community-level factors have received much less attention in prior research (Beyer et al., 2015; Voith, 2019). The growing body of literature examining environmental determinants of domestic violence indicates that unemployment (O'Campo et al., 1995), neighborhood disadvantage (Benson et al., 2003; McKinney et al., 2009), and neighborhood crime and disorder (Obasaju et al., 2009; Reed et al., 2009) can be risk factors of domestic violence regardless of individual characteristics of victims and perpetrators. Despite growing interest in studying these contextual risk factors, literature examining the geographic distribution of domestic violence and their situational and environmental determinants is relatively scarce.

Environmental criminology is an umbrella term used for criminological perspectives which focus on the role of place and situational characteristics in facilitating crime opportunities. Empirical research consistently reveals that crime is not randomly distributed, and some places experience disproportionately higher rates of crime (Brantingham & Brantingham, 1984; Sherman, 1995; Eck et al., 2005). Thus, environmental criminologists examine crime patterns

across urban space as well as the spatio-temporal dynamics of criminal incidents to understand why some areas create suitable venues for crime, and to find effective preventive solutions (Wortley & Mazerolle, 2013; Leclerc et al., 2016).

Routine Activities Theory (RAT) (Cohen & Felson, 1979) is a key environmental approach which could be useful for understanding potential geographic and frequency changes of domestic violence as a result of residential quarantines. Generally, this is because it provides a framework for understanding why crime might be more likely to occur across temporal and geographic settings. A fundamental thesis of routine activities theory is that macro-level forces can increase (or decrease) the convergence of suitable targets with motivated offenders in the absence of capable guardianship which also serves to increase the opportunity for crime events. Where potential offenders and suitable targets are separated (i.e. the absence of convergence) fewer crime events are likely to occur. Residential quarantines effectively alter the lifestyle routines of the community at large. In this, individuals are restricted to their homes where there is greater contact and interaction between members of the household.

A reasonable hypothesis from this view could be that with greater convergence of individuals in residential areas due to COVID-19 quarantines, the likelihood of domestic violence incidents might also increase. In the aftermath of a disaster, vulnerable people might become suitable targets for their abusive partners who may be experiencing psychological and financial stressors. Diminished capacity of first responders and community bystanders could also serve to lessen capable guardianship (Zahran et al., 2009; Frailing & Harper, 2017). Yet, this opportunity for DV is also mediated by the presence or absence of capable guardianship. It is equally plausible that increased numbers of residential occupants during quarantines could also serve to increase capable guardianship thereby *reducing* opportunities for DV offending.

Given the possibility of altered opportunities for domestic violence during the COVID-19 pandemic, it is important to examine the impact of home quarantines on geographic patterns of domestic violence and socio-economic characteristics of the environment which might affect its likelihood. To date, several empirical studies which conducted short-term time-series analyses of DV patterns in relation to pandemic-induced lifestyle changes have provided mixed findings. Piquero et al. (2021b) used an intervention time-series methodology to track changes in DV incident counts in Dallas, TX and found a short-term increase in the first two weeks after lockdown and a decline thereafter. Similarly, Leslie & Wilson (2020) and Silverio-Murillo et al. (2020) studied variations in 14 U.S. cities and Mexico City, Mexico, respectively, and found evidence for a short-term increase in incidents and a subsequent return to pre-COVID rates. Some other studies, however,

observed no significant changes in DV incidents after stay-at-home policies were implemented (Ashby, 2020; Campedelli et al., 2020; Shayegh & Malpede, 2020) while others reported a sharp decline (Halford et al., 2020) or a consistent increase (Ravindran & Shah, 2020). Conversely, a more recent study with a larger post-lockdown window did find some increase in DV but the overall trend was relatively stable (Piquero et al., 2021b).

While most studies have focused on detecting changes in time-series trends of DV prior to and after stay-at-home requirements were put into place (Piquero et al., 2021a; Ashby 2020; Campedelli et al., 2020; Shayegh and Malpede, 2020; Silverio-Murillo et al., 2020), some have in addition begun to decipher how these patterns have varied across socio-economic and demographic groups with findings here also mixed (Ivandic et al., 2020; Jetelina et al., 2021; Leslie and Wilson, 2020). For instance, while Leslie and Wilson (2020) reported that DV victimization did not vary across demographic groups during the COVID-19 study period within the major U.S. cities they examined, Ivandic et al. (2020) did find differences in the UK reporting that most of the DV increase occurred within the most economically deprived households. Additionally, Jetelina et al. (2021) found that reports of DV were significantly higher within households with a job/income change due to the pandemic.

