Original Article

Bull Emerg Trauma 2013;1(4):141-146.

Bulletin of Emergency And Trauma

The Spatiotemporal Pattern of Trauma in Victims of Violence Visited in Emergency Room of Rajaei Hospital, Shiraz, Iran

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Received: August 3, 2013
Revised: September 4, 2013
Accepted: September 28, 2013

ABSTRACT

Objective: To explain an important aspect of violence, the spatiotemporal pattern of trauma in victims of violence visited in emergency room of Rajaei hospital, Shiraz, Iran

Methods: This cross-sectional prospective study comprised 109 randomly selected victims of violence visited in emergency room of Rajaei hospital, a tertiary referral hospital affiliated to Shiraz University of Medical Sciences in winter 2013. We recorded the demographic information as well as data regarding the type and time of the injuries. The data collected for each victim was then entered in a data gathering form.

Results: The study included 88% males with mean age 27.8 ± 8.8 years, which encompassed more than 60% young adults. Our study showed a temporal pattern with triple peaks. Moreover, 64% of assault trauma occurred at night. Furthermore, our study showed the majority of our patients suffered from stab wounds and about 57% of patients studied lacked high school diploma. Moreover it was revealed that violence was more common in downtown Shiraz, especially in the Fifth city district with simultaneous presence of many risk factors for violence.

Conclusion: The result of this study showed that age, gender, educational status and temporal peak of violence were shown to be similar to other investigations conducted in other countries. Despite these similarities, stabbing were more prevalent in our study. Additionally, the Fifth city district of Shiraz seems to be the main city district where preventive intervention is needed to reduce violence-related injuries.

Keywords: Spatiotemporal pattern; Violence; Trauma; Stabbing.

Please cite this paper as:
Rouhezamin MR, Paydar S, Hasirbaf M, Bolandparvaz S, Abbasi HR. The Spatiotemporal Pattern of Trauma in Victims of Violence Visited in Emergency Room of Rajaei Hospital, Shiraz, Iran. *Bull Emerg Trauma.* 2013;**1**(4):141-146.

Introduction

Trauma is a major cause of hospitalization, mortality and morbidity worldwide [1,2]. This contemporary social problem is more severe in developing countries such as Iran, where trauma is the most common cause of death among young adult [3-6]. Violence, is defined as an intentional injury inflicted by a person or a little group of people, and is considered as a major cause of trauma. As WHO estimated, 1,658,000 death (about 3% of all mortalities) and 460 million disability adjusted life years (DALY) are caused by violence in 2000 [7].

Despite similarities in some aspects of violence-related injuries such as age group, gender and time of violence in published studies, the impact of some cultural differences in violence cannot be underestimated [7]. In previous studies violence was reported to be more common in young adult males [8]. Also, it was more prevalent at night [9]. In spite of these similarities, in a study carried out by Buchart *et al*. victims of stabbing were shown to be more frequent in South Africa [10]. On the other hand, firearm injury is more common in western countries [11]. Moreover, recent studies reveal new changes in the

pattern of violence. For instance, in a study by Ranney *et al*. females were shown to have more tendencies for interpersonal non-partner violence than before [12]. Besides, an analytic approach should be made along with comprehensive medical and surgical management of trauma to define the cause, pattern and type of violence-related injuries. Unfortunately there are a few studies about pattern of injury in Iran. This lack of knowledge may cause inability to prevent community violence and to apply powerful policies to reduce violence and violence related injury. The present study attempts to determine the spatiotemporal distribution of assault trauma, an important aspect of epidemiology of violence.

Materials and Methods

This prospective cross-sectional study was performed in Rajaei Hospital, Shiraz, Iran, a tertiary trauma center affiliated to Shiraz University of Medical Sciences. Shiraz is located in the southwest of Iran and consists of ten city districts. It is the fifth most populated city of Iran with a population of 1,443,960. The patients studied were categorized according to the site of violence. In this context, we studied the ten city districts of Shiraz (CDS). The borders of CDSs are shown in http://www.eshiraz.ir. (Figure 1). The study protocol was approved by medical research ethics committee as well as institutional review board (IRB) of Shiraz University of Medical Sciences.

We included all the assault-related trauma patients who were visited during a three month period from January to March 2013 in Emergency Room of Rajaei hospital. The demographic information including age and sex were recorded. The type of violence and assault trauma was also recorded. We used a standard data gathering form for collecting the information. The time of the assault trauma, the socioeconomic characteristics of the victims were entered into the forms. The data collected for each victim was then recorded in a data gathering form.

