Original article

Return to work after trauma: A survival analysis

Masoumeh Abedzadeh-Kalahroudi [a], Ebrahim Razi [a], Mojtaba Sehat [a, *], Mohsen Asadi-Lari [b]

[a] Trauma Research Center, Kashan University of Medical Sciences, Kashan, Iran
[b] School of Public Health, Iran University of Medical Sciences, Tehran, Iran

A R T I C L E I N F O

A B S T R A C T

Purpose: To evaluate the return to work (RTW) rate, time and predictors among trauma patients using survival analysis.
Methods: This cohort study was conducted with a three-month follow-up on 300 trauma patients hospitalized in Shahid Beheshti Hospital, Kashan, Iran in 2014. The data were collected through conducting interviews and referring to patients' medical records during their hospital stay and follow-up information at one & three months after discharge from hospital. Final analysis was conducted on the data retrieved from 273 patients. Data were analyzed by chi-square test, Mann—Whitney U test and survival analysis method.
Results: The rate of RTW at the end of the first and the third follow-up months was respectively 21.6% and 61.2%. Survival analysis showed that the RTW time (Time between admission to first return to work) was significantly longer among patients with illiteracy, drug abuse, hospitalization history in the intensive care unit, low socioeconomic status, non-insurance coverage, longer hospital stay, multiple and severe injuries as well as severe disability.
Conclusion: Our findings indicated that trauma has profound effects on the rate and time of RTW. Besides disability, many personal and clinical factors can affect the outcome of RTW.

Introduction

Trauma is the first leading cause of death and a major cause of disability of active population in developing countries.[1,2] It contributes to about 10% of disease burden worldwide.[3] Trauma mortality rate in the world and in our country, Iran, is respectively 99 and 43 cases per 100,000 people.[4] The mean incidence rate of different traumas resulting in hospitalization in Iran has been reported to be 168 cases per 1000 people,[5] much beyond data in other countries.[6,7]

The number of trauma survivors has increased in recent years. However, most of them are young people whose activities of daily living are affected by the consequences of trauma.[8] Besides imposing direct and indirect socioeconomic burdens on societies,[9] trauma also deeply affects return to work (RTW) time.[10] It is evident that long absence from work can incur considerable personal and social costs.[11] Therefore, evaluating health outcomes among trauma survivors is of paramount importance.

One of the specific criteria for trauma evaluation is RTW which can be explained by several personal, occupational, and trauma-related factors.[12] There are numerous studies with various follow-up periods on RTW, return to activities (RTA), and return to education (RTE) after trauma. These studies reported that the prevalence of RTW, RTA, and RTE is 15%—80%.[13–21] Some studies focused on certain types of trauma such as extremities,[18] or head and neck[15] traumas while others dealt mainly with multiple traumas[20] or major traumas.[17,19] Factors which have been reported as the predictors of RTW include age,[14,16,18,19,22] gender,[10,17,22] educational status,[14,16,18,20,22] socioeconomic status,[10,14,16,22] number of injured organs,[17] Injury Severity Score (ISS),[17] type of trauma,[18] spinal, brain or extremities traumas,[17,19,22] and length of hospital stay.[12,19,20] However, some other studies reported that age,[23] gender,[14,16,18] and ISS[16,18,20] do not significantly contribute to RTW.

Despite the extensive studies on RTW among trauma patients in the world, to the best of our knowledge RTW has not yet been evaluated in Iran and hence, there are limited data on the prevalence and the predictors of RTW in the country. Accordingly, this

* Corresponding author. Fax: +98 3155620634.
E-mail address: m.sehat2015@gmail.com (M. Sehat).

study was undertaken to narrow this gap. The aim of the study was to evaluate RTW rate, time, and predictors among patients with moderate-to-severe injuries in a three-month follow-up period using survival analysis. The study hypothesis was that besides the correlation of physical disability with RTW, personal, clinical, and trauma-related factors can also explain RTW variations.

Materials and methods

Study population

This cohort study was conducted with a three-month follow-up on 300 trauma patients hospitalized in Shahid Beheshti Hospital, Kashan, Iran, in 2014. Kashan County is located in the center of Iran and has a population of about 400,000 people. Shahid Beheshti Hospital is a teaching hospital and the only specialized trauma care center of Kashan. The incidence of injury in Kashan is high so that the rate of adult injury in this city (1245 per 100,000 population per year) is higher than the global rate.[24]

The inclusion criteria included age of 18–65 years, being employed prior to trauma, suffering from moderate to severe injuries (ISS ≥ 9), having no physical or mental disability before experiencing trauma, being hospitalized for at least 24 h, and residing in Kashan County. Patients who died during the study or were not accessible during the three-month follow-up period were excluded.

Measurements

Three questionnaires were used for data collection. The first questionnaire was related to participants' demographic characteristics such as age, gender, marital status, nationality, place of residence, drug abuse, insurance coverage, and socioeconomic status (SES). Patients' SES was determined through conducting principal component analysis (PCA) of data on their global assets. Accordingly, patients were divided into four quartiles based on their SES. Those below the 25th quartile and above the 75th quartile were considered as having respectively low and high SES.

