Operation CeaseFire–New Orleans: An infectious disease model for addressing community recidivism from penetrating trauma

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BACKGROUND: CeaseFire, using an infectious disease approach, addresses violence by partnering hospital resources with the community by providing violence interruption and community-based services for an area roughly composed of a single city zip code (70113). Community-based violence interrupters start in the trauma center from the moment penetrating trauma occurs, through hospital stay, and in the community after release. This study interprets statistics from this pilot program, begun May 2012. We hypothesize a decrease in penetrating trauma rates in the target area compared with others after program implementation.

METHODS: This was a 3-year prospective data collection of trauma registry from May 2010 to May 2013. All intentional, target area, penetrating trauma treated at our Level I trauma center received immediate activation of CeaseFire personnel. Incidences of violent trauma and rates of change, by zip code, were compared with the same period for 2 years before implementation.

RESULTS: During this period, the yearly incidence of penetrating trauma in Orleans Parish increased. Four of the highest rates were found in adjacent zip codes: 70112, 70113, 70119, and 70125. Average rates per 100,000 were 722.7, 523.6, 286.4, and 248, respectively. These areas represent four of the six zip codes citywide that saw year-to-year increases in violent trauma during this period. Zip 70113 saw a lower rate of rise in trauma compared with 70112 and a higher but comparable rise compared with that of 70119 and 70125.

CONCLUSION: Hospital-based intervention programs that partner with culturally appropriate personnel and resources outside the institution walls have potential to have meaningful impact over the long term. While few conclusions of the effect of such a program can be drawn in a 12-month period, we anticipate long-term changes in the numbers of penetrating injuries in the target area and in the rest of the city as this program expands. (*J Trauma Acute Care Surg*. 2014;77: 123–128. Copyright © 2014 by Lippincott Williams & Wilkins)

LEVEL OF EVIDENCE: Therapeutic study, level IV.

KEY WORDS: CeaseFire; violence prevention; recidivism; penetrating trauma; New Orleans.

Injuries from intentional trauma have long been a source of significant morbidity and mortality in the United States, with homicide by firearm as the fifth leading overall cause of violence-related injury death in the United States in 2010.[1] These injuries cause increased direct health care costs and economic costs owing to disability and lost production. According to the Centers for Disease Control, health care expenses caused by intentional trauma are estimated at $113 million per year for fatal injuries and $5.6 billion per year for nonfatal injuries.[1] Lee et al.,[2] reported 154,334 firearm-related assaults in the United States from 2003 to 2010, resulting in an average hospital length of stay of 7.1 days and an average of $75,884 per hospitalization.

Addressing violent injuries from a preventative and public health standpoint has been challenging. While education programs to reduce other preventable injuries, such as car seat and seat belt use, have been successful in reducing injury rates,[3,4] there has not been the same rate of success in programs aimed at intentional trauma.[5–9] Hospital-based violence interruption programs (VIPs) are in place in 34 cities across the United States. CeaseFire is a hospital-based VIP using an infectious disease model, using trained community members to help prevent retaliatory violence stemming from an initial incident. As part of this program, these violence interrupters are activated when a penetrating trauma presents to the hospital and engage the patient, family members, and friends while in the emergency department, through hospital stay and discharge, and coordinate with street-level outreach and linkage to available community resources.

According to a US Department of Justice report, New Orleans had rates of total, property, and violent crime comparable or less than that of similar-sized US cities for 2009; however, the homicide rate was 10 times that of the US national rate and 4 times that of comparable US cities.[10] From the same report, the most common reported injury motive was drug related at nearly 29%, followed by revenge at nearly 24% and argument/conflict at approximately 19%. New Orleans is served by a single Level I trauma center, the Interim LSU Hospital, which receives all emergency medical service–activated penetrating violent injury meeting trauma criteria.

