



Effect of COVID-19 Pandemic on Incidence and Mortality Rate Due to Road Traffic Injury in Shiraz

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► ABSTRACT

Objective: To evaluate the effect of COVID-19 pandemic on the incidence and mortality rate of road traffic injuries in Shiraz, Iran.

Methods: This cross-sectional study was performed on the data of patients who admitted by road traffic accidents 18 months before the outbreak of COVID-19 and 18 months after COVID-19 in the largest provider of trauma level 1 care services in southern Iran. SPSS 19 software was used to analyze the data.

Results: A significant decrease of 12.8% was observed in the number of patients admitted by road traffic accidents during the COVID-19 pandemic period compared to the same period before the pandemic ($p < 0.0001$). But the death toll from road traffic accidents has increased significantly during the COVID-19 pandemic period compared to the same period before the pandemic ($p = 0.01$).

Conclusion: Due to the COVID-19 restrictions, it seems that factors such as restrictions on suburban travel, closure of public and recreational spaces, reduction of intra-city traffic, people staying at home and a significant reduction in injuries caused by traffic accidents, is reasonable. On the other hand, these restrictions, quarantines, and COVID disease itself can lead to confusion, anxiety, fear of infection, and thus avoid or delay the search for health care and increase mortality. Therefore, planning and policy-making is essential in order to prepare the correct guidance for seeking treatment.

Keywords: COVID-19; Pandemic; Incidence; Mortality rate; Road traffic injury.

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Introduction

The COVID-19 pandemic is a major challenge worldwide. This pandemic is a physical disease that scientists are trying to understand from different angles [1, 2]. Designing a COVID-19 coronavirus protection project with social quarantine has

potentially unintended consequences, includes reducing the risk of accidents due to traffic restrictions and increasing the violence created by home quarantine [3]. Due to the outbreak of COVID-19, home quarantine played an effective role in the occurrence of accidents and serious consequences for mental health [4, 5]. As social

quarantine has changed the way people interact, it has reduced the rate of accidents and hospitalizations on an unprecedented scale [6]. Traumatic injuries involve a variety of penetrating and non-penetrating mechanisms, includes traffic accidents, sports injuries, natural disasters, and falls that can occur at home, at work, or on the street. Social quarantine measures have been put in place around the world to combat the spread of COVID-19 infection [7-9]. On the other hand, the prevalence of COVID-19 and social quarantine measures affect the mechanism, type and extent of these injuries. There is still no data on the short- and long-term consequences management of the COVID-19 pneumonia outbreak, epidemic and social quarantine measures around the world [10]. Therefore, the impact of the COVID-19 outbreak and injury mechanism's quarantine is essential in trauma patients [11, 12]. In general, few studies have been performed to determine and differentiate the impact of COVID-19 pandemic and social quarantine measures on the extent and type of traumatic injuries, the mechanism of injury in the general population, and other vulnerable groups worldwide [13].

As a result, this study was performed to investigate the effect of the prevalence of COVID-19 and the establishment of home quarantine on the extent and severity of injury mechanisms. The behavior of the general public has changed dramatically with the rise of virus awareness. Activities such as driving patterns and hospital presentation have changed, therefore, the objective of the present study is to evaluate the differences in trauma variables before and during the COVID-19 pandemic, to investigate the etiology of injury mechanisms, the impact of COVID pneumonia pandemic on the prevalence and cause of mortality in patients who referred to Rajaei trauma hospital from 2018 to 2021.

Materials and Methods

This is a cross-sectional study that investigate the impact of the COVID-19 pandemic on the prevalence and cause of death of road traffic accident victims who admitted to Rajaei Trauma hospital in 2018 to 2021. Rajaei trauma hospital in Shiraz is the largest provider of level 1 trauma care services in southern Iran. All the injured who referred to Rajaei trauma hospital in Shiraz (level 1 trauma) due to road traffic accidents were included in the study. And among the injured, those who were under 18 years old were excluded from the study. The study data were extracted from electronic medical records in Rajaei Trauma Hospital in Shiraz. The two study groups were included patients who admitted 18 months before the outbreak of COVID-19 and 18 months after COVID-19 pandemic. Identity information, mechanism of injury and severity of injury were extracted from patients' electronic records. In this study, the first group includes injured patients in the

18-months period before the outbreak of COVID-19 who referred to Rajaei Trauma Center and the second group of injured patients in the 18-months period after the COVID outbreak were examined separately.

