Original Article

Explaining Gender Differences in Transfer Time to a Trauma Center in Northern Iran

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Abstract

Background: The association between gender and time of receiving services (TRS) after traumatic injuries is rarely documented in developing countries. This study aimed to examine gender differences in time between occurring injuries and receiving services in hospital after trauma injuries in northern Iran. **Materials and Methods:** A total of 7085 injured patients were included in this study. Data on sociodemographic and clinical characteristics were extracted from the Guilan province trauma system registry (GTSR) from July 2017 to July 2018. The Oaxaca–Blinder (OB) method was used to explain the gender differences in the TRS after traumatic injuries. **Results:** There were significant differences between men and women in marital statues ($P < 0.001$), education level ($P < 0.001$), time of injury ($P = 0.025$), occupation ($P < 0.001$), type of trauma ($P < 0.001$), mode of transfer ($P < 0.001$), mean age ($P < 0.001$), average distance from hospital ($P = 0.052$), and average transfer time to the hospital ($P < 0.001$). We found gender differences in TRS after falling trauma ($P = 0.006$) when the transfer was performed by emergency medical services (EMSs) and in penetrating trauma ($P < 0.001$) when the transfer was performed by private vehicles. The difference in the observed characteristics of men and women explained 67% of gender differences in TRS ($P = 0.06$). **Conclusion:** The gender difference in the transfer of injured patients was in favor of men, depending on the socio-demographic and clinical factors. In OB analysis, the gender differences in falling trauma and transfer by EMS and the gender differences in penetrating trauma and private transmission to the hospital were also confirmed. Steps need to be taken to ensure that services are equally beneficial to both men and women.

Keywords: Gender difference, Iran, Oaxaca–Blinder decomposition, trauma services

Introduction

Trauma causes more than 5.8 million deaths worldwide each year.[1] Between 20 and 50 million people suffer from nonfatal injuries annually, many of which lead to different disabilities.[2] A study in a trauma center suggested that 60% of trauma-related deaths can be classified as definitely or probably preventable as per the World Health Organization framework.[1]

In Iran, the highest number of trauma-related mortalities are due to road traffic accidents[3] and Guilan province, located in

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northern Iran, is among the provinces with the highest rate of road accidents in Iran.[4]

Prehospital trauma care involves six main steps: detection, reporting, response, on-scene care, care in transfer, and transfer to receive final care. Initial transmission is based on the outcome of the evaluation using a trauma triage tool, which determines whether the patient will benefit from transfer to the nearest hospital. The appropriate transition of the patient to the hospital is critical in trauma care.[5,6]

Although evidence-based practice guidelines have been published for the field of triage and inter-hospital transmission, these guidelines do not ensure that men and women receive the same services in trauma centers.[7] Inequalities in health-care utilization have been observed between men and women. A study in India conducted among poor households with free access to hospital care showed that the proportion of women receiving hospital care was lower in most 14 common diseases in all age groups compared to men.[8] Women relative to men are less likely to survive heart diseases in the hospital or after discharge because they do not have the same opportunities as men to receive treatment.[9,10] Gender differences have also been reported in receiving pharmaceutical services. For example, men compared to women received more epinephrine for allergic reactions in cardiac arrest during transfer to the hospital. Similarly, men received morphine for chest pain in extremities fractures more than women.[11]

Gender differences have been reported in trauma outcomes. In a study conducted on 20,000 cases in a level one trauma center for 4 years, the mortality rate of men was 6.5% whereas this figure was reported 5.2% for women.[12] In contrast, some studies on patients with moderate to severe injuries indicated no significant difference in the mortality rates of both genders.[13,14]

The existing literature suggests that the rate of deaths among patients with blunt and penetrating trauma was higher when they were transferred to the hospital by public and private emergency medical services (EMSs) than by personal vehicles. Similar results were obtained even after the severity of the injury was adjusted. This indicated that there were some difficulties in transferring the patients by EMS.[15,16] Posttraumatic survival rates are closely related to the time of receiving trauma services. Half of the deaths occur during the period following a traumatic injury that requires rapid medical and surgical intervention (the golden time). Hence, early transfer to the hospital is critical for the patient's survival.[17,18]

