ORIGINAL ARTICLE

Spinal cord injury rehabilitation in Riyadh, Saudi Arabia: time to rehabilitation admission, length of stay and functional independence

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Objectives: (1) To describe functional status, length of stay (LOS) and time to rehabilitation admission trends. (2) To identify independent predictors of motor function following rehabilitation.

Study Design: Retrospective cohort study.

Setting: Spinal injury rehabilitation unit at King Fahad Medical City, Riyadh, Saudi Arabia.

Methods: From chart review of 312 traumatic and 106 nontraumatic adult patients with spinal cord injury (SCI) we extracted information on time from injury to rehabilitation admission, rehabilitation LOS, Functional Independence Measure (FIM) motor score (admission and discharge), American Spinal Injury Association Impairment Scale (AIS) grade and demographics. Hierarchical regression was employed to investigate variables associated with discharge FIM motor score for traumatic and nontraumatic SCI.

Results: Mean $\pm$ s.d., median days from injury to rehabilitation admission were 377 ± 855 , 150 days for traumatic SCI and 288 ± 403 , 176 days for nontraumatic SCI. For individuals with traumatic SCI, after accounting for admission FIM motor score, tetraplegia and time from injury to rehabilitation admission had a significant but small negative association with discharge FIM motor score. For individuals with nontraumatic SCI, increasing age and higher AIS grade had a significant negative association with discharge FIM motor score.

Conclusions: Shorter time from injury to rehabilitation admission may improve outcomes for those with traumatic SCI. As time spent in rehabilitation was shorter than in most other countries, a change in practice in this area may be warranted. Developing strategies to improve outcomes for older patients with nontraumatic SCI would also be beneficial.

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INTRODUCTION

Compared with western countries, limited research on spinal cord injury (SCI) has been conducted in Saudi Arabia, which reports one of the highest rates of road traffic accidents globally¹ and consequently, one of the highest rates of traumatic SCI in the world.^{1,2} Spinal cord injury requires intensive and specialized clinical rehabilitation³ and starting rehabilitation as soon as possible has been found to improve functional outcome at discharge.^{4–6} Therefore, it is important to identify trends in time to rehabilitation admission and rehabilitation length of stay (LOS), and explore their relationship with functional recovery.

Internationally, there is wide variation in the time from injury to rehabilitation admission among people with traumatic SCI. In the United States, time from injury to rehabilitation (usually spent in acute care) was reported recently to be 11 days on average.⁷ In China, a mean acute care LOS of 32 days (median 21 days) has been estimated.⁸ An average of 45 days from injury to admission to a specialized spinal unit has been reported in India.⁹ Two multi-center studies from Italy found that mean time from injury to admission was 37 days¹⁰ and 55 days.¹¹ A mean time of 37 days was reported in a recent study in Saudi Arabia.¹²

The onset of a nontraumatic SCI across conditions is variable; however, researchers often use admission to acute care as the date of onset when assessing time to rehabilitation admission. With this in mind, in Italy, Celani *et al.*¹¹ reported a time from onset to rehabilitation admission for nontraumatic SCI of 167 days (median 57 days). In a Dutch study, nontraumatic SCI patients stayed a median of 23 days in an acute care hospital prior to rehabilitation admission.¹³ We were unable to identify any published information on the amount of time from injury to rehabilitation admission for nontraumatic SCI in Saudi Arabia.

Once patients are admitted to rehabilitation the average LOS for traumatic SCI also varies considerably between countries. In the United States, median LOS ranges from 29 to 59 days, depending on injury.¹⁴ Examples of mean rehabilitation LOS in European countries span from a low of 47 days in Russia,¹⁵ up to 240 days in the Netherlands.¹⁶

Nontraumatic SCI LOS in rehabilitation is variable also, but generally shorter in comparison with LOS for traumatic SCI. A retrospective analysis of nontraumatic SCI in nine countries (Australia, Canada, Italy, India, Ireland, The Netherlands, Switzerland, the United Kingdom and the United States), showed median LOS in spinal rehabilitation units ranging from 13 days in the United States to

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143 days in the United Kingdom and an overall median LOS for all countries of 46.5 days.¹⁷ In Saudi Arabia, an average rehabilitation LOS for traumatic SCI of 59 days and nontraumatic SCI of 46 days, respectively, has been reported.¹⁸