In the statistical population of this study, road traffic accidents were classified into 5 groups based on the mechanisms of injury: The first group consisted of motorcycle drivers, the second group consisted of motorcyclists, the third group consisted of car drivers, the fourth group consisted of occupants, and the fifth group consisted of pedestrians.

Sampling method in this study was easy that all the injured who referred to Rajaei Trauma Hospital in Shiraz between 2018 and 2021 were included.

For descriptive analysis, mean and standard deviation were used for quantitative variables and frequency and frequency percentage were used for qualitative variables. To examine the effect of each variable as a univariate t-test, two independent samples, one-way ANOVA and Chi-square were performed for quantitative and qualitative factors, respectively.

Results

The total number of people admitted to Rajaei trauma hospital (Shiraz Trauma Center, Iran) in the previous 18 months and 18 months similar to the COVID-19 pandemic was 43,645. Of these, 32,355 were men (74.13%) and 11,290 were women (25.87%). Also, most of the admitted peoples were in the age group of 18-40 years (72.38%) and motorcyclist (27.24%).

A significant reduction was observed in the number of admitted patients during the COVID-19 pandemic period. The share of people admitted before the COVID-19 pandemic was 23,315 and the share of people admitted during the COVID-19 pandemic was 20,330, which shows a 12.8% reduction in the admission rate of patients (χ^2 (1, N=43645)=204.15, $p<0.0001$). A significant decrease in the admission of men and women was observed in the COVID-19 pandemic period. Therefore, this decrease was 7.07% in admitted men (χ^2 (1, N=32355)=43.54, $p<0.0001$), and in women 27.47% (χ^2 (1, N=11290)=286.34, $p<0.0001$). There was also a significant decrease in admission of patients in all age groups, and patients over 61 years had the highest percentage of admission reduction ($p<0.0001$).

There was a significant decrease in the admission rate of pedestrian's patients ($p<0.0001$), occupants ($p<0.0001$), and drivers ($p<0.0001$). On the other hand, while the increase in the acceptance rate of motorcycle drivers was significant ($p=0.01$), but this increase was not significant in motorcycle occupants ($p=0.62$).

In addition, the survival rate of patients in the COVID-19 pandemic period was significantly reduced compared to the same period before the pandemic (χ^2 (1, N=42982)=216.14, $p<0.0001$). And the mortality rate of patients in the COVID-19

pandemic period increased significantly compared to the same period before the pandemic (χ^2 (1, N=663)=5.98, $p=0.01$) (Table 1).

The findings of this study showed that the mortality rate in men and women during the COVID -19 pandemic has changed significantly compared to the same period before the pandemic. However, the mortality rate in men after the COVID-19 pandemic increased significantly ($p=0.01$). Also, the mortality rate in all age groups during the COVID-19 pandemic has changed significantly compared to the same period before the pandemic. The mortality rate in the age group of 41-60 years after the COVID-19 pandemic increased significantly ($p=0.01$). In addition, the results of this study showed that the mortality rate of pedestrian and car accidents during the COVID-19 pandemic period changed significantly compared to the same period before

the pandemic. Therefore, the death rate in car drivers after the COVID-19 pandemic increased significantly ($p=0.01$) (Table 2).

Findings of the study showed the frequency or number of hospitalized patients' admissions during the same 18 months before and after the COVID-19 pandemic. Number of traumatic patients decreased significantly during the COVID-19 pandemic (Figure 1). Also, the frequency or mortality rate of hospitalized patients during the same 18 months before and after the COVID-19 pandemic showed that the mortality rate has increased significantly due to accidents and during the COVID-19 pandemic (Figure 2).

Discussion

The present study which has conducted at the largest

Table 1. Comparison of trauma presentations before and after COVID-19 pandemic.