We examine the effects of the CeaseFire program in its first year in New Orleans, and we hypothesize that the rates of penetrating trauma in its target area will decrease compared with surrounding areas. Using an infectious disease model, we attempt to investigate whether traditional patterns and spread of violent injury in a city may be affected by an introduction of a VIP into one area.

PATIENTS AND METHODS

CeaseFire, now called *Cure Violence*, is a violence intervention program that started in Chicago, which uses an infectious disease, hospital-based model to address penetrating trauma. This program employs culturally appropriate messengers as violence interrupters (VIs) whose role is to interact with patients and families at the hospital immediately after a violent event, using this "teachable moment" to defuse further violence. In the New Orleans model, VIs are activated and present to our trauma center within 1 hour of every penetrating trauma activation that originated within the target zone. The initial hospital intervention is focused on obtaining background pertinent to the incident, identifying high-risk individuals, engaging family members, and arranging follow-up. Follow-up involves visiting patients in the hospital and in their homes, identifying their risk factors and social service needs, and conflict resolution. VIs often have personal experience with violent trauma, previous gang affiliation, or incarceration, and generally hail from the neighborhoods they serve. They receive training in conflict resolution, mediation, Health Insurance Portability and Accountability Act, and other medically relevant training by both national and local CeaseFire hospital and social service personnel. Regular Quality Improvement meetings between hospital personnel and CF are held to ensure that there is a 100% response rate to all activations.

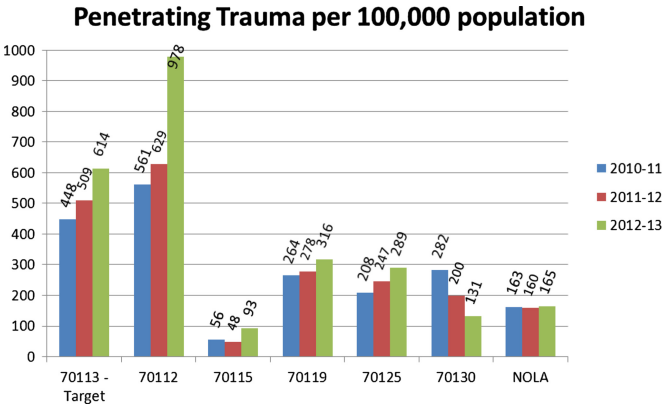

Figure 1. Incidence of penetrating trauma at the Interim LSU Hospital for the 2 years before and 1 year after CeaseFire implementation in May 2012.

The Interim LSU Hospital in New Orleans is the region's only Level I trauma center and, as such, receives all penetrating trauma meeting standard criteria. In accordance with American College of Surgeons' requirements, a registry is maintained, which collects data on all patients presenting with traumatic injury. The use of trauma registry data has been shown to be an effective tool in evaluating violent injury in a community.[11] Census data provide demographic information at the zip code level on population, income, and economic characteristics of a contiguous area.

This study evaluated trauma registry data from May 2010 to May 2013 in 12-month increments. In the postprogram implementation phase (May 2012 to May 2013), all intentional penetrating trauma in the target area (roughly equivalent to zip code 70113) that was treated at our Level I trauma center received immediate activation of and hospital intervention by CeaseFire personnel, whereas this intervention was not provided for patients whose injury took place outside this zone. Census data were used to calculate population in each zip code so as to provide the denominator for incidence calculation. With the use of trauma registry data, incidence of violent penetrating trauma and rates of change of this incidence were calculated for all zip codes in the city. Penetrating trauma incidence and rates of change in zip codes that were geographically contiguous with the target area were compared with 70113 both before and after the program implementation.