To obtain a meaningful result and in line with 6% prevalence of violence in a previous similar regional study [13] with power of 95 and d=1.5%, data gathering forms were filled for 109 patients. The collected data were finally entered in to a computer database for further analysis. The statistical package for social science, SPSS for Windows, Version 16.0 (SPSS Inc., Chicago, IL, USA) was used for data analysis. We reported the characteristics of assault traumas via descriptive statistics. Data are reported as the mean ± SD and proportions where appropriate.

Results

As mentioned previously, our study included 109 assault related trauma patients, of which 72% were taken to the hospital by Emergency Medical Service (EMS) and less than one percent were taken to hospital by Police. Also, 27.1% of victims of violence referred to Rajaei hospital by themselves. Our series consisted of 88.1% male and 11.9% female patients. Their mean and median ages were 27.8 ± 8.8 and 25.5 years respectively. Moreover, the minimum age of victims was 15 years and the oldest person aged 56 years, with young adults (20 to 35 years) comprising 64% of our patients.

Temporal Pattern of Assault Trauma

The daily temporal pattern of violence related patients seen in our center is shown in Figure 2. Clearly, violent behavior showed a temporal pattern with a peak at night which accounted for 64% of all assault related injuries, followed by the lowest incidence in the early morning. Two more peaks are also observed around 5.00 AM and midday.

Fig. 1. Map of Shiraz.city districts

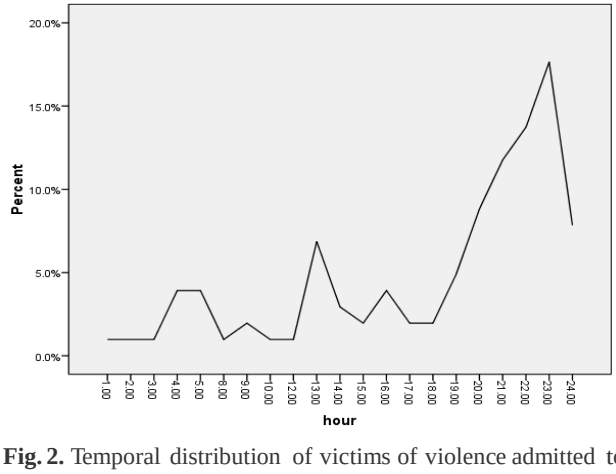

Fig. 2. Temporal distribution of victims of violence admitted to ERRH, winter 2013

Table 1. Characteristics of 109 patients referred to our center during a 3-month period due to assault trauma.

Variable	Value
Age	27.8 ± 8.8
Sex	
Male (%)	96 (88.1%)
Female (%)	13 (11.9%)
Employment status	
Employed (%)	77 (71.2%)
Unemployed (%)	22 (20.1%)
Student (%)	6 (5.5%)
Housekeeper (%)	4 (3.6%)
Shiraz regions	
Out of Shiraz (%)	9 (8.3%)
%First (%)	15 (13.1%)
Second (%)	16 (14.3%)
Third (%)	16 (14.3%)
Fourth (%)	3 (2.4%)
Fifth (%)	12 (13.1%)
Sixth (%)	8 (7.1%)
Seventh (%)	8 (7.1%)
Eight (%)	13 (11.9%)
Ninth (%)	4 (3.6%)
Tenth (%)	5 (4.8%)
Substance used by the victims	
No Addiction (%)	97 (88.9%)
Addiction (%)	12 (11.1%)
Multiple substances (%)	5 (4.8%)
Opium (%)	4 (3.6%)
Cannabis (%)	2 (1.8%)
Marijuana (%)	1 (0.9%)
Educational status	
Illiterate (%)	11 (10.1%)
Under diploma (%)	51 (46.8%)
Diploma (%)	38 (34.9%)
Associate diploma (%)	1 (0.9%)
BS[a]/BA[b](%)	6 (5.5%)
MS[c]/MA[d] (%)	1 (0.9%)
PhD[e] and higher degrees (%)	1 (0.9%)
Type of violence	
Domestic (%)	20 (18.4%)
Husband (%)	14 (12.9%)
Wife (%)	1 (0.9%)
Sibling (%)	4 (3.6%)
Father (%)	1 (0.9%)
Social (%)	77 (70.6%)
Unknown (%)	12 (11.1%)
Mechanism of injury	
Stabbing (%)	51 (46.8%)
Assault with object (%)	39 (35.8%)
Unarmed brawling (%)	18 (16.5%)
Firearm (%)	1 (0.9%)
Number of surgeries	
None (%)	40 (36.7%)
One (%)	61 (56.0%)
Two (%)	7 (6.4%)
Three (%)	1 (0.9%)