The second questionnaire contained items on the characteristics of trauma such as its mechanism, place and type, the injured organ(s), the number of injured organs, ISS, hospitalization in intensive care unit (ICU), length of hospital stay, and hospital care quality. The quality of hospital care was determined by conducting PCA on indices which had been adjusted for ISS. These indices were the average number of daily visits, average daily hospital costs, ratio of emergency department stay to total hospital stay, and time interval between physician's order for patient transfer and actual transfer from emergency department to ward. Accordingly, patients were divided into three groups by the quality of the received care, including low, moderate, and high quality care. ISS was determined by using the Abbreviated Injury Scale (AIS). AIS is a predictive scoring system through which the severity of injury is determined in different parts of the body (head, neck, face, thorax, abdomen, and extremities). The items of the AIS are scored on a 0–6 scale in which higher scores are associated with lower survival rate. ISS is calculated by sum of the squares of the three highest-scored items of the AIS. The range of ISS is from 1 to 75 and if the patient has AIS score 6, the ISS is 75.[25] Then patients were categorized according to their ISS into three groups of ISS of 9–15, ISS of 16–25, and ISS > 25.[26]

The third study questionnaire was the World Health Organization Disability Assessment Schedule II (WHODAS II). WHODAS II is a valid and reliable tool among Iranian trauma patients,[27] and assesses disability in six domains of understanding and participation, getting around, self-care, getting along with others, life activities, and participation in society. It consists of twelve items which are

scored on a five-point Likert scale from 1 (No disability) to five (Severe disability). The minimum and maximum total scores of the WHODAS II are respectively 12 and 60. We changed the 12–60 scoring of the scale into a 0–100 scale. Higher scores reflect more serious disability. For survival analysis, the total score of WHODAS II was categorized into five levels as follows: 0–4: no disability; 5–25: mild disability; 26–50: moderate disability; 51–75: severe disability; and 76–100: very severe disability.[28] Finally, RTW was assessed by asking two questions: "Have you returned to work?" and "When did you return to work?"

All data were collected through interviewing patients or their family members (for unconscious patients) and referring to patients' medical records. Data on RTW and disability at one and three months after hospital discharge were gathered through telephone interviews, which were held by one of the authors.

Data analysis

The results of the Kolmogorov–Smirnov test revealed that the study variables did not have a normal distribution. The association of categorical variables (such as gender and educational status) and continuous variables (such as age and ISS) with the outcome of RTW was examined through conducting the chi-square test and the Mann–Whitney U test, respectively.

For survival analysis, the dichotomous variable of RTW and the time interval between the occurrence of trauma and first RTW time during the follow-up period were considered respectively as the outcome variable and "time to event". Accordingly, the life table estimates were calculated. The Kaplan–Meier method was used for estimating cumulative proportion of patients returning to work while the relationship of cumulative probability of RTW and each of the factors was examined via the log rank test. The effects of the study variables on the outcome of RTW were assessed through univariate survival analysis using the Cox regression while the confounding effects of other variables were adjusted via the multivariate Cox regression analysis. Accordingly, variables with a p value of 0.1 or less in univariate analysis were entered into the model; hazard ratio (HR) and confidence interval (CI) were calculated for them. The relationship of variables with potential collinearity was assessed by doing pre hoc Spearman's correlation test. If the correlation coefficient between the two intended variables was greater than 0.5, one of them was excluded from multivariate analysis. Statistical analyses were performed via SPSS v. 14.0.

Ethical considerations

The present study was approved by the Ethics Committee of Kashan University of Medical Sciences, Kashan, Iran. All patients provided written informed consent for participation in the study. They were ensured that their information would remain confidential.

Results

Among the 300 patients participating in the study, twelve patients experienced death. Fifteen patients were excluded due to being inaccessible during follow-up, i.e. a follow-up rate of 95%. Therefore, final analysis was conducted on the data retrieved from 273 patients. About 96.3% of the participants were male and all of them were employed before experiencing trauma. Their mean age was (31.7 ± 12.5) years (median, 30). During the first and third month of follow-up, respectively 21.6% and 61.2% of the patients reported RTW. In other words, 38.8% of the participants were unable to RTW mainly due to feeling partial recovery (63.8%), having sick leave (25.7%), or losing job (8.6%).

Demographic characteristics and RTW

Table 1 shows that non RTW among patients with an age of 36−55 years (46.8%) was significantly greater than other age groups and the difference among the age groups was statistically significant ($p = 0.006$). However, the difference between male and female participants in terms of RTW was not significant (60.5% vs. 80.0%). Patients with Iranian nationality had a greater RTW compared with patients with non-Iranian nationality ($p = 0.022$) while patients who lived in urban and rural areas did not differ significantly from each other regarding RTW. Moreover, the rate of RTW among drug abusers was significantly lower than non-drug abusers ($p = 0.003$). The rate of RTW among patients with high SES (71.4%) was greater than patients with low SES (51.4%); and, this difference was statistically significant ($p = 0.048$). RTW rate was also significantly higher among patients with higher education ($p = 0.041$). Finally,

Table 1
Demographic and injury characteristics of study population based on RTW status.