Considering the nascent understanding of how the COVID-19 quarantine has impacted DV, the need to unpack the factors related to DV trends remains. Indeed, literature on the factors influencing DV have been well documented in the literature (see Kaukinen, 2020). Moreover, many community and situational level attributes have been studied in relation to violent crime generally, providing insights to improve neighborhood conditions and ultimately prevent crime (He et al., 2017; Leclerc et al., 2016; Wortley & Smallbone, 2006; Leclerc et al., 2011). Of particular importance is a study conducted by Moise and Piquero (2021) in Miami Dade County which utilized two cluster detection techniques to identify clusters of violent crime arrests during the 2020 COVID-19 lockdown in comparison with an equivalent period in 2018 and 2019. The results revealed no significant violent crime clusters in 2020, while core clusters were detected in the two prior years.

Beyond this, a clear gap exists in the previous literature which has yet to fully examine these community-level or environmental attributes and their relationship with geographic concentrations of domestic violence in the aftermath of the COVID-19 pandemic.

The Current Study

The purpose of this study was twofold. First, we sought to examine for any changes in both the volume and geographic dispersion of domestic violence patterns following

the COVID-19 pandemic residential quarantines. Second, we investigated the impact of a series of socio-economic variables on variations in domestic violence patterns. The study relied on data from the city of New Orleans, Louisiana. Considering the mechanisms discussed within Routine Activities Theory, this study examined variations in domestic violence patterns following the widespread lockdown in New Orleans and the determinants of these variations. Three research questions were addressed: (1) Has domestic violence increased in different phases of the COVID-19 pandemic? (2) Did the hot spots of DV change during stay-at-home and phased reopening periods? (3) Did existing socio-economic determinants/risk factors of domestic violence change over the study period?

Research Methods

This study adopted a multi-method approach using quantitative and geospatial analysis techniques to examine the effect of stay-at-home order and the subsequent phased reopening periods on domestic violence patterns in New Orleans, LA. As of April 2020, the city had a population of 383997 (US Census Bureau, 2020). The New Orleans Police Department (NOPD) is responsible for public safety in the city of New Orleans. NOPD oversees eight police districts in the entire Orleans Parish with over 1200 officers and civilians and routinely collects incident data of all crimes reported.

In response to the rise of COVID-19 cases in New Orleans, the city mayor issued a stay-at-home order on March 15, 2020, which lasted for two months. On May 15, the city lifted some of its restrictions and entered the first phase of reopening which lasted for 28 days. On June 13, the second phase of reopening started and based on the city's regulations, the study period was divided into four phases: pre-pandemic (January 1 – March 15), stay-at-home (March 16 – May 15), phase one reopening (May 16 – June 12), and phase two reopening (June 13 – September

29). September 29 marks the end of the second phase of reopening in New Orleans. However, the state governor issued a proclamation on November 25 that established more restrictions and Louisiana started to operate under a modified version of phase two which lasted until December 30.

Data

The data for the dependent variable (domestic violence) came from the NOPD calls for service database which is available at the City of New Orleans Open Data Portal (NOLA Data, 2020). All DV incidents reported between January 1, 2020 – September 29, 2020 were included in the analyses. For comparison purposes, the data of the same time period in the prior year, 2019, were analyzed as well (NOLA Data, 2019). The data included five types of domestic violence cases including, domestic disturbances, simple battery, simple assault, aggravated battery, and aggravated assault. According to the NOPD's Operation Manual, domestic violence is defined as "battering, a crime of violence, or property damage between individuals with a domestic relationship" (NOPD, 2021, p 3). Domestic relationship refers to any relationship, including same sex relationships, between current and former spouses, parents and adult/minor children, stepparents and adult/minor stepchildren, foster parents and adult/minor foster children, or current or former dating partners, living together or not (NOPD, 2021).

Table 1 provides descriptive statistics for total domestic violence and its individual categories during the study period as well as the definition of each type of domestic violence.