Although several studies have investigated the gender differences in the demographics of traumatic patients transferred to trauma centers,[10,11] it is important to know if there are gender inequalities in the time of receiving services (TRS) after traumatic injuries because the fast transfer to the hospital and fast triage reduces the risk of death. Identifying these gender differences in a trauma center is the first step in reducing such inequalities in trauma care.[19,20]

The association between gender and TRS after traumatic injuries has rarely been documented in developing countries such as Iran. Considering that the incidence of traumatic injuries, derived from a traffic accident is remarkably high in Iran, it is crucial to assess gender differences in transfer services of trauma patients to develop appropriate interventions. To fill this gap in the literature, we aimed to examine gender inequality in TRS after trauma injuries in Guilan province, Iran. Understanding gender inequality in TRS after traumatic injuries may provide valuable information for improving patient management and reducing gender inequalities in access to trauma care in Iran.

Materials and Methods

Participants

In this cross-sectional study, the data were obtained from the Guilan Trauma Data Bank. We included injured patients who were referred directly to Poursina Hospital in Rasht and were injured in Guilan province. The patients referred from other hospitals to Poursina Hospital were excluded from the study.

We used the data of 7085 injured patients from the Guilan Trauma System Registry (GTSR) system archived between July 2017 and July 2018. The GTSR project has started from July 2017 and collects information of all patients injured due to trauma who are referred to Poursina Hospital, the largest trauma center in Guilan. The data were collected directly from the medical records, the patients, and their families. The demographic characteristics (e.g., age, gender, education level, and occupation), types of injury (traffic accident, falling, blunt trauma, other penetrating trauma), prehospital conditions, place of the injury, time of injury, time of arriving at the hospital, and mode of transfer to the hospital were gathered. The outcome variable in the study is TRS and calculated by the difference between the time of injury and the time of arrival at the hospital. Marital status, level of education, occupation, type of injury, time of injury, the distance between injury place and hospital, and whether or not the injury occurred during weekend/holiday were included in the analysis as explanatory variables. Besides, the distance between the place of injury and hospital was calculated using geographic information system and included in the analysis. This research was confirmed by the Ethics Committee of Guilan University of Medical Sciences, Rasht, Iran (IR.GUMS.REC.1396.217).

Statistical analysis

The Chi-square test was used to examine the descriptive variables. The Oaxaca–Blinder (OB) method was employed to explain gender inequality in TRS after traumatic injuries. Assume that we have a linear regression model linking TRS (logged to correct for skewness), *ln* (TRS), to a set of explanatory factors, *X*, for males and females, separately such as:

$$ln\,(TRS_m) = X_{mi}\,b_{mi} + u_{mi} \text{ for males and}$$
$$ln\,(TRS_f) = X_{fi}\,b_f + u_{fi} \text{ for females,} \quad (1)$$

Where X is the vector of explanatory variables. B is the vector of coefficients, and u is the regression error term. The difference in the average TRS, M (ln (TRS), between males and females, can be decomposed using the OB decomposition approach as follows:

$$Diff = \mathrm{M}\left(\ln\left(TRS_m\right)\right) - \mathrm{M}\left(\ln\left(TRS_f\right)\right)$$
$$= M\left(X_{mi}\beta_m + u_{mi}\right) - M\left(X_{fi}\beta_f + u_{fi}\right) \quad (2)$$

$$Diff = M(X_{mi}\beta_m) - M(X_{fi}\beta_f) + M(u_{mi} - u_{fi}) \quad (3)$$

As one of the assumptions of linear regression is that the average of error terms is equal to zero, the error terms can be deleted from the model as:

$$Diff = M(X_{mi}\beta_m) - M(X_{fi}\beta_f) \quad (4)$$

The equation above can be rewritten as follows:

$$Diff = \beta_m\left(M(X_m) - M(X_f)\right) + M(X_f)(\beta_m - \beta_f)$$
$$+ \left(M(X_m) - M(X_f)\right)(\beta_m - \beta_f) \quad (5)$$

Based on Equation 5, differences in the average TRS can be decomposed into three parts: (1) difference due to endowments: β_m ($M(X_m)$ - $M(X_f)$), (2) differences due to coefficients (M (X_f) (β_m - β_f), and (3) differences due to interactions: (M (X_m) M (X_f)) (β_m - β_f). The endowment part captures differences in the average TRS due to group differentials in explanatory variables. This part shows the changes in the gap in TRS if men and women had similar observable characteristics. The coefficients part captures the differences in the TRS that can be explained by differences in coefficients (including the differences in the intercept) between males and females. The interaction term captures the differences in endowments and coefficients that exist simultaneously between males and females. $P > 0.05$ was considered statistically significant. All analyses were performed using STATA SE v13.1, STATA CORP, United States.