Variable	Before ^a No. (%)	After ^b No. (%)	p-value ^c
Overall	23315	20330	<0.0001
Sex			
Male	16771 (71.9)	15584 (76.7)	<0.0001
Age			
18-40	16688 (71.6)	14903 (73.3)	<0.0001
41-60	4665 (20.0)	3906 (19.2)	
>61	1962 (8.4)	1521 (7.5)	
Mortality			
Survived	23015 (98.7)	19967 (98.2)	<0.0001
Dead	300 (1.3)	363 (1.8)	

^aBefore: Before the outbreak of COVID-19 pandemic; ^bAfter: after the outbreak of COVID-19 pandemic; ^cp-values derived from χ^2 tests for independence, $p<0.05$ deemed significant.

Table 2. The relationship between sex, age, and injury mechanism before and after COVID-19 pandemic.

Variable			Dead No. (%)	Live No. (%)	p-value ^c	
Sex	Male	Before ^a	239 (1.4)	16532 (98.6)	<0.0001	
		After ^b	296 (1.9)	15288 (98.1)		
	Female	Before ^a	61 (0.9)	6483 (99.1)	0.017	
		After ^b	67 (1.4)	4679 (98.6)		
Age	18-40	Before ^a	144 (0.9)	16544 (99.1)	0.005	
		After ^b	173 (1.2)	14730 (98.8)		
	41-60	Before ^a	58 (1.2)	4607 (98.8)	<0.0001	
		After ^b	87 (2.2)	3819 (97.8)		
	>61	Before ^a	98 (5.0)	1864 (95.0)	0.016	
		After ^b	103 (6.8)	1418 (93.2)		
	Mechanism of Injury	Pedestrian	Before ^a	107 (2.2)	4845 (97.8)	<0.0001
			After ^b	124 (3.4)	3546 (96.6)	
Motorcycle occupant		Before ^a	11 (0.7)	1480 (99.3)	0.517	
		After ^b	12 (0.8)	1506 (99.2)		
Car occupant		Before ^a	61 (1.0)	5992 (99.0)	0.140	
		After ^b	55 (1.3)	4337 (98.7)		
Motorcycle driver		Before ^a	68 (1.2)	5746 (98.8)	0.092	
		After ^b	89 (1.5)	5988 (98.5)		
Car driver		Before ^a	53 (1.1)	4952 (98.9)	0.002	
		After ^b	83 (1.8)	4590 (98.2)		

^a Before: Before the outbreak of COVID-19 pandemic; ^b After: after the outbreak of COVID-19 pandemic; ^cp-values derived from χ^2 tests for independence, $p<0.05$ deemed significant.

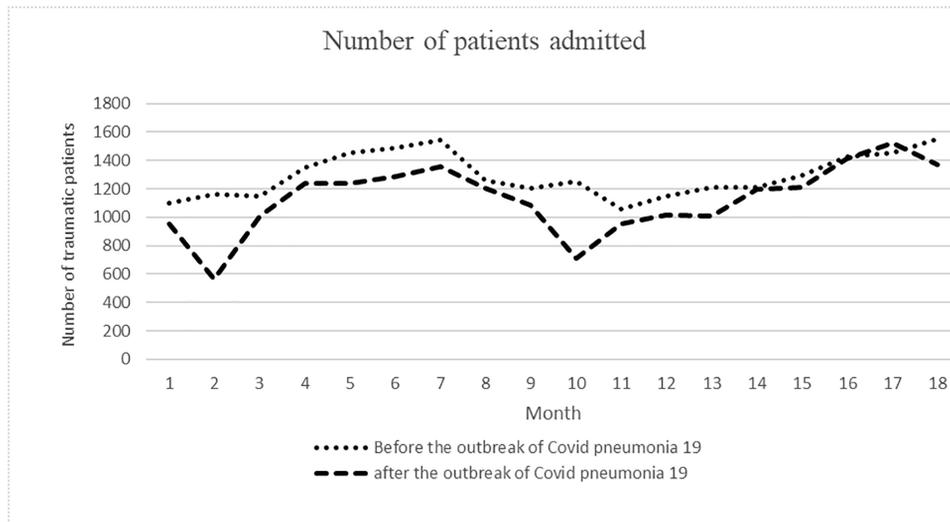


Fig. 1. Evaluation the number of hospitalized patients during the same 18 months before and after the outbreak of COVID-19 pandemic.