Variables	RTW	Non RTW	p value	X² or U value
Age group (yr)			0.006*	10.239
<35	122 (67.8)	58 (32.2)		
36−55	37 (53.2)	42 (46.8)		
>55	8 (57.1)	6 (42.9)		
Gender			0.213*	1.542
Male	159 (60.5)	104 (39.5)		
Female	8 (80.0)	2 (20.0)		
Nationality			0.022*	5.555
Iranian	153 (63.8)	87 (36.2)		
Non Iranian	14 (42.4)	19 (57.6)		
Place of Residence			0.142*	2.160
City	151 (59.9)	101 (40.1)		
Rural	16 (76.2)	5 (23.8)		
Drug abuse			0.003*	9.048
No	162 (63.5)	93 (36.5)		
Yes	5 (27.8)	13 (72.2)		
Socioeconomic class			0.048*	3.912
Low	17 (51.5)	16 (48.5)		
High	50 (71.4)	20 (28.6)		
Patient education			0.041*	6.407
Illiterate	10 (43.5)	13 (56.5)		
Under diploma	131 (60.6)	85 (39.4)		
Diploma and above	26 (76.5)	8 (23.5)		
Insurance			0.0001*	12.216
No	35 (44.9)	43 (55.1)		
Yes	132 (67.7)	63 (32.3)		
Mechanism of trauma			0.778*	1.095
Traffic accident	126 (61.8)	78 (38.2)		
Home	8 (66.7)	4 (33.3)		
Work	20 (54.1)	17 (45.9)		
Other	13 (65.0)	7 (35.0)		
Type of trauma			0.221*	1.493
Single organ	93 (64.6)	50 (35.4)		
Multiple organ	74 (57.4)	56 (42.6)		
Hospital care			0.008*	9.671
low	74 (52.5)	67 (47.5)		
Medium	74 (69.2)	33 (30.8)		
high	19 (76.0)	6 (24.0)		
Length of hospital stay (d)			0.0001*	18.258
1−6	116 (71.6)	46 (28.4)		
>6	51 (45.9)	60 (54.1)		
Injured organ				
Head	63 (58.9)	44 (41.1)	0.532*	0.390
Extremities	135 (62.8)	80 (37.2)	0.291*	1.116
Spinal	30 (61.2)	19 (38.8)	0.993*	0.00
Other organs	17 (50)	17 (50)	0.153*	2.041
ISS (Mean, SD)	12.38 ± 5.8	16.06 ± 8.8	0.001**	6718
GCS (Mean, SD)	14.63 ± 1.3	13.87 ± 2.62	0.042**	8030
WHODAS II Score (Mean, SD)	8.05 ± 11.6	34.24 ± 21.4	0.0001**	1862

Data were expressed as *n* (%) except stated otherwise. *Chi square test; **Mann Whitney *U* test.

the rate of RTW was significantly greater among patients with insurance coverage ($p = 0.0001$).

Trauma characteristics and RTW

Regarding the mechanism of trauma, non RTW was more common among patients who had experienced occupational injuries; however, the difference among the groups was not statistically significant. Moreover, RTW among patients with isolated traumas was not significantly different from patients with multiple traumas. RTW rate among patients who had received high quality hospital care was significantly higher than patients receiving low quality care (76.0% vs. 52.5%, $p = 0.008$). Moreover, patients with longer hospital stay had significantly lower RTW rate compared with patients whose hospital stay was 1−6 days. Finally, patients who returned to work had significantly lower ISS, higher Glasgow Coma Scale (GCS) score, and lower WHODAS II score compared with patients who failed to RTW (Table 1).

The Kaplan−Meier analysis and RTW

The life table estimates of survival analysis revealed that the rate of non RTW in the first post-trauma week was 96%. Twelve and twenty weeks after trauma, this rate decreased respectively to 52% and 18%. The mean of RTW time was 85.14 days (median, 92) with a standard error of 2.8 days, denoting that 95% of patients had returned to work until the 91st post-trauma day.

Table 2 shows the mean of RTW time for all 167 patients who returned to work based on other study variables. The Kaplan−Meier analysis indicated that the mean of RTW time among female and male patients was 66.7 and 85.9 days. However, the log rank test showed that this difference between male and female patients was not statistically significant. Moreover mean RTW time of patients with an age of 36−55 years was significantly longer than other age groups ($p = 0.003$). Besides, the mean RTW time of patients living in urban areas and patients with Iranian nationality was longer; however, the difference between the groups was not statistically significant. The mean RTW time of drug abuse and non-drug abuse patients was 117.0 and 83.3 days. The log rank test revealed that this difference was statistically significant ($p = 0.004$). In addition, the results of the log rank test illustrated that RTW survival rate of participants who had low SES, suffered from more severe disability, had no insurance, and were illiterate was significantly higher than other groups.

Individuals who had experienced isolated traumas returned to their work within significantly shorter amount of time compared with individuals suffering from multiple traumas ($p = 0.016$). Moreover, participants with occupational injuries had a longer RTW time albeit the difference among the groups was not significant. In addition, RTW survival rate among patients who had received high quality care was significantly lower than patients receiving low quality care (65.5 days vs. 97.2 days, $p = 0.000$). The results of the log rank test also demonstrated that moderate injuries, non-hospitalization in ICU, and shorter hospital stay were significantly associated with lower RTW survival rate (Table 2).