[a]BS: Bachelor of Science; [b]BA: Bachelor of Art; [c]MS: Master of Science; [d]MA: Master of Art; [e]PhD: Doctorate of Philosophy

Contrary to 24 hour temporal pattern of violence, the weekly temporal pattern of assault trauma has no peak. About 73.9% of our patients were admitted to our center on workdays, in other words about 14% per workday. On the other hand, weekends, the day before weekends and holidays accounted for 26.1% of assault trauma or 12.4% per day. Accordingly no obvious difference was detected in frequency of violence on workdays and other days (14% vs. 12.4%). Moreover, our study showed that most violent actions occurring on workdays were associated with the first (14.8%), second (11.5%), third (16.4%) and the eighth (13.1%) CDSs. However, 22% and 27% of injuries occurred on non-workdays and related to the second and the fifth CDSs respectively. Employment is another variant assessed in our study where a risk factor or a protector element may be involved in violence. The occupation frequency in victims of violence is shown in Table 1.

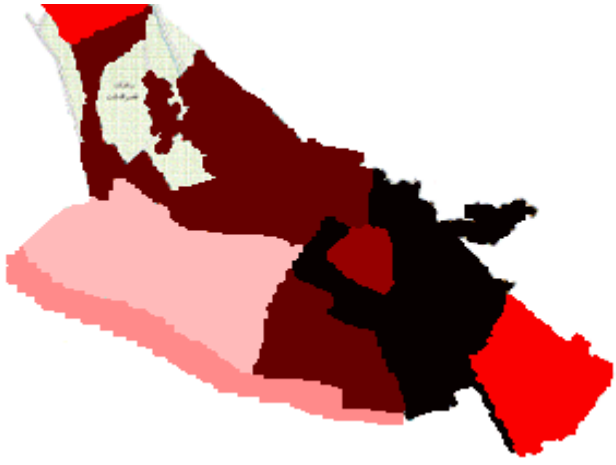

Fig. 3. Shiraz assault trauma density map.

As shown by the first peak, all patients involved in assault trauma from 4.00 AM to 6.00 AM, had been employed. Also, the majority of the patients suffered from violence at noon (the second peak) were employed (72.7% vs. 27.3%). However no student was involved in violent actions as shown by the first and the second peak. Most of the students (80%) suffered from an interpersonal conflict after 19.00. Employed patients also constituted the majority of violence victims after 19.00 (third peak) (Figure 3).

Spatial Pattern of Assault Trauma

Table 1 summarizes the spatial pattern of violence-related patients seen in our center. The most violent areas were the first (14.4%), second (15.5%), third (15.5%), fifth (14.4%) and eighth (12.9%) CDSs. About 7.2% of assault related admissions to our center were from rural or urban areas other than Shiraz. Moreover the fourth (2%), ninth (3%) and tenth (4%) districts were the least violent areas.

Figure 3, an assault trauma density map, reveals that the second, third and fifth CDSs, which are downtown districts accounted for about 58% of all violent related-trauma. Finally, the majority of interpersonal contacts resulting in injury occurred on the streets (62.6%) and in the victims' houses (29%). It seems that education is a strong protector against involvement in violence. In our study more than half of patients involved in assault were illiterate or lacked