Results

A total of 6812 injured trauma patients were included in the study. Of whom, 5250 were men, and 1562 were women. The descriptive characteristics of the study population are reported in Table 1. Significant differences were found between marital status, and the number of married men was found to be more than that of married women ($P < 0.001$). Of the total injured patients, 2029 cases had a high school degree, and 2061 individuals were injured between 10 am and 4 pm. Moreover, 1164 patients out of the total sample were homemakers. The distribution of the patients based on different types of trauma, occupation status, and mode of transfer to the hospital are presented in Table 1.

Table 2 shows the unadjusted difference in age, distance, and TRS between males and females. As shown in Table 2, the mean age of injured patients was 36.637 years, and significant differences were found between the mean ages of men and women (males: 36.475 versus females: 45.928 years) ($P < 0.001$). The average distance from the place of injury to the hospital was 18.326 km, and it was significantly higher for men at a 95% confidence interval: 17.119 versus 18.682 ($P = 0.052$). The average TRS was higher in women compared with men (males: 170.129 min vs. females: 208.033 min, vs. $P < 0.001$).

The OB decomposition results for the differences in the average TRS between males and females for total injuries and by types of injury are reported in Table 3. The overall gender gap (females-males) in TRS, regardless of types of trauma was 39.70 min ($P < 0.001$). The difference in the observed characteristics (endowments) between men and women explained 26.79 min of gender difference in TRS ($P = 0.06$). This result suggested that if women had similar characteristics as men, on average, the gap in TRS would be reduced by 26.79 min. The remaining difference in TRS is due to the differences in coefficients and interactions between men and women.

There were substantial gaps in the average TRS between females and males for blunt trauma (32.53 min, $P = 0.060$) and fallings (30.65 min, $P = 0.006$). The gap between females and males for penetrating trauma was 48.44 ($P = 0.066$) and traffic accidents 5.90 min ($P = 0.573$). The OB decomposition did not reveal significant contributions of endowment, coefficients, or interaction to the observed gaps for different types of trauma injuries.

There existed significant differences in the average TRS for males and females by a vehicle used to transport to the hospital. The gender gap for EMS, personal care, and other vehicles was 36.30 ($P < 0.001$), 31.72 ($P < 0.001$), −26.38 ($P = 0.783$) minutes, respectively. The OB decomposition results did not generally demonstrate significant contributions of endowment, coefficients, or interaction to the observed gender gaps in the average TRS by transportation types.

Table 4 shows the matrix of gender difference for the type of vehicle and type of injury. The coefficients of difference in the OB method were added into the table which indicates the extent of gender difference in TRS by different transportation and injury types. As shown in Table 4, the gender gap for those patients with falling trauma and transported by EMS was 64.95 min, which was statistically significantly higher than the average gender gap of EMS in all types of trauma. The gender gap in penetrating trauma and private cars was also statistically significant (−54.66 min). For other combinations of type of injury and type of vehicle, no significant relationship was found.

Discussion

Our study showed significant differences in marital status, education level, time of injury, occupation, types of trauma, mode of transfer, the average distance from the hospital, and average TRS for men and women among trauma patients in Guilan, Iran.

In the present study, falling trauma was more in women than in men followed by traffic accidents whereas in men higher traffic