Cox regression analysis and RTW

The results of univariate Cox regression analysis indicated a strong correlation between RTW time and age, drug abuse, educational status, insurance coverage, disability score, ISS, hospital care quality, trauma type, admission to ICU, and length of hospital stay (Table 3). Multivariate analysis was conducted for evaluating and comparing the importance of each factor in predicting RTW time. The variable of "admission to ICU" was excluded from multivariate analysis due to its collinearity with ISS.

Table 2
Kaplan—Meier Estimate of the cumulative proportion of patients RTW survival rate and their characteristics.

Variables	No.	Estimate of RTW survival rate	Standard error	Log-rank
Sex				0.182
Female	10	66.7	11.9	
Male	263	85.9	2.8	
Age (yr)				0.003
<35	180	77.3	3.3	
36—55	79	99.2	4.3	
>55	14	83.0	9.2	
Place of resident				0.197
Rural	21	75.8	8.2	
City	252	85.7	2.9	
Nationality				0.082
Iranian	240	84.2	2.9	
Non Iranian	33	86.9	8	
Drug abuse				0.004
Yes	18	117.0	7.1	
No	255	83.3	2.9	
Socioeconomic status				0.094
Low	33	87.3	7.7	
High	70	73.9	4.1	
Patient education				0.004
Illiterate	23	94.9	8.8	
Under diploma	149	90.3	3.8	
Diploma and higher	101	73.7	4.1	
Insurance				0.002
No	78	93.0	5.1	
Yes	195	81.6	3.2	
Disability degree				0.000
None	77	47.7	3.4	
Mild-Moderate	169	90.4	2.9	
Severe and very severe	27	137.0	1.7	
Trauma type				0.016
Single organ	144	78.4	3.7	
Multiple organ	129	91.4	3.9	
Mechanism of accident				0.653
Motor vehicle	204	84.3	3.3	
Home	12	73.7	8.3	
Work	37	90.9	4.9	
Other	20	75.8	8.9	
Hospital care				0.000
Low	141	97.2	3.5	
Medium	107	69.1	3.9	
High	25	65.5	5.7	
ISS				0.000
9—15	205	74.7	3.0	
16—24	42	108.9	5.8	
≥25	26	118.7	4.9	
ICU stay				0.000
Yes	39	113.6	5.5	
No	230	77.4	3.1	
Length of hospital stay (d)				0.000
1—6	162	64.2	2.4	
>6	111	103.3	3.9	

Accordingly, the results of multivariate analysis showed that the probability of RTW was greater among patients who had younger age, insurance, lower disability score, and who received high quality hospital care. Although the results of univariate analysis revealed that the factors of drug abuse and higher education were significantly correlated with RTW, the correlation of these factors with RTW was not statistically significant in multivariate analysis (Table 3). This finding can be attributed to the confounding effects of these factors. Figs. 1—4 (the Kaplan—Meier plot) depict a bidirectional correlation between RTW and its predictors.

Discussion

This study employed survival analysis to examine post-trauma RTW time and its predictors during a three-month follow-up period. The findings revealed that 61.2% of patients achieved RTW during the follow-up period. This is almost congruent with the findings of the previous studies. For instance, Meerding et al[12] reported a RTW rate of 61% during two months. Clay et al[18] also found that 68% of their participants returned to work during the first six months after trauma. In addition, the four-month RTW rate in a study conducted by Kendrick et al[10] was 57%. However, Lehmann et al[15] found that RTW rate after five years from experiencing severe head injuries was 42%. Moreover, RTW rate in studies conducted by Mackenzie et al[16] and Vles et al[17] was slightly higher than our study. These conflicting findings can be attributed to the differences in characteristics of the studies such as follow-up period, study population, inclusion criteria, and definition of RTW as well as patients' access to healthcare services.

Demographic factors

Our findings showed that the mean RTW time in the age group of 36—55 years was significantly longer than other age groups. Other studies also have reported a negative correlation between age and recovery from traumas.[16,18,29] This finding not only indicates slower recovery with increasing age, but also denotes the greater difficulty of maintaining employment stability following long absence from work. Cox regression analysis also revealed a strong correlation between age and RTW time in that the risk of non RTW increased by 2% with each one year increase in age. This finding was also in line with the findings of a study conducted by Mackenzie et al[16] which showed that patients' age was a predictor for RTW. They also found that the probability of RTW among patients with an age of 18—24 years was three times more than patients with an age of 45 years or greater. Other studies also demonstrated that age is a predictor for RTW.[14,18,19,22]

Study findings also indicated no significant difference between male and female participants regarding RTW survival rate and time. Moreover, Cox regression analysis also revealed that gender was not a predictor for RTW. This is congruent with the findings of previous studies.[11,13,14] However, several other studies reported gender as a predictor for RTW.[10,17,22] This conflicting finding can be attributed to greater proportion of male participants in our study.