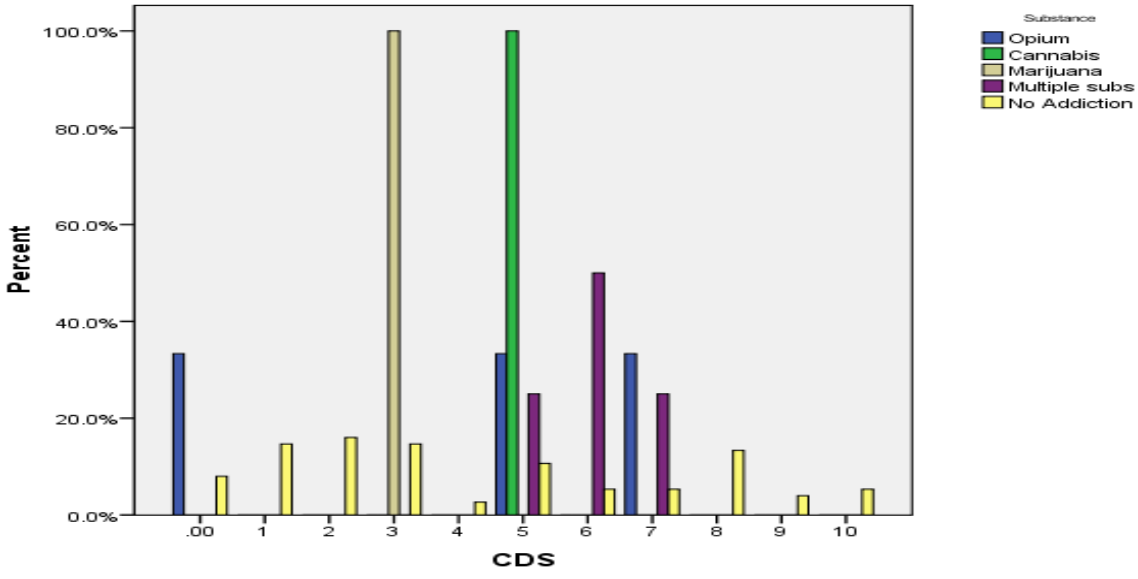

Fig. 4. The frequency of substance use according to ten CDSs in victims of violence seen in our study during the study period. **CDS:** City district of Shiraz, **00:** Out of Shiraz

high school diploma (56.9%), and more than one-third had diploma degree (Table 1). Moreover, most of the patients (42%) who had no educational degree were from the second, third and fifth CDSs.

Substance abuse, addiction, smoking and alcohol consumption are probably important problems of Iranian society. More than one tenth of our patients were addict. About half of them admitted that they were addicted to multiple substances such as opium, methamphetamine and its derivatives, cannabis and marijuana. Figure 4 shows the frequency of substances used by our patients. Besides, most of our patients with addiction came from the fifth (37.5%) and sixth (25%) CDSs. Figure 4 shows the frequency of substances used by our patients in relation to the CDSs.

Smoking and alcohol consumption were also prevalent among patients seen in our center. About 26% of our patients were smoker of which 17% consumed alcohol. The majority of smokers (27.3%) were from the fifth CDS. Although most (21.4%) alcoholic patients involved in assault trauma were from the ninth CDS; alcoholism is prevalent in some other CDSs as shown in Figure 5.

Domestic violence is a kind of violent behavior among family members. In our study, 18.4% of our patients suffered from a domestic violence of which 11% were attacked by a known person who was not a family member (Table 1). About one-third of patients suffering from domestic violence, were from the first CDS of which less than 20% came from the tenth CDS. Social violence was also more prevalent