The 2020 calls for service data were available as a shapefile carrying spatial components (longitude and latitude of where the incidents occurred) which allowed for a series of geospatial analyses to visualize and explain the variations

Table 1 Frequency and Definitions of Domestic Violence Types

Types	Definition	Jan-Sep, 2019	Jan-Sep, 2020
Domestic disturbances	Calls for service involving individuals with a domestic relationship that do not involve a crime.	7981	8607
Simple battery domestic	Intentional use of force or violence committed by one household member upon another.	3304	2896
Simple assault domestic	Assault without a dangerous weapon committed by one household member upon another.	136	112
Aggravated battery domestic	Intentional use of force or violence causing serious injuries committed by one household member upon another.	90	121
Aggravated assault domestic	Assault with a dangerous weapon committed by one household member upon another.	199	229
Total		11710	11965

in domestic violence patterns before and after the pandemic began. Using ArcGIS 10.8.1, domestic violence point features were located on the city map, and spatial join feature was used to add the neighborhood statistical areas (NSA) polygons to the data. Of 11965 total incidents, 463 were dropped because of missing information (zip code and police district), and thus GIS was not able to locate them on the map. The 11502 remaining incidents were then classified into four categories based on the incident report dates. As the 2019 calls for service shapefile were not available, we were not able to analyze 2019 data geospatially.

Table 2 lists the dataset attributes and their descriptions which were used for the purpose of geospatial analyses.

Additionally, several independent variables were collected from ArcGIS online portal to account for the impact of socio-economic factors on domestic violence patterns. These variables were included in the analyses because socio-economically disadvantaged populations such as those living in adverse environmental conditions are likely to experience more drastic changes in their routine activities during a widespread pandemic, and thus be affected by domestic violence more seriously (Kaukinen, 2020). These variables and their descriptions are listed below.

Diversity Index This is a composite index that measures the likelihood that two individuals chosen randomly from the same area, belong to different race or ethnic groups (Esri, 2020). This index ranges from 0 - 100 with 0 meaning no diversity and 100 being complete diversity).

Average Household Size This variable refers to the average number of people per household by NSA. It is calculated by dividing the household population by the total number of households.

Minority Population This variable represents the number of people who belong to a racial or ethnic minority group within each NSA. ArcGIS online data has adopted the definition of the U.S. Census Bureau for minority groups. Thus, the minority groups included in the data are composed of

Black, American Indian, Asian, Pacific Islander, Other, Two or More races, and Hispanics (Esri, n.d).

Education (Population 25+ with a BA) This variable shows the number of people aged 25 or older within each NSA who hold a Bachelor's degree.

Per Capita Income This variable represents income per person by NSA and is calculated by dividing the sum of all incomes by total population.

Total Crime Index This index reports the total crime level of a given area compared with the national average. The index value for the United States is 100, therefore, a value of 130 implies 30% higher than the national average and an index of 70 means 30% lower than the US average.

Analytical Approach

Multiple methods were used to analyze the impact of the stay-at-home order on domestic violence patterns in the City of New Orleans.

Quantitative Analysis

To address the first research question, a series of quantitative analyses were conducted. First, a descriptive analysis was conducted to compare the risk of domestic violence in the four study periods (39 weeks = 273 days) in 2019 and 2020. Second, a one-way analysis of variance (ANOVA) was conducted to understand if there was a significant difference between group means of the four study periods. Third, a series of independent-samples t-tests were used to determine if there was a significant difference between the means of each study period in 2020 with the same period in 2019.

Geospatial Analysis

To answer the second research question, geospatial techniques were used to visualize the distribution of domestic violence incidents across the city NSAs. This allowed for the identification of statistically significant hot spots of domestic violence using Optimized hot spot analysis. Additionally, Gini coefficient (measure of dispersion) was computed to understand if the hot spots of domestic violence incidents have varied given the changes in people's routine activities.

OLS Regression Analysis

Finally, to address the third research question, OLS regression analysis was used to examine the effect of several socio-economic factors on domestic violence patterns in the four study periods. As the dependent variable (DV count) was

Table 2 Domestic Violence Geospatial Data

Column Name	Description
NOPD Item	Item Number
Date	Incident Date and Time
Block Address	Partially Concealed Addresses
Police District	Police District Codes
X	Longitude
Y	Latitude
NSA	Neighborhood Statistical Areas

a continuous level variable, OLS regression allowed us to investigate the relationship between the study variables and determine if the significance of socio-economic risk factors of domestic violence have changed over the study period.