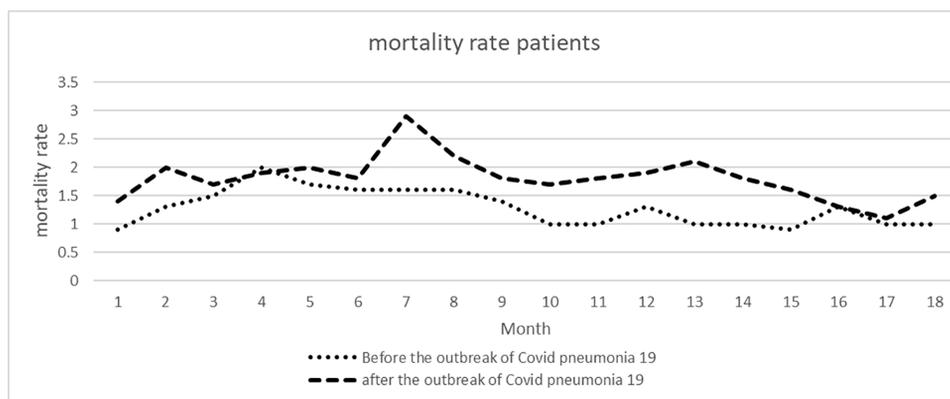


Fig. 2. Mortality rates evaluation of hospitalized patients during the same 18 months before and after the outbreak of COVID-19 pandemic.

trauma center in Shiraz showed that some factors includes COVID-19 pandemic, the constraints created during this period, and the behavioral changes of the population had limited people indoors.

In the present study, the number of admitted patients in the COVID-19 pandemic period compared to the same period of last year had a significant decrease of 12.8%. There was a significant decrease in admission of patients in men and women and in all age groups ($p < 0.0001$). Similarly, the review studies of Waseem *et al.*, [14], Zhu *et al.*, [15] in China, MacDonald *et al.*, [13] in the UK, Devarakonda *et al.*, [16] in the USA, Dolci *et al.*, [8] in Italy, and Jacob *et al.*, [17] in Australia confirmed a significant reduction in accidents during the COVID-19 pandemic period compared to the same period before COVID-19. However, a study in Turkey [18], and a study in New York, USA [19] showed that the rate of road accidents during the COVID-19 pandemic period decreased compared to the same period before COVID. But this decrease was not statistically significant. Restrictions on long-distance and intra-city traffic during the COVID-19 pandemic in many countries around the world, including Iran, led to several checkpoints across the roads and serious crackdowns on violators. Therefore, it seems that the reduction of traffic and road traffic has reduced accidents. It

is not surprising that the number of accidents has decreased by following the instructions to stay at home. On the other hand, it can be said that the fear of COVID-19 disease in the hospital environment has led to the reluctance of patients with minor trauma to the hospital.

On the other hand, there was a significant decrease in the admission rate of pedestrians, car occupants, and car driver's accidental patients. And while the increase rate of admitted motorcycle driver was significant, it was not significant in motorcycle occupants. The results of the study by Fahy *et al.*, [2] in Ireland showed no changes in pedestrian accidents before and after COVID-19. The sample of 9 or less pedestrians is one of the limitations of their study that could not find a statistically significant relationship. In the study by MacDonald *et al.*, [13] the largest reduction in the type of road traffic accidents was in multi-vehicle collisions. In contrast, the frequency of car collisions with cyclists was significantly increased. These results have probably been observed due to the relative decrease in car travel and to the existence of COVID-19 restrictions and the tendency to increase relative travel by bicycle and motorcycle.

In addition, the death rate from crashes during the COVID-19 pandemic has increased significantly.

In the study of MacDonald *et al.*, [13], the mortality of trauma patients in COVID-19 disease was significantly higher than the same period of last two years. It appears that the increase in accidental patient mortality in the COVID-19 pandemic is due to COVID secondary effects and delays in the process of preparing operating rooms to clear COVID contamination, the likelihood of COVID-19 disease and death, or a weakened immune system due to previous COVID-19 disease and lack of resistance to accident trauma.