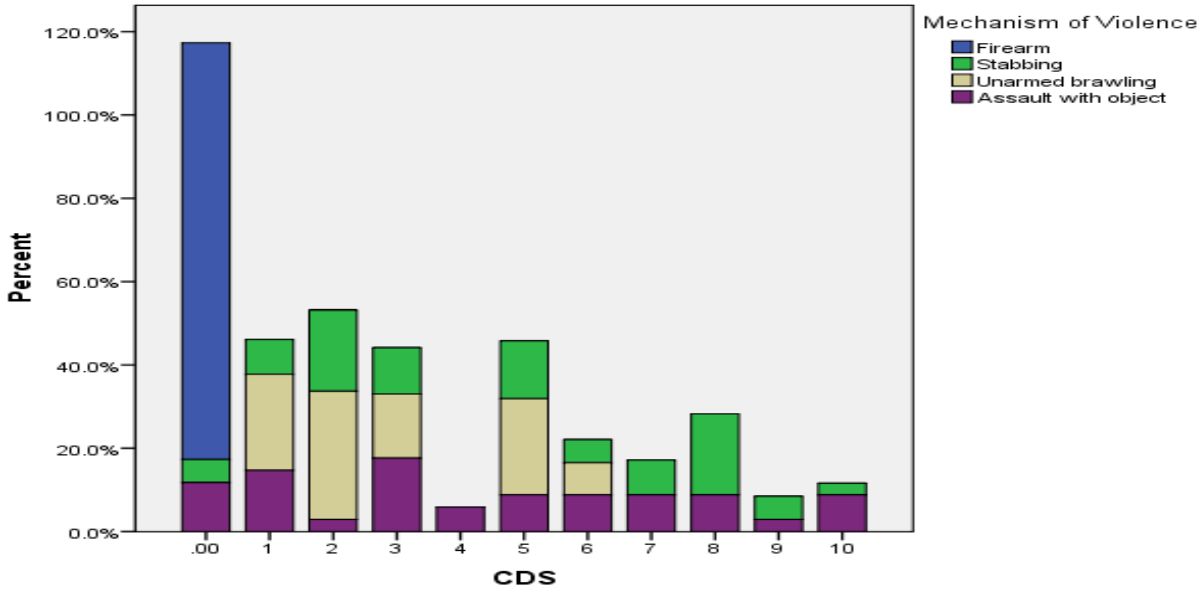

Fig. 5. The Frequency of different modes of injury in relation to CDSs, in victims of trauma seen in our study during the study period. **CDS:** City district of Shiraz, **00:** Out of Shiraz

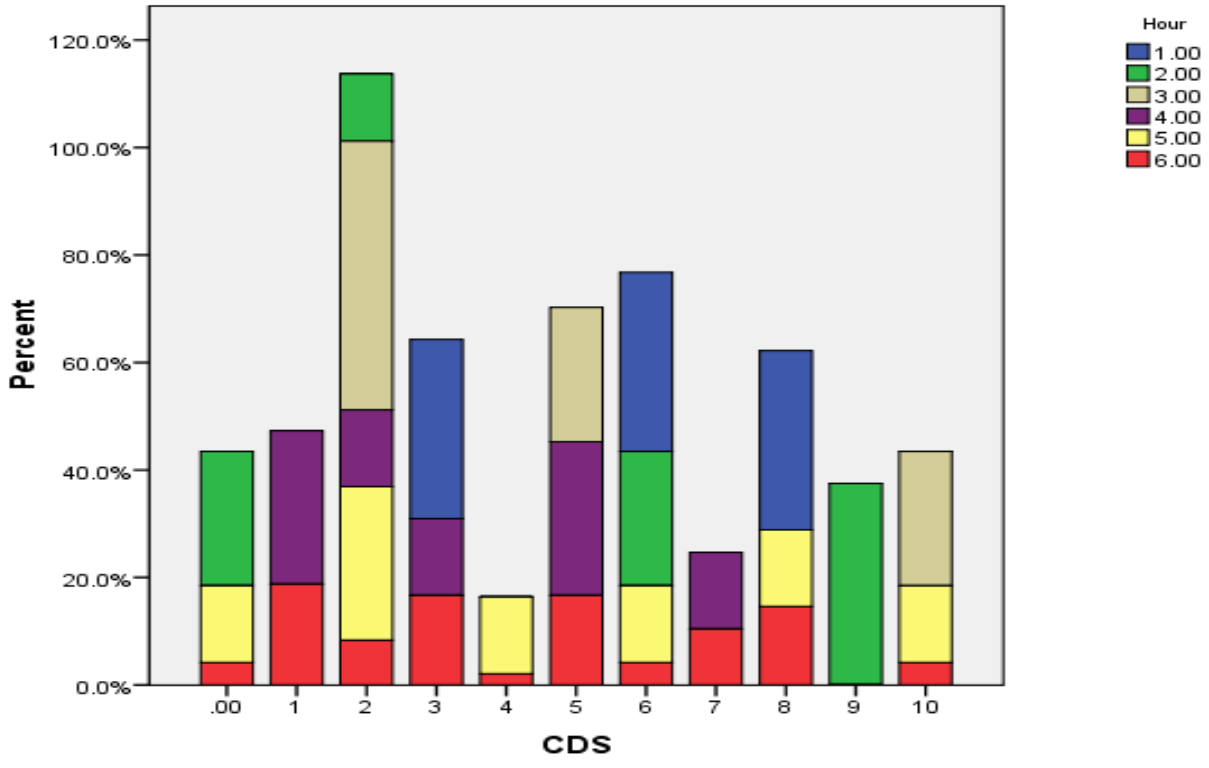

Fig. 6. The spatiotemporal pattern of assault trauma in victims of violence seen in our study during the study period. **CDS:** City district of Shiraz, **00:** Out of Shiraz; **1:** 1.00-3.00AM; **2:** 4.00-6.00 AM; **3:** 7.00-11.00 AM; **4:** 12.00-14.00; **5:** 15.00-18.00; **6:**19.00-24.

in the fifth (19.3%) and third (17.5%) CDSs. In our study, stabbing was the most common mechanism of trauma which accounted for 46.8% of visited assault trauma patients (Table 1).