Results

Quantitative Analyses Results

Tables 3 and 4 report DV incident counts in each study period as well as percent change in DV per day in 2019 and 2020, respectively. To account for any seasonal differences, percent change in DV in each period compared to the first study period was computed for the previous year (2019). Although the total number of domestic violence in 2020 is higher than that of 2019, looking at variations in incident counts for the entire study period reveals several interesting findings. Given the unequal number of days in the periods, the number of incidents per day were calculated for each. Then, percent change in daily incidents in each period compared to period one (pre-pandemic) was computed. As indicated in Table 4, the number of incidents in 2020 increased from 40 per day in period one to 43 per day in periods two and three, and 46 per day in period four. In other words, domestic violence increased after the stay-at-home order went into effect and this increase continued into the subsequent phased reopening periods. As reported in Table 3, incident counts per day in the second and third period of 2019 had increased at a higher rate than 2020. However, the increase in the number of incidents in the fourth study period in 2019 was notably lower than the same period in 2020.

Figure 1 provides a weekly comparison of DV incidents in 2019 and 2020. As indicated by the linear trendlines, there was a mild upward trend in DV incidents from January to September of 2019, however, this increase has accelerated in 2020.

The ANOVA results helped to provide additional insight into the variations observed in domestic violence in the four study periods in 2020. The null hypothesis was that there is no difference between means of domestic violence in the four study periods in 2020. The independent variable (time) included four groups: pre-pandemic (M = 40.24, SD = 7.79, n = 75), stay at home (M = 43.23, SD = 8.28, n= 61), phase one reopening (M = 43.39, SD = 6.82, n = 28), and phase two reopening (M = 46.74, SD = 8.13, n= 109). The ANOVA was significant, $F(3,269) = 10.12$, $p = .00$, $\eta2 = .10$. Thus, there is significant evidence to reject the null hypothesis and conclude there is a significant difference in domestic violence in the study periods. The eta squared effect size ($\eta2 = .10$) represents the proportion of the total sample variance in domestic violence that is associated with independent variable (time) suggesting that the difference in the mean scores between groups is quite large. Post hoc comparisons to evaluate pairwise differences among group means were conducted using a Bonferroni test since equal variances were tenable. The Bonferroni test revealed that domestic violence in time 4 (phase two reopening) was significantly higher than in time 1 (pre-pandemic period) and time 2 (stay at home period). However, time 3 (phase one reopening) did not significantly differ from other three periods. Also, the mean scores of domestic violence in time 1 and time 2 were not significantly different.

Independent-samples t-tests were conducted to understand if domestic violence patterns in 2020 were significantly different from the prior year (2019). Each study period in 2020 was compared with the same period in 2019.

Table 3 Risk of Domestic Violence in the Four Study Periods in New Orleans, LA (2019)

	Time 1 (Jan 1-Mar 15)	Time 2 (Mar 16-May15)	Time 3 (May 16-Jun 12)	Time 4 (Jun 13-Sep 29)
Days in period	75	61	28	109
Total DV in period	3042	2748	1324	4596
DV per day	40.56	45.04	47.29	42.17
Percent change in incident per day from Period 1	0	+ 11.04	+ 16.56	+ 3.94

Table 4 Risk of Domestic Violence in the Four Study Periods in New Orleans, LA (2020)