Also, the mortality rate in men, in the age group of 60-41 years, and car drivers has increased significantly after the COVID-19 pandemic. Kuo *et al.*, [3] in Taiwan concluded that mean age, sex distribution, severity of injury, and mortality were statistically similar between patients referred to the trauma hospital before and during the COVID-19 pandemic. But transport accidents have increased from 43.2 before to 47.2% during the COVID-19. The results of their study are contrary to the present study. It can be said that Taiwan's society and medical system, as a country with a low COVID-19 pandemic, has not have as strong impact as the rest of the world. However, the scenario in Taiwan was quite different, as the only restrictive behaviors that government imposed on the people were wearing masks in the public and social distancing. Therefore, it seems logical that in a country where there are no traffic and travel restrictions, there has been no changes in the rate of accidents.

Therefore, staying home and other COVID-19 restrictions can reduce the number of accidents and have health-related effects. Due to the COVID-19 restrictions placed on people staying at home, as well as restrictions on intercity travel, a significant reduction in trauma injuries appears to be in line with COVID-19 guidelines. On the other hand, these restrictions, quarantines, and COVID disease itself can lead to confusion, anxiety, fear of infection, and thus avoid or delay the search for health care and increase mortality. Probably the best way to minimize these effects is to provide guidance to the general public during a pandemic.

The study was conducted in the largest trauma center in southern Iran and a large sample size was one of the strengths of the present study. The limitation of the present study was lack of access to data from other trauma centers in the world and comparison with current data and lack of access to severe patient's injury. Also, seasonal variation may be effect on the trauma pattern, but time intervals was not matched.

The COVID-19 pandemic has put a lot of pressure on the world healthcare system, including Iran. If the disease is not controlled, it will affect the provision of health services. For this reason, Iran, like other countries in the world, has implemented a series of restrictive measures aimed to limit the spread

of the disease. Some of these restrictions included restrictions on suburban travel, closure of public and recreational spaces, and reduction of intra-city traffic. However, the trauma caused by accidents is inevitable and the study of the impact of COVID-19 on accidents can be the basis for policymakers' plans to properly allocate financial and human resources and service planning at the time of COVID-19.

Therefore, staying home and other COVID-19 restrictions can reduce the number of accidents and have health-related effects. Due to the COVID-19 restrictions placed on people staying at home, as well as restrictions on intercity travel, a significant reduction in trauma injuries appears to be in line with COVID-19 guidelines. On the other hand, these restrictions, quarantines, and COVID disease itself can lead to confusion, anxiety, fear of infection, and thus avoid or delay the search for health care and increase mortality. Probably the best way to minimize these effects is to provide guidance to the general public during a pandemic.

Declarations

Ethics approval and consent to participate: This study approved by institutional review board of Shiraz university of medical science (Approval ID: IR.SUMS.REC.1400.703).

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Authors' contributions: MY: conceptual and design study, data acquisition, data analysis, drafted and revision paper. MK: contributed to conceiving and design of the study, interpretation of data, commented on drafts, and made significant revisions to the paper. NB: contributed to the design of the study, interpretation of data, commented on the draft, and made significant revisions to the paper. ZG: contributed to the design of the study, statistical analysis, commented on drafts, and made significant revisions to the paper. LS: ZG: statistical analysis, interpretation of data, commented on drafts, and made significant revisions to the paper.