Table 1: Descriptive statistics of the study population

Variables	Categories	Females (%)	Males (%)	Total (%)	Test results
Marital status	Married	985 (63.06)	2995 (57.05)	3980 (58.43)	χ^2=17.96; *P*<0.001
	Others	577 (36.94)	2255 (42.95)	2832 (41.57)	
	Total	1562 (100.00)	5250 (100.00)	6812 (100.00)	
Education level	Illiterate	610 (39.05)	719 (13.70)	1329 (19.51)	χ^2=544.72; *P*<0.001
	Primary school	331 (21.19)	1146 (21.83)	1477 (21.68)	
	Secondary school	206 (13.19)	1218 (23.20)	1424 (20.90)	
	High school	302 (19.33)	1727 (32.90)	2029 (29.79)	
	Advanced diploma	21 (1.34)	163 (3.10)	184 (2.70)	
	Bachelor degree	81 (5.19)	234 (4.46)	315 (4.62)	
	Master's degree	9 (0.58)	38 (0.72)	47 (0.69)	
	Doctorate degree	2 (0.13)	5 (0.10)	7 (0.10)	
	Total	1562 (100.00)	5250 (100.00)	6812 (100.00)	
Time of injury	6–9 am	206 (13.19)	533 (10.15)	729 (10.70)	χ^2=11.16; *P*=0.025
	10 am to 4 pm	437 (27.98)	1594 (30.36)	2061 (30.26)	
	5–7 pm	338 (21.64)	1058 (20.15)	1386 (20.35)	
	8–10 pm	295 (18.89)	1000 (19.05)	1295 (19.01)	
	11 pm to 6 am	286 (18.30)	1065 (20.29)	1341 (19.69)	
	Total	1562 (100.00)	5250 (100.00)	6812 (100.00)	
Occupation	Housewife	1083 (69.33)	81 (1.54)	1164 (17.09)	χ^2=4.23, *P*<0.001
	Unemployed	35 (2.24)	580 (11.05)	615 (9.03)	
	Retired	69 (4.42)	354 (6.74)	423 (6.21)	
	Employed	95 (6.08)	3242 (61.75)	3337 (48.99)	
	Student	146 (9.35)	654 (12.46)	800 (11.74)	
	Preschooling children	131 (8.39)	206 (3.92)	337 (4.95)	
	Have income without working	3 (0.19)	133 (2.53)	136 (2.00)	
	Total	1562 (100.00)	5250 (100.00)	6812 (100.00)	
Types of trauma	Blunt	171 (10.95)	1314 (25.03)	1485 (21.80)	χ^2=408.39, *P*<0.001
	Non-blunt	78 (4.99)	337 (6.42)	415 (6.09)	
	Traffic accidents	427 (27.34)	2018 (38.44)	2445 (35.89)	
	Falling	880 (56.34)	1535 (29.24)	2415 (35.45)	
	Others	6 (0.38)	46 (0.88)	52 (0.76)	
	Total	1562 (100.00)	5250 (100.00)	6812 (100.00)	
Mode of transfer	Using EMS services	589 (37.71)	2362 (44.99)	2951 (43.32)	χ^2=26.27, *P*<0.001
	Using private transportation	961 (61.52)	2846 (54.21)	3807 (55.89)	
	Others	12 (0.77)	42 (0.80)	54 (0.79)	
	Total	1562 (100.00)	5250 (100.00)	6812 (100.00)	

EMS: Emergency medical services

accidents than falling were observed, both of which were the first and second-most common types of trauma.

These findings are similar to other studies where traffic accidents and falling were found to be the first and second types of trauma injuries in Iran.[21,22] This is in contrast with the results of a study conducted in Oklahoma, USA, which reported falling as the most common type of trauma.[23]

This result seems to depend on the differences in traffic safety infrastructures of different countries, in which traffic accidents may rank first or others as the cause of trauma.

In the present study, the most common mode of hospital transfer was private vehicles in both men and women. Although this finding was not significant, it needs to be investigated since, despite the availability of EMS, most of them used private vehicles. In an Iranian study, the rate of patient satisfaction of the arrival time of EMS was about 68% (Jamali 2018). However, it has been reported that there is no difference in the two modes of transfer in terms of impact on mortality (Huang, Rau *et al*. 2016).

In the present study, there was a difference in the gender of the patients in terms of their mode of transfer to the hospital. The number of women using private vehicles instead of EMS was significantly higher than that of men. In a study comparing transfer by EMS and non-EMS vehicles, it was revealed that the condition of the patients in the EMS group was worse and needed more endotracheal intubation and care (Huang, Rau *et al*. 2016). Therefore, it is possible that in the present study, because a significant majority of women suffered from falling trauma and had a better general condition, they preferred to use more private vehicles. In Guilan, all EMS personnel are men, so most of the husbands of women who experience trauma prefer

Table 2: Unadjusted differences for age, distance, and time to receive services

Variables	Number of cases	Mean*	Standard deviation
Age			
Females	1562	45.92	24.29
Males	5250	36.47	19.50
Total	6812	38.63	21.12
T-statistics	15.84		P<0.001
Distance			
Females	1562	17.11	24.89
Males	5250	18.68	28.68
Total	6812	18.32	27.89
T-statistics	−1.95		P=0.05
Time			
Females	1562	208.03	243.26
Males	5250	170.12	204.25
Total	6812	178.82	214.40
T-statistics	6.15		P<0.001

*Time

private vehicles due to cultural issues. As previously reported in a study, Muslim women were more likely to be treated by a female physician (Willis, King, *et al*. 2017). In developed countries, both male and female emergency personnel are sent for each EMS request so it is recommended that in EMS personnel planning in Iran, similar changes in prehospital emergency services be made so that women benefit as much as men from EMS transfers.