	Before Pandemic (Jan 1-Mar 15)	Stay at Home (Mar 16-May15)	Reopen 1 (May 16-Jun 12)	Reopen 2 (Jun 13-Sep 29)
Days in period	75	61	28	109
Total DV in period	3018	2637	1215	5095
DV per day	40.24	43.23	43.39	46.74
Percent change in incident per day from Period 1	0	+ 7.43	+ 7.82	+ 16.15
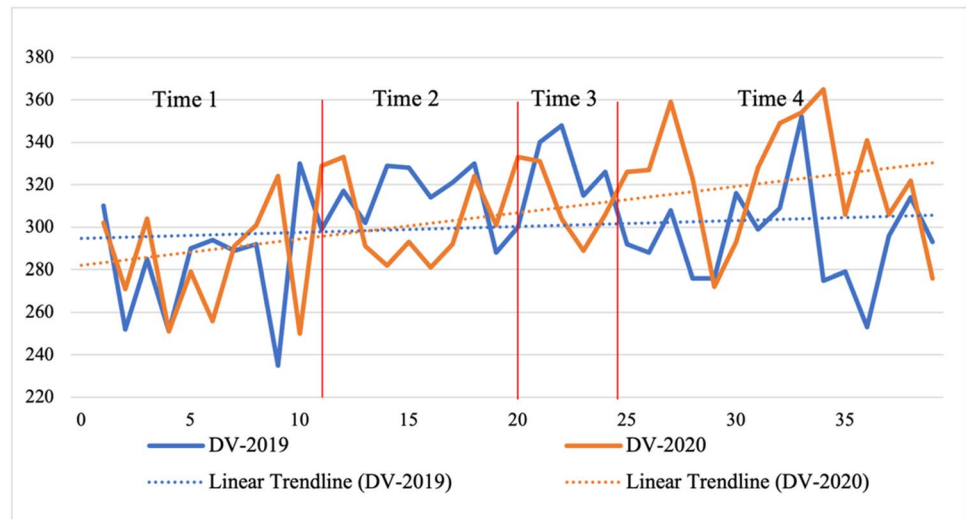
In time 1 (before pandemic), there was not a statistically significant difference in domestic violence between 2020 ($M = 40.24$, $SD = 7.79$, n = 75) and 2019 ($M = 40.56$, $SD = 7.97$, n = 75), t (148) = .25, $p = .08$. Similarly, in time 2 (stay at home period), a statistically significant difference was not detected between domestic violence in 2020 ($M = 43.23$, $SD = 8.28$, n = 61) and 2019 ($M = 40.05$, $SD = 7.42$, n = 61), t (119) = 1.28, $p = .20$. Likewise, in time 3 (phase one reopening), there was not a statistically significant difference in domestic violence between 2020 ($M = 43.39$, $SD = 6.82$, n = 28) and 2019 ($M = 47.29$, $SD = 8.16$, n = 28), t (52) = 1.94, $p = .06$. In time 4 (phase two reopening), however, 2020 domestic violence incidents ($M = 46.74$, $SD = 8.13$, n = 109) are significantly higher than 2019 incidents ($M = 42.17$, $SD = 8.11$, n = 109), t (216) = -4.15, $p = .00$. The t-tests results suggest that the observed differences in incident reports of 2019 and 2020 were not statistically significant during the lockdown and phase one reopening period while the subsequent increase in domestic violence after lifting more restrictions in phase two reopening was significantly higher than the same time period in 2019.

Geospatial Analyses Results

Using optimized hot spot analysis in ArcGIS, significant spatial clusters of domestic violence were identified and displayed across the city of New Orleans. The neighborhood statistical areas (NSA) polygons were used as the reference data to locate point features (incidents) across the city's 72 NSAs. The null hypothesis for point pattern analysis is Complete Spatial Randomness (CSR). The hotspot analysis calculates p-value (probability) and z-score (standard deviation) for each cell (hexagon) which will determine whether the null hypothesis can be rejected. A very small p-value associated with a very low (< -.25) or very high z-score (>

2.5) indicates that the spatial clustering was not created by random chance (ArcGIS Pro, n.d.).

Figure 2 consists of four maps that indicate clusters of statistically significant hotspots of domestic violence in the four study periods in 2020. Statistically significant clusters represent areas where a point feature with a high value is surrounded by high value nearby features (Kalinic and Krisp, 2018). The red hexagons represent intense clustering with 99% confidence, yellow represents clustering with 95% confidence, pink indicates 90%, and white means no significant clustering.

The spatial analysis allowed for additional quantitative analyses to understand if new hot spots of domestic violence have emerged given the changes that had occurred in people's routine activities during lockdown and reopening periods. Using the attribute tables produced for each study period, the number of incidents reported within each NSA were taken to calculate Gini coefficients (measure of dispersion). As reported in Table 5, the measure of dispersion does not change over time. This suggests that although the number of incidents had initially increased during lockdown, though not significantly, and then increased significantly during phase two reopening period, these variations stayed within the original hot spots and did not disperse to new locations.