Our findings also demonstrated that although RTW survival rate among patients with Iranian nationality was significantly lower than non-Iranian participants, the difference between these two groups regarding RTW time was not significant. Higher RTW rate among Iranian participants is probably due to the facts that Iranian individuals usually secure official employment or are self-employed and have insurance and better SES while non-Iranians are mainly construction or farm workers who have no strong financial and insurance support and lose their employment during convalescence.

RTW survival rate was also higher among patients residing in urban areas although the difference between these patients and patients living in rural areas was not statistically significant. Villagers are usually engaged in agriculture and animal husbandry and therefore, they need to return to their work early due to having no strong financial and insurance support.

RTW survival rate and RTW time among drug abusers was also significantly greater than non-drug abusers. However, once adjusting the effects of confounding factors using multivariate analysis, drug abuse was not identified as a predictor for RTW. Mackenzie et al[16] also found that alcohol abuse was significantly associated with lower RTW while regression analysis in their study showed that this factor was not a significant predictor of RTW. Drug abuse is correlated with individuals' employment, educational, and socioeconomic status and drug abusers usually

Table 3
Results of univariate and multivariate Cox regression analysis on RTW event.

Variable		Unadjusted			Adjusted		
		p value	*OR*	95% *CI*	*p* value	*OR*	95% *CI*
Sex	Female		1				
	Male	0.195	0.62	0.30—1.27	–	–	–
Age		0.000	0.97	0.96—0.98	0.016	0.98	0.96—0.99
Place of resident	Rural		1				
	City	0.202	0.71	0.42—1.19	–	–	–
Nationality	Non Iranian		1				
	Iranian	0.087	1.61	0.93—2.85	–	–	–
Drug abuse	Yes		1				
	No	0.007	3.43	1.40—8.38	–	–	–
Socioeconomic status	Low		1				
	High	0.100	1.61	0.91—2.77	–	–	–
Patient education	Illiterate		1				
	Under diploma	0.180	1.54	0.81—2.93	–	–	–
	Diploma and Higher	0.017	2.44	1.17—5.09	–	–	–
Insurance	No		1				
	Yes	0.003	1.76	1.21—2.56	0.026	1.55	1.05—2.29
Disability degree		0.000	0.91	0.90—0.93	0.000	0.95	0.94—0.96
Trauma type	Multiple organ		1				
	Single organ	0.017	1.45	1.06—1.98	–	–	–
ISS		0.000	0.92	0.89—0.95	0.056	0.96	0.93—1.001
Hospital care	Low		1				
	Medium	0.058	1.42	0.98—2.05	0.238	1.38	0.80—2.37
	High	0.002	1.83	1.25—2.68	0.021	1.52	1.06—2.18
ICU stay	Yes		1				
	No	0.000	3.23	1.83—5.68	–	–	–
Length of hospital stay (d)	>6		1				
	1—6	0.000	3.03	2.09—4.39	–	–	–

have no employment stability and may lose employment following traumatic injuries.

We also found that although RTW survival rate among patients with high SES was lower than patients with low SES, the difference between these two groups was not statistically significant. Generally, individuals from lower socioeconomic class have smaller income and inadequate insurance and hence, have limited access to rehabilitation services. Therefore, their recovery is slower and their RTW is longer. Moreover, they lack employment stability.

Accordingly, the findings of the present study revealed that SES cannot be an independent predictor for RTW time while several studies reported it as a significant predictor for RTW.[10,14,16,22] This difference may be due to implementation of health system reform in Iran, in which out of pocket payments for medical care are reduced.

Participants who had insurance were more likely to RTW. The Kaplan—Meier analysis also showed longer RTW survival rate among patients without insurance coverage. Lack of
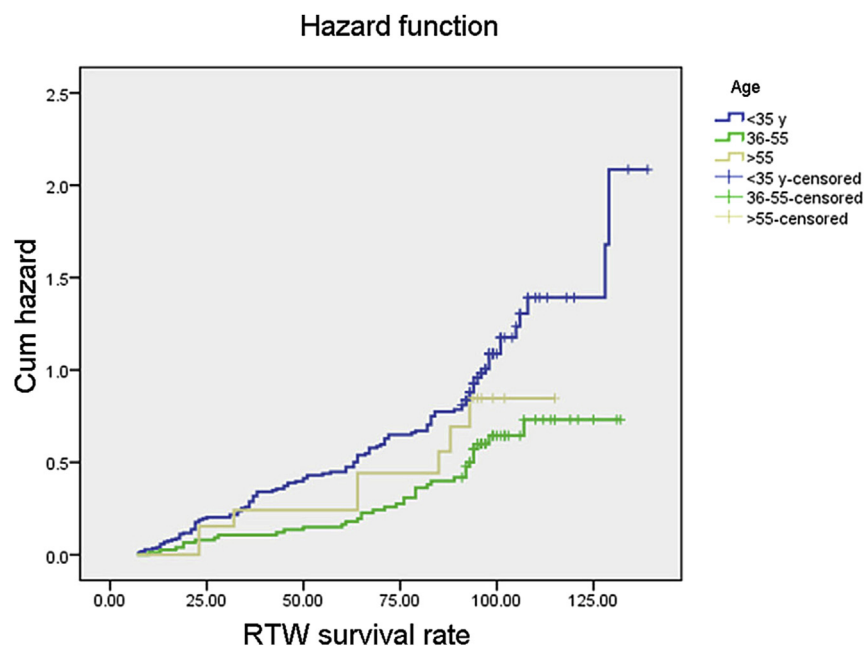