In the present study, the distance from the place of trauma to the hospital was shorter in women than in men, but in terms of time their transfer to the hospital significantly took longer, and the gender difference was significant. In this regard, studies report that women were generally less likely to seek medical care than men.[24-26]

In addition, according to the OB analysis in the present study, regardless of the type of trauma, there was a total gender difference in TRS between the male and female groups and women had significantly more delayed TRS than the opposite group. The difference was 39 min, the majority (26 min) of which was related to the difference between the observed characteristics of men and women. The remaining 13 min was related to other factors. That is, regardless of the type of trauma, and even the difference in gender characteristics (i.e., if women are equal to men based on gender characteristics), women were still taken to the hospital later than men. A similar study explained that injured women seek care later than men.[27]

Another study reported that fewer ambulance alarms were used in transporting women to hospital compared with that of men.[28]

Therefore, the difference in TRS between men and women in the present study depends on the differences in the sociodemographic and clinical characteristics of the two genders, and these factors are generally the most important

Table 3: Decomposition of gender inequality in the time to receive hospital services after traumatic injuries by types of trauma and transportation

	Coefficient[a]	*P*
Total trauma		
Average TRS for females	208.04	
Average TRS for males	170.13	
Total gap (difference)	39.70	<0.001
Decomposition		
Endowments (explained part)	26.79	0.06
Coefficients (unexplained part)	16.97	0.30
Interaction	−5.85	0.78
Blunt trauma		
Average TRS for females	181.25	
Average TRS for males	148.71	
Total gap (difference)	32.53	0.06
Decomposition		
Endowments (explained part)	45.61	0.18
Coefficients (unexplained part)	35.48	0.39
Interaction	−48.57	0.36
Penetrating trauma		
Average TRS for females	164.93	
Average TRS for males	213.37	
Total gap (difference)	−48.44	0.06
Decomposition		
Endowments (explained part)	−93.54	0.26
Coefficients (unexplained part)	−55.58	0.10
Interaction	100.68	0.25
Traffic accidents		
Average TRS for females	149.38	
Average TRS for males	143.48	
Total gap (difference)	5.90	0.57
Decomposition		
Endowments (explained part)	−6.31	0.74
Coefficients (unexplained part)	12.07	0.49
Interaction	0.14	0.99
Falling		
Average TRS for females	246.18	
Average TRS for males	215.52	
Total gap (difference)	30.65	0.00
Decomposition		
Endowments (explained part)	18.5	0.47
Coefficients (unexplained part)	12.54	0.66
Interaction	−0.400	0.99
Others (violence, etc.)		
Average TRS for females	111	
Average TRS for males	119.21	
Total gap (difference)	−8.21	0.81
Decomposition		
Endowments (explained part)	168.16	0.28
Coefficients (unexplained part)	14.65	0.46
Interaction	−191.03	0.22
Transportation method: EMS		
Average TRS for females	168.89	
Average TRS for males	132.58	
Total gap (difference)	36.30	<0.001

Contd...

Table 3: Contd...

	Coefficient[a]	*P*
Decomposition		
Endowments (explained part)	11.32	0.50
Coefficients (unexplained part)	40.24	0.04
Interaction	−15.26	0.53
Transportation method: Personal cars		
Average TRS for females	231.79	
Average TRS for males	200.06	
Total gap (difference)	31.72	<0.001
Decomposition		
Endowments (explained part)	34.15	0.10
Coefficients (unexplained part)	−8.67	0.73
Interaction	6.24	0.84
Transportation method: Other (walking to hospital, bicycles, motorcycle)		
Average TRS for females	226.33	
Average TRS for males	252.71	
Total gap (difference)	−26.38	0.78
Decomposition		
Endowments (explained part)	517.28	0.71
Coefficients (unexplained part)	84.61	0.27
Interaction	−628.28	0.65