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References

1. Matthay ZA, Kornblith AE, Matthay EC, Sedaghati M, Peterson S, Boeck M, et al. The DISTANCE study: Determining the impact of social distancing on trauma epidemiology during the COVID-19 epidemic-An interrupted time-series analysis. *J Trauma Acute Care Surg.* 2021;**90**(4):700-707.
2. Fahy S, Moore J, Kelly M, Flannery O, Kenny P. Analysing the variation in volume and nature of trauma presentations during COVID-19 lockdown in Ireland. *Bone Jt Open.* 2020;**1**(6):261-266.
3. Kuo LW, Fu CY, Liao CA, Liao CH, Wu YT, Huang JF, et al. How much could a low COVID-19 pandemic change the injury trends? A single-institute, retrospective cohort study. *BMJ Open.* 2021;**11**(3):e046405.
4. Devarakonda AK, Wehrle CJ, Chibane FL, Drevets PD, Fox ED, Lawson AG. The Effects of the COVID-19 Pandemic on Trauma Presentations in a Level One Trauma Center. *Am Surg.* 2021;**87**(5):686-689.
5. Forrester JD, Liou R, Knowlton LM, Jou RM, Spain DA. Impact of shelter-in-place order for COVID-19 on trauma activations: Santa Clara County, California, March 2020. *Trauma Surg Acute Care Open.* 2020;**5**(1):e000505.
6. Ghafil C, Matsushima K, Ding L, Henry R, Inaba K. Trends in Trauma Admissions During the COVID-19 Pandemic in Los Angeles County, California. *JAMA Netw Open.* 2021;**4**(2):e211320.
7. Staunton P, Gibbons JP, Keogh P, Curtin P, Cashman JP, O'Byrne JM. Regional trauma patterns during the COVID-19 pandemic. *Surgeon.* 2021;**19**(2):e49-e52.
8. Dolci A, Marongiu G, Leinardi L, Lombardo M, Dessi G, Capone A. The Epidemiology of Fractures and Musculo-Skeletal Traumas During COVID-19 Lockdown: A Detailed Survey of 17.591 Patients in a Wide Italian Metropolitan Area. *Geriatr Orthop Surg Rehabil.* 2020;**11**:2151459320972673.
9. Yeates EO, Grigorian A, Barrios C, Schellenberg M, Owattanapanich N, Barmparas G, et al. Changes in traumatic mechanisms of injury in Southern California related to COVID-19: Penetrating trauma as a second pandemic. *J Trauma Acute Care Surg.* 2021;**90**(4):714-721.
10. Kaseda ET, Levine AJ. Post-traumatic stress disorder: A differential diagnostic consideration for COVID-19 survivors. *Clin Neuropsychol.* 2020;**34**(7-8):1498-1514.
11. Pellegrini M, Roda M, Di Geronimo N, Lupardi E, Giannaccare G, Schiavi C. Changing trends of ocular trauma in the time of COVID-19 pandemic. *Eye (Lond).* 2020;**34**(7):1248-1250.
12. Ajayi B, Trompeter A, Arnander M, Sedgwick P, Lui DF. 40 days and 40 nights: Clinical characteristics of major trauma and orthopaedic injury comparing the incubation and lockdown phases of COVID-19 infection. *Bone Jt Open.* 2020;**1**(7):330-338.
13. MacDonald DRW, Neilly DW, Davies PSE, Crome CR, Jamal B, Gill SL, et al. Effects of the COVID-19 lockdown on orthopaedic trauma: a multicentre study across Scotland. *Bone Jt Open.* 2020;**1**(9):541-548.
14. Waseem S, Nayar SK, Hull P, Carrothers A, Rawal J, Chou D, et al. The global burden of trauma during the COVID-19 pandemic: A scoping review. *J Clin Orthop Trauma.* 2021;**12**(1):200-207.
15. Zhu W, Li X, Wu Y, Xu C, Li L, Yang J, et al. Community quarantine strategy against coronavirus disease 2019 in Anhui: An evaluation based on trauma center patients. *Int J Infect Dis.* 2020;**96**:417-421.
16. Devarakonda AK, Wehrle CJ, Chibane FL, Drevets PD, Fox ED, Lawson AG. The Effects of the COVID-19 Pandemic on Trauma Presentations in a Level One Trauma Center. *Am Surg.* 2021;**87**(5):686-689.
17. Jacob S, Mwangiru D, Thakur I, Moghadam A, Oh T, Hsu J. Impact of societal restrictions and lockdown on trauma admissions during the COVID-19 pandemic: a single-centre cross-sectional observational study. *ANZ J Surg.* 2020;**90**(11):2227-2231.
18. Coşkun S, Çinka H, Büyükceran İ, Şahiner G, Yurtbay A, Erdoğan F, et al. An evaluation of orthopaedic trauma patients presenting at the emergency department during lockdown in the COVID-19 pandemic. *Journal of Health Sciences and Medicine.* 5(1):79-83.
19. DiFazio LT, Curran T, Bilaniuk JW, Adams JM, Durling-Grover R, Kong K, et al. The Impact of the COVID-19 Pandemic on Hospital Admissions for Trauma and Acute Care Surgery. *Am Surg.* 2020;**86**(8):901-903.

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