Fig. 1. Correlation between RTW and age.
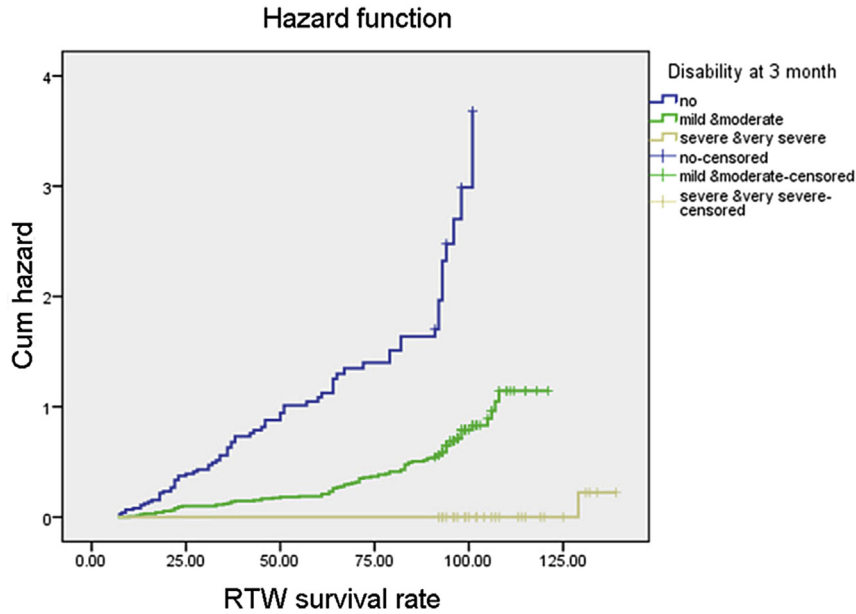
Hazard function

Fig. 2. Correlation between RTW and disability at 3 months.

insurance can be associated with more limited access to healthcare services and longer recovery period. On the other hand, in Iran, individuals who have employment stability are provided with insurance. Moreover, employment stability is considered as a significant factor in RTW. The results of Cox regression analysis showed that after adjusting confounding variables, the odds of RTW among patients with insurance coverage increased by 50%.

Clinical factors

Our findings showed that RTW survival rate among patients with moderate ISS (i.e. an ISS of 9–15) was significantly lower than other patients. Patients with major traumas usually have a longer

hospital stay, recovery, and rehabilitation and hence, delayed RTW among them is expected. However, in the Cox regression analysis ISS was not as a predictor for RTW. Some studies also reported trauma severity as a predictor of RTW,[17,20,22] while Clay et al[18] found that it was not an RTW predictor due to the overlapping effects of ISS and length of hospital stay.

Individuals with isolated traumas had significantly shorter RTW survival rate. Isolated traumas are usually less severe and are associated with milder disability. Accordingly, these patients achieve recovery and RTW in relatively shorter period of time. Nonetheless, in Cox regression analysis, the type of trauma was not identified as a predictor of RTW. Clay et al[18] also found that the probability of early RTW was higher among patients with isolated orthopedic injuries.
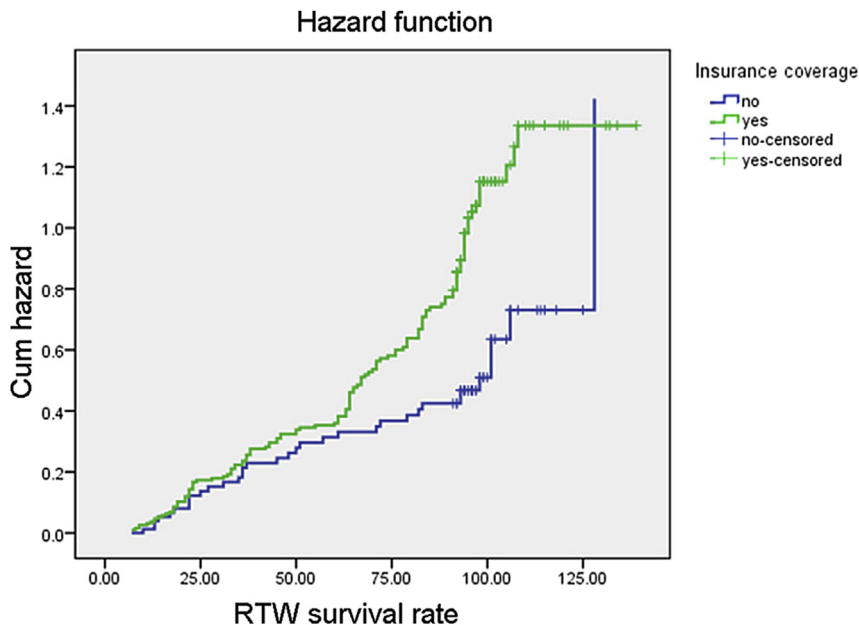
Hazard function