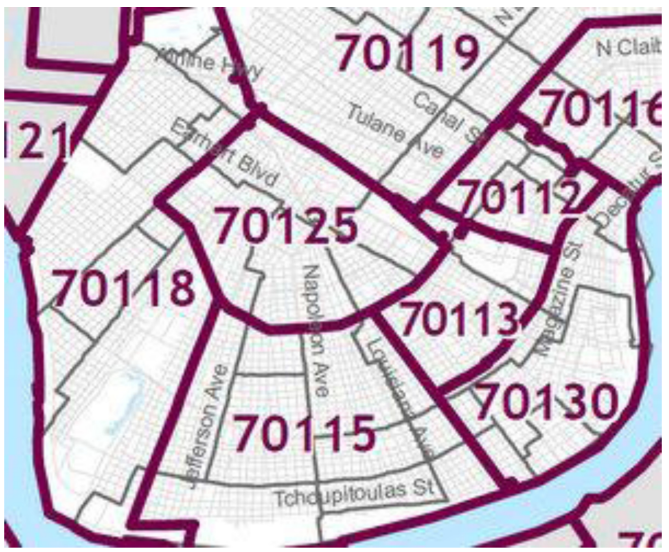

Figure 2. Map of zip codes surrounding 70113.

RESULTS

Analysis of our data shows that in the year following the implementation of the CeaseFire pilot project in May 2012, the annual incidence of penetrating trauma (per 100,000 people) increased both citywide and in the 70113 target zone (Fig. 1). Zip code 70113 has five neighboring zip codes as follows: 70112, 70115, 70119, 70125, and 70130 (Fig. 2). In the year following CeaseFire implementation, each surrounding zip code experienced an increase in penetrating trauma, except for one area, 70130. Table 1 shows the incidence of penetrating trauma for the 12-month periods before and after CeaseFire implementation and the percent change between the two years. Two surrounding zip codes, 70112 and 70115, had a greater increase in penetrating trauma compared with the target zone. Two zip codes, 70119 and 70125, had a smaller increase in penetrating trauma compared with the target zone, while one zip code, 70130, experienced an overall decline in penetrating trauma during this period.

We calculated the monthly incidence of penetrating trauma in each zip code to find monthly variations and identify trends that may not be apparent in the annual incidence data. Figures 3 and 4 show the monthly incidence of penetrating trauma in 70113 versus its surrounding zip codes and versus the rest of New Orleans (minus 70113). These figures include the most recent data available for this publication, which was September 2013, and display the 17-month periods before and after May 2012, when CeaseFire began. We do not intend to use these graphs to quantitate changes or to predict future violence; however, they do show a discernable trend toward decline in monthly penetrating trauma in the target zone since May 2012, compared with other areas. Closer examination of the post-CeaseFire data reveals a 1-month spike (January 2013). This outlier is explained by a single incident on January 21 at a holiday parade in which five people were shot at once. Absent this multicasualty event,

TABLE 1. Annual Incidence of Penetrating Trauma and Percent Change for 70113, Its Surrounding Zip Codes, and the City of New Orleans

	2011–2012	2012–2013	% Change
Target, 70113	509	614	20.7
70112	629	978	55.6
70115	48	93	93.2
70119	278	316	13.7
70125	247	289	17.3
70130	200	131	−34.1
NOLA	160	165	3.1

NOLA, New Orleans, Other.

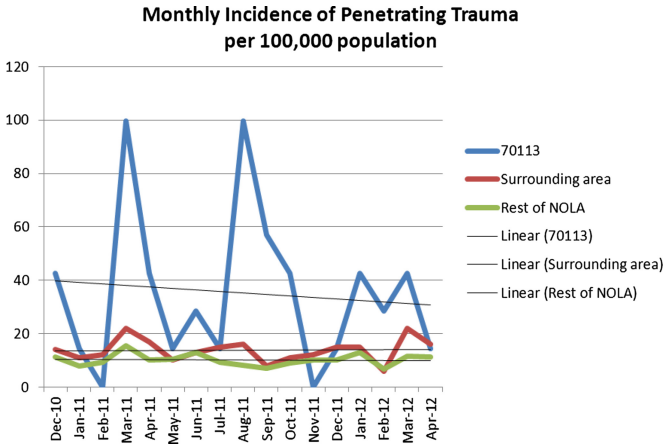

Figure 3. Monthly incidence in 70113 versus surrounding zip codes and the rest of New Orleans, before CeaseFire implementation.

the trend toward decreased violent injury might well be more significant.