[a]The model was adjusted for marital status, education level, occupation status, types of injury, injury time, the distance between injury place and hospital, and occurring in holidays. TRS: Time to receive hospital services, EMS: Emergency medical services

Table 4: Matrix of gender difference by types of trauma and transportation using the Oaxaca-Blinder decomposition method

Types of injury	Transportation method		
	By EMS services	By private cars	Others (walking, motorcycles, bicycles)
Blunt trauma	17.52 (31.74)	28.78 (18.57)	317.18 (366.5)
Penetrating trauma	2.26 (24.05)	−54.66* (32.77)	No data
Traffic accidents	12.35 (11.56)	−34.77 (29.02)	−63.25 (64.58)
Falling	64.95** (21.57)	18.91 (13.50)	−101.13 (121.04)
Others	50.37 (97.69)	−16.73 (36.51)	−124.3* (71.28)

*Significance level was 95%. Standard errors are in parenthesis. EMS: Emergency medical services

determinants of delay in the process of receiving EMS services among women.

In our study, in terms of types of trauma, the rate of blunt trauma was different between men and women groups followed by falling trauma considering TRS. Women with these two types of trauma had significantly higher TRS than other trauma types and received relevant services later than men with the same mechanism of trauma.

Previous studies emphasize gender differences in receiving hospital services favoring men.[29,30] This means that there may be more urgency and priority and a need for a faster transmission based on the type of injury (e.g., traffic injuries) among men compared with women. Transportation of injured women usually prolonged due to the lack of urgency in certain types of injuries such as falling and blunt trauma. A study showed that patients with more severe injuries (higher injury severity score) were transferred faster.[31]

Thus, it can be concluded that this gender difference depends significantly on the mechanism of trauma (clinical factors). The TRS need more attention in women with blunt trauma and falling more than before. On the other hand, Schmittdiel (2000) reported that when people have the right to choose or the opportunity to choose, they choose a doctor willingly and even try to choose physicians of the same sex (Schmittdiel, Grumbach *et al*. 2000). Probably in the case of falling trauma and blunt trauma, women are given such an opportunity, and delays in deciding to choose a hospital will delay their arrival at the hospital.

Regarding the mode of transfer in the present study, women had significantly later TRS than men in transfer by EMS. When transferred by private vehicles, their TRS was still more delayed than men, i.e., in both common modes of transmission in Guilan, women had access to services slower than men. Therefore, a gender difference was confirmed in the mode of transmission to hospital between the groups.

It seems that the prehospital emergency system and private system deals with trauma in women differently than men, and female characteristics prolong the process of transmission. Female characteristics might have made transmission time longer for women than men.

In a previous study in Guilan, the time of transferring women with acute myocardial infarction was found to be significantly different from that of men. Women often reported more nonspecific signs of a heart attack than men, and men were more aware of the severity of the symptoms than women.[32] Therefore, informing women about the risks of late transfer to the hospital is of high importance.

In OB analysis, when comparing the type of transport vehicle and the type of trauma, the gender difference in falling trauma and transfer by EMS was significant. Furthermore, the gender difference in penetrating trauma and private transmission was significantly greater. Previous studies have confirmed such gender differences in service delivery in different types of trauma and diseases. A study in Ontario, Canada revealed a significant proportion of men, as compared with women, received medical care in the trauma, which can be attributed to unintentional gender discrimination.[7] A systematic review revealed that women with acute myocardial infarction arrived at the hospital later than men, even after adjusting for confounders such as age.[33] Gender inequalities in morbidity and mortality have also reported among patients with severe injuries in trauma centers.[7,34]

Achieving specific care in golden time or reducing response time is a permanent objective of trauma systems; if severely

injured patients are transferred to EMS quickly, they will have better survival outcomes.[31] New global positioning system data, including traffic congestion and distance, can shorten hospital transition times. Several rural trauma systems have improved their prehospital services through air transportation. They have increased their training program for EMS personnel to decrease the transmission time as much as possible.[35] Our findings highlighted that this longer transfer time was not necessarily an inequality concern within the trauma care system, and gender differences can be attributed to sociodemographic and clinical characteristics.

Limitation

The limitation of this study was that by using this method it was not possible to identify other factors influencing these gender differences including cultural factors.