Our study showed that the second and the eighth CDSs accounted for 40% of stab wounds, about 20% each. Figure 6 shows the modes of violence in each CDS. To assess the impact of trauma on health systems, multiple factors were evaluated such as the length of stay (LOS), which in our study it ranged from 0 to 10 days. About 81.9% of our patients stayed in hospital for one or less than one day. Furthermore, 50% of patients with LOS of more than two days mostly came from the fifth CDS. Another factor is the number of injuries. Surprisingly, the majority of our patients suffered from multiple injuries (66.3% vs. 33.7%). The patients admitted to our hospital from the fifth CDS were more prone to have multiple injuries. The third factor is the type of management. About 37.3% of clients seen in our center were managed conservatively of which 66.7% underwent surgery. As expected, 73% of surgeries were done for the patients from the fifth CDS. The last factor in our study was the number of surgeries which ranged from one to three (Table 1). Frequently, the victims of trauma from the fifth CDS were more susceptible to undergoing multiple surgeries.

Spatiotemporal Pattern of Assault Trauma

Figure 6 shows the spatiotemporal pattern of violence-related injuries. Clearly, most of the violent behavior occurred in the first temporal peak (4.00-6.00 AM) of violence, including the patients from the ninth CDS. The majority of people coming to ERRH around the second temporal peak came from the first and fifth CDSs. Finally, as shown in Figure 6, almost all of the patients involved in violence from 19.00 to 24.00 hours (third temporal peak) came from the first, third, fifth and seventh CDS.

Discussion

As implied repeatedly in previous studies, young males [8] are the most vulnerable group to violence especially at night [9]. In our study, this temporal peak in violent behavior occurred in crowded streets, and leisure and public places. As mentioned in studies by Cusimano *et al*., [9] the night temporal peak in their studies was around the opening time of bars but this did not apply to our study, because of the absence of such places in Shiraz. In our region, the opening of entertainment centers and establishments may account for this aggregation of violence related injuries in the time periods between 19.00 and 24.00. Contrary to the study by Cusimano *et al*., [9] which showed two temporal peaks, our study revealed a temporal pattern with triple peaks. As discussed above, the majority of the patients involved in violent behavior around the first or second temporal peaks were employed patients. Furthermore, these temporal peaks were consistent with the opening and closure

time of private and governmental organizations.

In spite of several studies conducted in western countries [11], stabbing was shown to be more prevalent in the present study. This pattern was similar to the violence reported in studies by Buchart from South Africa [10]. Two important reasons can explain this finding about mode of violence. First, the victims of stab wounds are more prone to hospitalization even when the injury is not severe. Secondly, despite the powerful laws in our country against firearm, lack of strong laws against wounds inflicted by knives and similar tools is a major cause of high prevalence of stab wounds

Attention to spatial pattern of assault- related trauma may be helpful in control of criminal behavior by government. As declared above, the adjacent downtown CDSs are the most violent CDSs, especially the fifth district. Besides, the risk factors for violence are more prevalent in these CDSs. For example, the majority of addict clients visited in ERRH were from the fifth CDS. Smoking and alcoholism were also more prevalent in this CDS. Low educated people were also shown to be mostly from the fifth CDS. Accordingly, it appears that more budgets should be allocated to education and preventive interventions in foregoing districts, especially the fifth CDS to reduce the incidence of crime and violence-related injury.

Our study showed that the patients visited from the fifth CDS accounted for the majority of severe injuries, prolonged LOS, and surgeries. Therefore the health staff employed in this area should be more educated in order to deal with more complicated trauma patients and to prevent further medical complications. In spite of the fifth CDS which accounted for the majority of social violence, most of domestic violence occurred in the first CDS, which deserves more education and counseling facilities. Finally, the aforementioned spatiotemporal pattern of violence may help reasonable allocation of police force to each CDS in line with the time of peak of violence to reduce the incidence of violence-related injuries.

We note some limitations to our study. The patients in our study were categorized according to place of violence reported by the victims. Gathering information about the place of residence of attackers may be more useful for preventive purposes. Furthermore, in our study we could not determine the economic status of visited patients due to the lack of knowledge about the economic status of CDSs.

In conclusion, the result of this study showed that age, gender, educational status and temporal peak of violence were shown to be similar to other investigations conducted in other countries. Despite these similarities, stabbing were more prevalent in our study. Additionally, the Fifth city district of Shiraz seems to be the main city district where preventive intervention is needed to reduce violence- related injuries.

Conflict of Interest: None declared.

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