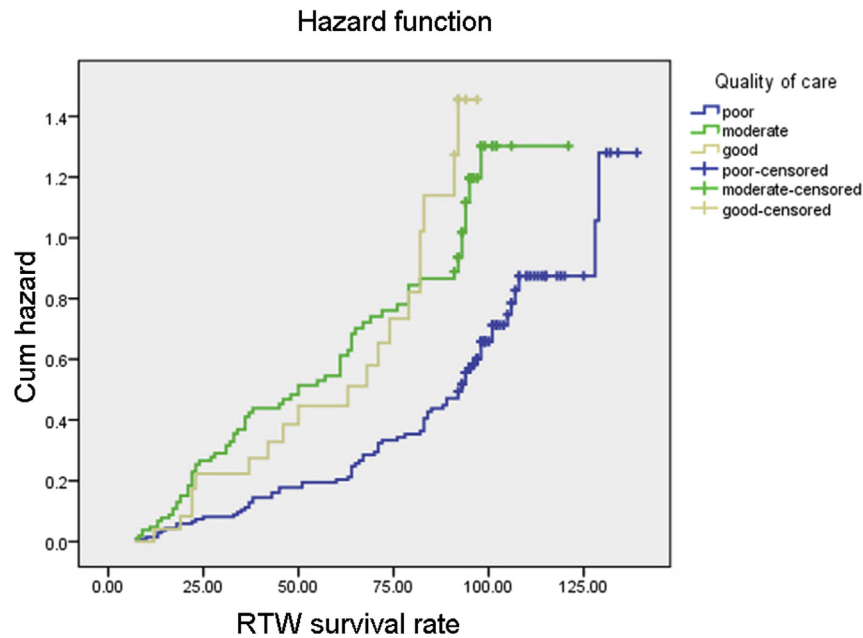**Fig. 3.** Correlation between RTW insurance coverage.

Hazard function

Fig. 4. Correlation between RTW and quality of care.

RTW survival rate and time among patients with longer hospital stay were respectively higher and longer than patients with shorter hospital stay. Soberg et al[20] also reported the same finding. Seemingly, patients with shorter hospital stay suffer from less severe traumas and hence, their recovery and RTW are faster. The factor of length of hospital stay was not entered into the regression model due to its collinearity with ISS. However, previous studies reported it as a predictor for RTW.[12,19,20]

Our results also indicated that RTW survival rate among patients who received high quality care was significantly lower than patients receiving low quality care. The results of the Cox regression analysis also showed that after controlling the effects of confounding variables, care quality was a predictor of RTW among patients with trauma. Accordingly, the odds of RTW among patients receiving moderate and high quality care was respectively 38% and 52% more than patients receiving low quality care. To the best of our knowledge, none of the previous studies assessed the value of care quality in predicting RTW and hence, comparison of our findings relating to care quality with other studies was not possible. It seems that higher care quality is associated with faster recovery period and consequently quicker RTW.

We also found that the mean score of WHODAS II in patients who returned to work was significantly lower than patients with non RTW. The Kaplan–Meier analysis showed that RTW survival rate was higher among patients with severe and very severe disabilities. Cox regression analysis also indicated that disability score was a predictor for RTW time. In other words, each one point increase in the WHODAS II score was associated with 5% increase in the risk of non RTW. In line with our findings, Mackenzie et al[16] also reported that disability was a strong predictor for RTW. However, Soberg et al[20] found that disability cannot predict RTW probably due to its moderate correlation with length of hospital stay.

To the best of our knowledge, this was the first study in its kind which assessed RTW among patients experiencing trauma in Iran. The strengths of this study were its cohort and prospective design, low attrition rate (a follow-up rate of 95%), and use of a valid and reliable instrument for disability assessment. On the other hand, the limitations of the study were its relatively short follow-up and heterogeneous sample.

Conclusion

The findings of the present study showed that trauma has profound effects on the rate and the time of RTW. The causality pathway from trauma to disability and RTW is a complex pathway and many personal and clinical factors other than disability can affect the outcome of RTW. These factors are age, insurance coverage, disability degree and care quality. Therefore, these factors need to be evaluated in larger-scale, longer-term studies with more homogeneous samples in terms of the type and the severity of traumas. Care quality and insurance coverage are factors which deserve special attention and more rigorous evaluation. Moreover, conducting interventional studies is recommended for pinpointing patients who are at risk for non RTW.

Acknowledgements

References

1. London JA, Mock CN, Quansah RE, et al. Priorities for improving hospital-based trauma care in an African city. *J Trauma*. 2001;51:747–753.
2. Krug EG, Sharma GK, Lozano R. The global burden of injuries. *Am J Public Health*. 2000;90:523–526.
3. Murray CJ, Lopez AD. Mortality by cause for eight regions of the world: global burden of disease study. *Lancet*. 1997;349:1269–1276.
4. Azizi A, Abdoli G. Mortality rates in Kermanshah province – 2000. *J Kermanshah Univ Med Sci*. 2003;7:10–17.
5. Hafezi-Nejad N, Rahimi-Movaghar A, Motevalian A, et al. Population-based incidence and cost of non-fatal injuries in Iran: a consistent under-recognized public health concern. *Public Health*. 2015;129:483–492. http://dx.doi.org/10.1016/j.puhe.2015.01.016.
6. Vyrostek SB, Annest JL, Ryan GW. Surveillance for fatal and nonfatal injuries–United States, 2001. *MMWR Surveill Sum*. 2004;53:1–57.
7. Smith GS, Wellman HM, Sorock GS, et al. Injuries at work in the US adult population: contributions to the total injury burden. *Am J Public Health*. 2005;95:1213–1219.
8. Barker M, Power C, Roberts I. Injuries and the risk of disability in teenagers and young adults. *Arch Dis Child*. 1996;75:156–158.