Conclusion

Therefore, in Guilan, more women than men had used the private transfer mode instead of EMS, and although the distance from the place of trauma to the hospital in women was shorter than men, they were transferred later than men, with and without considering the type of trauma, there was a difference between the gender of patients at the TRS, especially in blunt trauma and falling. In both common transfers (EMS and private), women received the services later than men. The gender difference was greater in falling with transfer by EMS and the gender difference in penetrating trauma and private transfer was more. The results showed that delaying these processes are not necessarily a deliberate gender inequality, and that the resulting gender differences depend on some sociodemographic and clinical factors. Identifying all of the factors responsible for this gender difference was not one of the objectives of the present study. Furthermore, whether this gender difference is an unconscious inequality or intentionally requires further studies.

Informed consent

Informed consent was taken from the patients when performing the study.

Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent forms. In the form, the patients have given their consent for their images and other clinical information to be reported in the journal. The patients understand that their names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

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Conflicts of interest

There are no conflicts of interest.

References

1. Oteng RA, Osei-Kwame D, Forson-Adae MSE, Ekremet K, Yakubu H, Arhin B, *et al*. The preventability of trauma-related death at a tertiary hospital in Ghana: A multidisciplinary panel review approach. Afr J Emerg Med 2019;9:202-6.
2. Shahbazi F, Hashemi Nazari SS, Soori H, Khodakarim S. socioeconomic inequality in mortality from road traffic accident in Iran. J Res Health Sci 2019;19:e00437.
3. Soodejani MT, Mahmoodimanesh M, Abedi L, Ghaderi A. Traffic accident mortality in Najafabad, Iran: A time series model. J Inj Violence Res. 2019;11:48.
4. Mohtasham-Amiri Z, Dastgiri S, Davoudi-Kiakalyeh A, Imani A, Mollarahimi K. An epidemiological study of road traffic accidents in Guilan province, Northern Iran in 2012. Bull Emerg Trauma 2016;4:230-5.
5. Davies G, Chesters A. Transport of the trauma patient. Br J Anaesth 2015;115:33-7.
6. Bayiga Zziwa E, Muhumuza C, Muni KM, Atuyambe L, Bachani AM, Kobusingye OC. Road traffic injuries in Uganda: Pre-hospital care time intervals from crash scene to hospital and related factors by the Uganda Police. Int J Inj Contr Saf Promot 2019;26:170-5.
7. Gomez D, Haas B, de Mestral C, Sharma S, Hsiao M, Zagorski B, *et al*. Gender-associated differences in access to trauma center care: A population-based analysis. Surgery 2012;152:179-85.
8. Shaikh M, Peters SA, Woodward M, Norton R, Jha V. Sex differences in utilisation of hospital care in a state-sponsored health insurance programme providing access to free services in South India. BMJ Glob Health 2018;3:e000859.
9. Clarke KW, Gray D, Keating NA, Hampton JR. Do women with acute myocardial infarction receive the same treatment as men? BMJ 1994;309:563-6.
10. Greenwood BN, Carnahan S, Huang L. Patient-physician gender concordance and increased mortality among female heart attack patients. Proc Natl Acad Sci U S A 2018;115:8569-74.
11. Weiss SJ, Ernst AA, Phillips J, Hill B. Gender differences in state-wide EMS transports. Am J Emerg Med 2000;18:666-70.
12. Wohltmann CD, Spain DA, Carrillo EH, Boaz PW, ALuchette F, Kearney PA. Does gender effect outcome in trauma patients? Critical Care Med 1999;27:176A.
13. Offner PJ, Moore EE, Biffl WL. Male gender is a risk factor for major infections after surgery. Arch Surg 1999;134:935-8.
14. Oberholzer A, Keel M, Zellweger R, Steckholzer U, Trentz O, Ertel W. Incidence of septic complications and multiple organ failure in severely injured patients is sex specific. J Trauma 2000;48:932-7.
15. Johnson NJ, Carr BG, Salhi R, Holena DN, Wolff C, Band RA. Characteristics and outcomes of injured patients presenting by private vehicle in a state trauma system. Am J Emerg Med 2013;31:275-81.
16. Wandling MW, Nathens AB, Shapiro MB, Haut ER. Association of prehospital mode of transport with mortality in penetrating trauma: A trauma system-level assessment of private vehicle transportation vs. ground emergency medical services. JAMA Surg 2018;153:107-13.
17. Alavi E, Pilehvari Z, Bahrami M. Standards of helicopter emergency medical service (HEMS) for patient transport in urban areas. Tehran Univ Med J TUMS Pub 2008;66:146-57.
18. Taylor BN, Rasnake N, McNutt K, McKnight CL, Daley BJ. Rapid ground transport of trauma patients: A moderate distance from trauma center improves survival. J Surg Res 2018;232:318-24.
19. Tien HC, Jung V, Pinto R, Mainprize T, Scales DC, Rizoli SB. Reducing time-to-treatment decreases mortality of trauma patients with acute subdural hematoma. Ann Surg 2011;253:1178-83.
20. Alarhayem AQ, Myers JG, Dent D, Liao L, Muir M, Mueller D, *et al*. Time is the enemy: Mortality in trauma patients with hemorrhage from torso injury occurs long before the "golden hour". Am J Surg 2016;212:1101-5.
21. Azami-Aghdash S, Sadeghi-Bazargani H, Shabaninejad H, Abolghasem Gorji H. Injury epidemiology in Iran: A systematic review. J Inj Violence Res 2017;9:27-40.
22. Hemmati H, Chabok SY, Dehnadimoghadam A, Melksari HM, Dafchahi MA, Shabani S. Trauma in Guilan (North of Iran): An epidemiologic study. Acta Med Iran 2009:403-8.
23. Khorgami Z, Fleischer WJ, Chen YA, Mushtaq N, Charles MS, Howard CA. Ten-year trends in traumatic injury mechanisms and