OLS Regression Results

Table 6 reports the descriptive statistics for the variables used in the OLS regression analysis. The dependent variables are domestic violence counts by NSA in the four study periods in 2020. And, the independent variables are diversity index, household size, minority population, education, per capita income, and total crime index by NSA in 2020. Given the unequal number of days in the study periods,
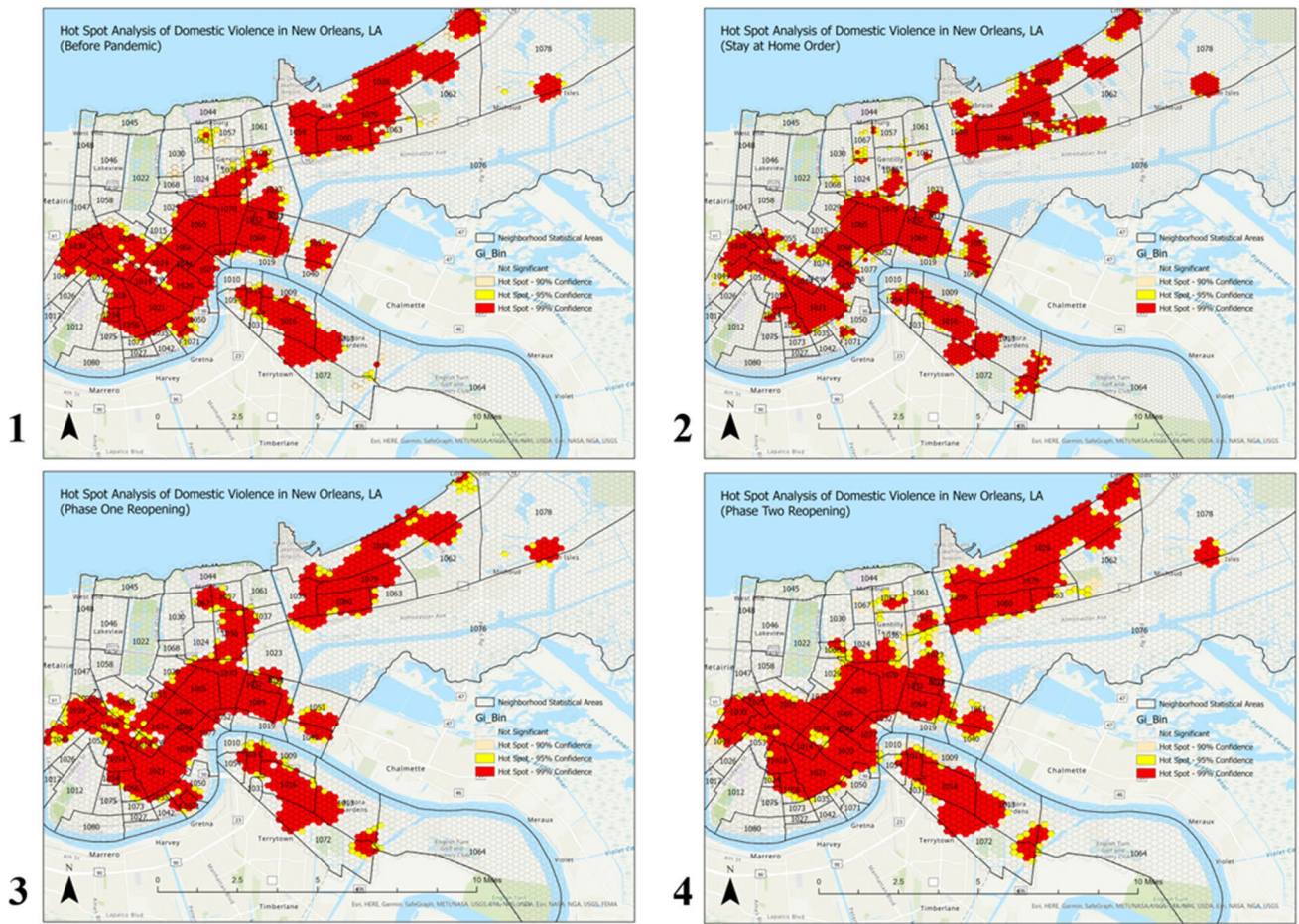
Fig. 2 Hot spots of domestic violence in New Orleans in the four study periods in 2020

Table 5 Dispersion of Domestic Violence Incidents across NSAs of New Orleans, 2020

	Before Pandemic	Stay at Home	Reopen 1	Reopen 2
	(Jan 1-Mar 15)	(Mar 16-May15)	(May 16-Jun 12)	(Jun 13-Sep 29)
Gini Coefficient	.561	.558	.558	.561

Range: 0 (perfect stability) – 1 (perfect dispersion)

mean values of DV incidents are not used for comparison purposes but are included here for interpreting standard deviations from the mean. The standard deviation of DV in the fourth study period is higher than the other three study periods, suggesting that the data in the fourth period are more spread out from the mean (time four SD=91.07 vs. time three SD=21.19, time two SD=46.84, time one SD=53.63). This might be due to the wide range of values that potentially fall within a longer study period. In addition, the descriptive statistics report the mean scores, range, and standard deviation of the independent variables in the 72 NSAs of the City of New Orleans in 2020.