9. Zamani M, Esmailian M, Mirazim MS, et al. Cause and final outcome of trauma in patients referred to the emergency department; a cross sectional study. *Iran J Emerg Med*. 2014;1:22–27.

10. Kendrick D, Vinogradova Y, Coupland C, et al. Getting back to work after injury: the UK Burden of Injury multicentre longitudinal study. *BMC Public Health*. 2012;12:584.

11. Dembe AE. The social consequences of occupational injuries and illnesses. *Am J Ind Med*. 2001;40:403–417.

12. Meerding WJ, Looman CW, Essink-Bot ML, et al. Distribution and determinants of health and work status in a comprehensive population of injury patients. *J Trauma*. 2004;56:150–161.

13. Du CL, Lai CF, Wang JD. Delayed return-to-work in workers after non-severe occupational upper extremity fracture in Taiwan. *J Formos Med Assoc*. 2007;106:887–893.

14. Hou WH, Tsauo JY, Lin CH, et al. Worker's compensation and return-to-work following orthopaedic injury to extremities. *J Rehabil Med*. 2008;40:440–445. http://dx.doi.org/10.2340/16501977-0194.

15. Lehmann U, Pape HC, Seekamp A, et al. Long term results after multiple injuries including severe head injury. *Eur J Surg*. 1999;165:1116–1120.

16. MacKenzie EJ, Morris Jr JA, Jurkovich GJ, et al. Return to work following injury: the role of economic, social, and job-related factors. *Am J Public Health*. 1998;88:1630–1637.

17. Vles WJ, Steyerberg EW, Essink-Bot ML, et al. Prevalence and determinants of disabilities and return to work after major trauma. *J Trauma*. 2005;58: 126–135.

18. Clay FJ, Newstead SV, Watson WL, et al. Determinants of return to work following non life threatening acute orthopaedic trauma: a prospective cohort study. *J Rehabil Med*. 2010;42:162–169. http://dx.doi.org/10.2340/16501977-0495.

19. Holtslag HR, Post MW, van der Werken C, et al. Return to work after major trauma. *Clin Rehabil*. 2007;21:373–383.

20. Soberg HL, Finset A, Bautz-Holter E, et al. Return to work after severe multiple injuries: a multidimensional approach on status 1 and 2 years postinjury. *J Trauma*. 2007;62:471–481.

21. Abedzadeh-Kalahroudi M, Razi E, Sehat M, et al. Measurement of disability and its predictors among trauma patients: a follow-up study. *Arch Trauma Res*. 2015;4:e29393. http://dx.doi.org/10.5812/atr.29393.

22. MacKenzie EJ, Shapiro S, Smith RT, et al. Factors influencing return to work following hospitalization for traumatic injury. *Am J Public Health*. 1987;77: 329–334.

23. Lilley R, Davie G, Ameratunga S, et al. Factors predicting work status 3 months after injury: results from the Prospective Outcomes of Injury Study. *BMJ Open*. 2012;2:e000400. http://dx.doi.org/10.1136/bmjopen-2011-000400.

24. Fazel MR, Fakharian E, Mahdian M, et al. Demographic profiles of adult trauma during a 5 year period (2007-2011) in Kashan, IR Iran. *Arch Trauma Res*. 2012;1: 63–66. http://dx.doi.org/10.5812/atr.6770.

25. Champion HR, Copes WS, Sacco WJ, et al. The Major Trauma Outcome Study: establishing national norms for trauma care. *J Trauma*. 1990;30:1356–1365.

26. Brasel KJ, Guse CE, Layde P, et al. Rib fractures: relationship with pneumonia and mortality. *Crit Care Med*. 2006;34:1642–1646.

27. Abedzadeh-kalahroudi M, Razi E, Sehat M, et al. Psychometric properties of the world health organization disability assessment schedule II -12 Item (WHODAS II) in trauma patients. *Injury*. 2016;47:1104–1108. http://dx.doi.org/10.1016/j.injury.2015.11.046.

28. Virues-Ortega J, de Pedro-Cuesta J, Seijo-Martinez M, et al. Prevalence of disability in a composite ≥75 year-old population in Spain: a screening survey based on the International Classification of Functioning. *BMC Public Health*. 2011;11:176. http://dx.doi.org/10.1186/1471-2458-11-176.

29. Cheadle A, Franklin G, Wolfhagen C, et al. Factors influencing the duration of work-related disability: a population-based study of Washington State workers' compensation. *Am J Public Health*. 1994;84:190–196.