DISCUSSION

Crime in New Orleans, like many other urban areas, is pervasive and entrenched in the life of the city. Endemic to New Orleans are its homicide rates, which have been as high as 10 times the national average and 4 times that of similar sized cities.[10] CeaseFire aims to decrease homicides and gun violence by facilitating the collective efficacy of a neighborhood to abate acts of violence.[12,13] It has shown success in other high-crime cities by using culturally appropriate messengers to engage individuals in conflict resolution alternatives and neighborhoods in awareness and behavior change activities independent of the criminal justice system.[12,14] We examined the first year of CeaseFire implementation in New Orleans by comparing trauma incidences in its target zone with that in surroundings areas from 2 years before the CeaseFire implementation to the first year of CeaseFire implementation.

From 1 year before the CeaseFire implementation to CeaseFire's first year, the incidence of penetrating trauma in 70113 (the zip code representing the CeaseFire target zone) increased at a lower rate, measured as the percent change from the previous year's incidence, compared with two of the surrounding zip codes, 70112 and 70115. In the same comparison, 70113 had a slightly higher increase in incidence compared with 70119 and 70125. During the period studied, it is difficult to discern the cause of these variations. Yearly variations in violent crime rates in specific areas can be random and erratic; however, we know that violent injuries cluster in areas of low socioeconomic status and social deprivation.[15,16] Zip codes 70119 and 70125 have significantly higher median incomes and lower rates of poverty than those of 70113. Concordantly, the overall incidence of violent trauma in these zip codes is lower than that in 70113 as well. In light of these differences, we point out that the percent change during CeaseFire's first year is more similar among these three zip codes to that observed between the 2 years before CeaseFire implementation.

A similar perspective brings insight into observing the higher rise in penetrating trauma incidence in 70112 versus 70113 in CeaseFire's first year. There is greater poverty, lower median income, and lower age in 70112 than in 70113. All three of these factors may explain the greater rise in violent trauma; however, between the 2 years before CeaseFire implementation, the rise in violent trauma incidence was very similar between 70112 and 70113. It is possible that these two zip codes, which share a large border, did not share a similar rise in violent trauma from 1 year before CeaseFire implementation to CeaseFire's first year owing in part to the presence of CeaseFire.

Zip codes 70115 and 70130 are included in this analysis because they border 70113. While portions of these two zip codes share socioeconomic characteristics similar to those of 70113, there are large portions of these zip codes that are very dissimilar as demonstrated by the increases in median income and decreases in the level of poverty. These zip codes cover much larger portions of the city than does 70113. Why then were these zip codes included in this study? The CeaseFire model of primary prevention borrows its conceptual framework from efforts to curb the spread of infectious disease. Previous studies have demonstrated that the spread of violence and its diffusion over time is not unlike that of an infectious disease.[17,18]

There are three components involved in the spread of infections disease: a source, a mode of transmission, and a susceptible host. When examining violence, there is a source—the interactions that result in violence; a mode of transmission—coming in contact with these interactions; and a susceptible host—socioeconomically disadvantaged areas with young, minority populations.[17] Furthermore, populations that surround pockets of violence may over time arm themselves as a means of protection. This primes these areas for the spread of violence and homicides by increasing the presence of firearms and the willingness to use them.[19] Therefore, any early or future study of CeaseFire's impact should examine all surrounding areas. Moving forward, we may consider using