The OLS regression results are reported in Table 7. The results indicate that NSAs with a higher proportion of minority populations tend to have more domestic violence. This variable was a significant predictor of domestic violence at the .01 level prior to the pandemic and remained as significant in all study periods. Average household size was not initially a significant predictor variable. However, it became negatively related to domestic violence at the .05 significance level in the subsequent periods suggesting that bigger households had a lower likelihood of domestic violence during the lockdown and phased reopening periods. Diversity index was not a significant predictor of domestic violence in the first three study periods, but it became significant at the .05 level in the last period (phase two reopening) suggesting that NSAs with more diverse populations tend to have a lower share of domestic violence. None of the other independent variables were found to be significant.

Table 6 Descriptive Statistics

Variable	Min	Max	Mean	Std. Dev.	Range	N
Dependent Variables						
DV counts						72
Time 1	0	373	39.73	53.63		72
Time 2	0	303	35.23	46.84		72
Time 3	0	143	16.34	21.19		72
Time 4	2	624	68.44	91.07		72
Independent Variables						
Diversity index	0	75.3	39.08	38.54	0-100	72
Average household size	1.4	3.29	2.33	2.34		72
Minority population	6	35449	3788	3736.24		72
Population 25+ BA	0	3280	826	815.36		72
Per capita income	0	90176	30084	29666.83		72
Total crime index	91	506	207	210.28		72

Table 7: OLS Regression Models Explaining Domestic Violence Patterns

	Before Pandemic	Stay at Home	Reopen 1	Reopen 2
Average household size	-30.635	-34.307**	-15.070**	-62.690**
Diversity index	-.475	-.423	-.183	-.924**
Minority population	.010***	.008***	.004***	.017***
Population 25+ BA degree	-.010	-.007	-.004	-.015
Per capita income	.000	6.019	8.733	.000
Total crime index	.128	.049	.027	.229
R^2	.616	.569	.540	.617

*$p < .1$. **$p < .05$. ***$p < .01$

Discussion and Conclusion

This study examined the impact of COVID-19 on the nature of domestic violence in New Orleans. The initial analyses indicated that domestic violence reports after the pandemic hit were lower than the same period in 2019, which then increased significantly during the second phase of reopening. The lower number of incident reports following the widespread lockdown compared to the same period in 2019 might be explained by people's possible inability of or reluctance in making a report during an unprecedented pandemic. However, in the fourth period, as restrictions started to be removed, we observed a significant increase in DV reports. These findings add to the understanding of the impact of the pandemic in several ways. First, like others (Leslie & Wilson, 2020; Piquero et al., 2020; Silverio-Murillo et al., 2020; Jetelina et al., 2021) the findings suggest that domestic violence did increase following the residential quarantine, however, the increase was limited to a specific time-period and was not consistent throughout the post-lockdown period. The delayed increase during the second re-opening phase could suggest that if these observed patterns continue to be found

in other studies, the influence of residential quarantines on crime levels may be short-lived rather than enduring. It also suggests that, in terms of domestic violence at least, the observed increases may be driven more by situational factors explained by routine activities theory than they are by offenders' dispositional tendencies. This implies that once the residential quarantine is lifted and normal lifestyles resumed, that levels of DV will decrease. The good news for policy and practice is that situations are more easily ameliorated than are dispositional inclinations.

The spatial analysis of DV incidents throughout the city also suggests that the geographic dispersion of DV incidents remained largely constant throughout the period of study. Thus, the identified concentrations or 'hot-spots' for DV did not appear to substantially change because of the residential quarantine. Instead, the observed increase in DV incidents during the re-opening phase appeared to occur in places where they had before. This seems to suggest that the quarantine, or at least the conditions accompanying it (i.e. unemployment, lack of income, restricted living conditions), made matters worse for those who had already experienced DV rather than resulting in the onset of new cases (for more discussion on DV risk factors,

see Abramsky et al., 2011; Benson et al., 2003; Kauki-nen, 2020; among others). This is distinct from previous findings which found that increases in observed DV incidents following the pandemic appeared to result from new households experiencing violence (Leslie & Wilson, 2020). This difference may be the result of methodology, but it may also be an actual difference. In their study, Leslie and Wilson (2020) relied on city level blocks to identify "repeat households" while noting its imprecise nature. Here we relied on neighborhood statistical areas to assess for differences in spatial concentration over time which also lacks precision. Considering that households made up within the same neighborhood statistical area are likely to fall within the same socio-demographic structure, it is possible that new households exhibited new DV events which were not detected here. Whether residential quarantine increases the frequency of DV within existing households or leads to new households experiencing DV incidents (or both) remains unsettled. Given this, the opportunity for future research to examine further the nature of DV dispersion following residential quarantines remains an important area of inquiry.