outcomes: A trauma registry analysis. Am J Surg 2018;215:727-34.
24. McGinn AP, Rosamond WD, Goff DC Jr., Taylor HA, Miles JS, Chambless L. Trends in prehospital delay time and use of emergency medical services for acute myocardial infarction: Experience in 4 US communities from 1987-2000. Am Heart J 2005;150:392-400.
25. Moser DK, McKinley S, Dracup K, Chung ML. Gender differences in reasons patients delay in seeking treatment for acute myocardial infarction symptoms. Patient Educ Couns 2005;56:45-54.
26. Banks AD, Dracup K. Are there gender differences in the reasons why African Americans delay in seeking medical help for symptoms of an acute myocardial infarction? Ethn Dis 2007;17:221-7.
27. Tenenbaum A, Nordeman L, Sunnerhagen KS, Gunnarsson R. Gender differences in care-seeking behavior and healthcare consumption immediately after whiplash trauma. PLoS One 2017;12:e0176328.
28. Lewis JF, Zeger SL, Li X, Mann NC, Newgard CD, Haynes S, *et al*. Gender Differences in the Quality of EMS Care Nationwide for Chest Pain and Out-of-Hospital Cardiac Arrest. Womens Health Issues 2019;29:116-24.
29. Meischke H, Eisenberg MS, Larsen MP. Prehospital delay interval for patients who use emergency medical services: The effect of heart-related medical conditions and demographic variables. Ann Emerg Med 1993;22:1597-601.
30. Ashour A, Cameron P, Bernard S, Fitzgerald M, Smith K, Walker T. Could bystander first-aid prevent trauma deaths at the scene of injury? Emerg Med Australasia 2007;19:163-8.
31. Swaroop M, Straus DC, Agubuzu O, Esposito TJ, Schermer CR, Crandall ML. Pre-hospital transport times and survival for Hypotensive patients with penetrating thoracic trauma. J Emerg Trauma Shock 2013;6:16-20.
32. Momeni M, Salari A, Ghanbari A, Shakiba M. Sex differences in duration of pre-hospital delay in patients with acute myocardial infarction. Payavard Salamat 2013;7:133-42.
33. Nguyen HL, Saczynski JS, Gore JM, Goldberg RJ. Age and sex differences in duration of prehospital delay in patients with acute myocardial infarction: A systematic review. Circ Cardiovasc Qual Outcomes 2010;3:82-92.
34. Mackenzie EJ, Rivara FP, Jurkovich GJ, Nathens AB, Egleston BL, Salkever DS, *et al*. The impact of trauma-center care on functional outcomes following major lower-limb trauma. J Bone Joint Surg Am 2008;90:101-9.
35. Corfield AR, Adams J, Nicholls R, Hearns S. On-scene times and critical care interventions for an aeromedical retrieval service. Emerg Med J 2011;28:623-5.