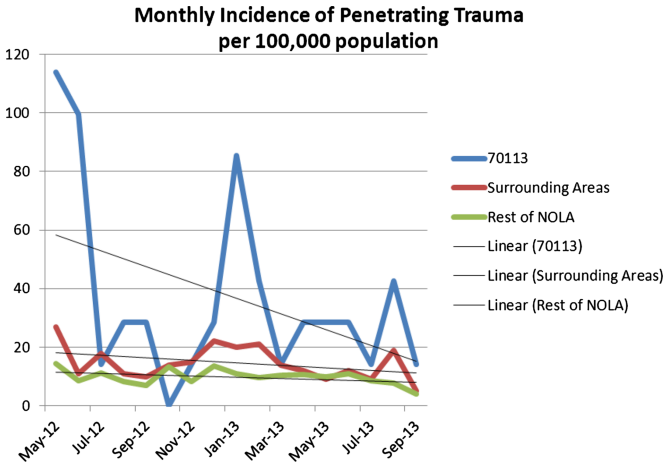

Figure 4. Monthly incidence in 70113 versus surrounding zip codes and the rest of New Orleans, after implementation of CeaseFire.

smaller demographic units that can help exclude those areas that are dissimilar to the CeaseFire target zone, a refinement that addresses one of the major limitations of this study.

LIMITATIONS

There are several limitations at this early stage of analysis of CeaseFire–New Orleans' efficacy that prevent any definitive conclusions from being made. The short time frame of the program, and this evaluation limit our ability to meaningfully attribute any changes in violent trauma rates to CeaseFire or any other single component. Studies of CeaseFire in Chicago evaluated a 16-year period of crime data and, in Baltimore, evaluated a 10-year period of crime data. These studies were able to demonstrate significant results, whereas the study of a CeaseFire program in Newark, which evaluated a period similar to the one in this study, failed to demonstrate significant results.[20] The culture of urban violence in these cities, as in New Orleans, developed over decades.[11,18] Reversing this momentum will take far greater than one or several years to occur. In so doing, any demonstration of the efficacy or failure of CeaseFire in New Orleans will require persistence and time.

The use of zip codes is another limitation. The trauma registry data used in this study provide only the zip code where the injury occurred. However, zip codes encompass neighborhoods of often widely divergent characteristics in addition to commercial and industrial zones. While the zip code used to examine the CeaseFire intervention closely approximates the target zone, the CeaseFire target zone extends slightly beyond this zip code. Our ability to investigate these areas is hindered by the fact that more specific location data are not available in the trauma registry. Future studies should consider using data that routinely collect the location of injury down to the numerical address.

Our inability to collect data on victims of homicides in the field who do not present to the trauma center is an additional limitation. Although these are not activated by hospital VIs, VIs do respond to such incidents within the target zone. Although these numbers are not included in the trauma registry data, after evaluating other modalities including crime statistics, we found this to be the most reliable representation of penetrating trauma in the target area.

Finally, a limitation shared by this study and many others looking at the effects of violence intervention programs is the inability to control for the many factors that affect urban violence. Streets, neighborhoods, cities all changes over time. Policing strategies and resources change over time. The factors that motivate violence evolve with these changes. A common tool that attempts to reduce these confounders is to control for a city's overall changes in rates of homicide and violence. Specifically in New Orleans, there have been other community- and police-based programs to combat violence during our study period. Earlier, we have included figures that demonstrate citywide trends in violent trauma during the study periods. Ostensibly, an accurate trend is difficult to extrapolate given the short time frame. As we continue to evaluate violence in New Orleans, we will have more data points over time to determine a best-fit line that can be used to help control for the trends in crime attributable to factors outside CeaseFire.

CONCLUSION

As CeaseFire develops, the emergency department plays a greater role in helping implement VIPs that reach patients during critical "teachable moments."[5] Examining outcomes and evaluating programs will help target improvements to existing programs and implement new programs in the most appropriate areas. This evaluation begins to determine how to accomplish this using population- and hospital-based data and the limitations that need to be addressed in understanding violent injury interventions.

AUTHORSHIP

All authors on our study have contributed significantly to and are willing to take public responsibility for one or more aspects of the study.

DISCLOSURE

The authors declare no conflicts of interest.

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