Finally, the findings here related to the demographic and circumstantial characteristics of neighborhood statistical areas and their relationship to DV levels throughout the pandemic study period also offer some interesting insight. Of note, we found that household size was inversely related to the likelihood of a DV incident which began to be significantly related during the residential quarantine and continued to be significantly related during the remaining reopening periods. From the routine activities perspective this might be explained by the increased presence of capable guardianship which resulted from greater numbers of either immediate or extended family members residing in the same household. The tendency for domestic violence, particularly intimate-partner, to occur when the parties are home alone may be common. The presence of added household occupants (ostensibly serving as bystanders) increases the risk for would-be offenders and appears to be a salient factor for reducing the likelihood of DV even while accounting for other positively related factors. Once again, for policy and practice this is a helpful finding which might assist in risk screening as well as formulation of prevention strategies. We also found that DV incidents tended to remain concentrated in minority areas and this factor stayed significant both prior to and throughout the re-opening periods. This suggests that the pandemic continued to disproportionately impact communities already in need for services. While minority areas are a measurable construct, more importantly it is an indicator of areas where widespread, generational disadvantage has resonated. The significance of this measure underscores the importance of delivering services designed to alleviate the factors (i.e. economic disadvantage, blocked opportunities) which have disproportionately impacted those communities.

While these findings contribute to the collective understanding of the impact of the pandemic on crime patterns, several caveats remain. First, the level of measurement utilized here, which examined incidents at the neighborhood statistical area, does not allow for more precise estimates of DV patterns across households. Also, with this level of analysis, we were not able to unpack the geographic composition of each NSA to further explain DV concentrations. In the end, we are left with understanding only what went on within those geographical areas in terms of stability or mobility of DV concentrations. Thus, the opportunity to unpack this stability remains for future research. Additionally, like most, this study relied on reported crime incidents and the limitation of that data is well understood. Indeed, an examination of self-reported victimization data may reveal different findings. Even so, prior research in this area indicating that a significant portion of DV calls during quarantine tended to come from third parties (Ivandic et al., 2020) suggest that the reported crime data (usually from victims) may not be as inaccurate as is often claimed. A final constraint is that the time periods examined following the implementation of the residential quarantine are limited in length. It is possible that a broader sample could find something different. In fact, what impact the pandemic may have on domestic violence within communities beyond these immediate time frames remains to be determined. If DV incidents are found to continue to increase or maintain higher levels in the coming months as pandemic conditions improve, then it could suggest that broader economic and/or employment conditions are responsible rather than the immediate situational condition of being confined to one's home. This indeed would have direct implications for the crafting of policy and delivery of services to those victims and offenders.

Though meager, the emerging body of research on this topic does offer important implications. First, the accumulative finding that incidents of DV are likely to increase during time periods of residential quarantine give foresight to politicians and practitioners in preparation for future scenarios. With this anticipation, practitioners can be better positioned to deliver preemptive services to relevant community members. At the very least, they would be able to formulate a strategy which could be deployed should these patterns begin to emerge during future pandemics. Secondly, If the geographic stability of DV concentrations holds true in future research, it provides an additional vantage point for government leaders and service providers to more prudently target the delivery of services. Knowing beforehand that DV incidents are likely to increase in areas known for previous occurrences, allows for better planning and positioning of resources. Third, the unique finding that DV incidents appear to be inversely related

to the size of household provides an even further basis for practitioner decision making, namely as a method for triaging the delivery of services when resources may be limited.

For policymaking purposes, the good news is that the effects of residential quarantines may be short-lived. Indeed, future research with longer follow up periods will tell us more, but if the observed increases prove temporary, then programs might be tailored and strategically delivered to counter any increases in victimization within communities during targeted time periods. For theory, the temporary nature of pandemic related increases seems best explained by and supportive of opportunity and situational theories of crime. It makes sense then that these theories could assist in developing future prevention and response strategies in the event of another similar or perhaps different pandemic.

Declarations

Conflict of Interest The authors declare that they have no conflict of interest.

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