Etiology of SCI appears to have an effect on functional outcomes. Functional independence has been shown to be lower in nontraumatic SCI than traumatic SCI^{19,20} though Ones *et al.*²¹ showed no such difference. Variation in motor functional outcome for traumatic SCI has been related to severity of neurological injury, degree of disability at admission, age, complications and other demographic variables.^{22–27} In a study of 100 patients with nontraumatic SCI, Van der Putten²⁸ found the primary factors associated with improved Functional Independence Measure (FIM) motor change score (accounting for 54% of the variance) were admission FIM motor score and reduced time from symptom onset to admission to the neurorehabilitation unit. In a Dutch study, neurological completeness and level of injury, and LOS have been associated with changes in FIM motor scores.¹³ A study in Saudi Arabia among those with traumatic SCI found FIM motor change score to have a negative association with FIM motor score at admission, level and severity of injury, anxiety/depression score, and time between injury and admission to rehabilitation, and a positive association with rehabilitation LOS.¹²

Given high rates of SCI in Saudi Arabia and limited research on predictors of functional outcomes, especially among those with nontraumatic SCI, we conducted a study with the following objectives: (1) to describe the amount of time from injury to rehabilitation admission and LOS in rehabilitation for individuals with traumatic and nontraumatic SCI, and (2) to identify factors impacting motor FIM score at discharge from rehabilitation for individuals with traumatic and nontraumatic SCI. For both groups we expected that time to admission and LOS in rehabilitation would be longer than that for other countries. We hypothesized that after controlling for admission FIM motor score, time to admission and LOS in rehabilitation would significantly contribute to predicting discharge FIM motor score.

MATERIALS AND METHODS

Participants

In this retrospective cohort study, data were obtained from chart review of individuals with traumatic and nontraumatic SCI discharged from the inpatient rehabilitation program at King Fahad Medical City–Rehabilitation Hospital located in Riyadh, Saudi Arabia between 2009 and 2014.

Nontraumatic SCI was defined as a neurological impairment resulting from spinal stenosis, tumor, ischemia, transverse myelitis or infection.²⁰ Charts were included for review if individuals were new admissions to rehabilitation and were ≥ 16 years of age. No patients with American Spinal Injury Association Impairment Scale (AIS) grade D injury were included in this study because the Rehabilitation Hospital manages such patients through outpatient care. Patients are admitted to this facility from a variety of sources, including home, acute care and facility placement. The study protocol was approved by the King Fahad Medical City medical ethics committee.

Data collection

Data extracted from chart review included: age, sex, injury level (paraplegia/tetraplegia), AIS grade, time from injury to rehabilitation admission, LOS in rehabilitation, discharge setting (for example, community dwelling, assisted living, chronic hospital) and the FIM motor score, which was assessed at admission and discharge from inpatient rehabilitation.

The FIM measures the level of independence in activities of daily living. The FIM is an 18-item assessment composed of 13 motor tasks (eating, grooming, bathing, upper body dressing, lower body dressing, toileting, bladder management, bowel management, bed to chair transfer, toilet transfer, shower transfer, locomotion (ambulatory or wheelchair level) and stairs) and five

cognitive tasks that were not included in our analyses as the FIM cognitive score is affected by a ceiling effect when used with persons with SCI.^{23,29} Each item is scored on a 7-point ordinal scale ranging from 1 (total dependence) to 7 (total independence). The inter-rater reliability, validity and responsiveness of the FIM are well established.^{30–32} The FIM is a widely used tool in rehabilitation³³ and is the major source of functional status information in North American rehabilitation data systems.^{34,35}

Data analysis

Descriptive statistics (means, s.d.s, medians, frequencies) for patient demographics were performed. For the FIM motor score, a mixed model analysis of variance was used to investigate changes between admission and discharge for individuals with traumatic versus nontraumatic SCI. Effect size (partial eta squared) was calculated (small effect size = 0.01, a medium effect size = 0.06 and a large effect size = 0.14).³⁶

Separate hierarchical regressions were used for patients with traumatic and nontraumatic SCI to identify independent predictors of discharge FIM motor score while controlling for admission FIM motor score, demographic variables and injury characteristics. The variable entered into the first block was admission FIM motor score, variables entered into the second block included demographics (age and gender) and type of injury (tetraplegia/paraplegia and AIS grade), and variables entered into the third block included time from injury to rehabilitation admission and LOS in rehabilitation. Diagnostics were performed to look for the presence of multivariate outliers and to ensure that statistical assumptions were not violated.

Alpha was set at $P \leq 0.05$. Statistical software, SPSS 21 (SPSS Inc., Chicago, IL, USA) was used for all analyses.

RESULTS

Patient demographics

A total of 532 patients with SCI were discharged from inpatient rehabilitation between 2009 and December 2014. Of these, 40 were readmissions, 18 were under 16 years of age, 57 were categorized as having SCI other than paraplegia or tetraplegia and six fulfilled more than one of the previous criteria, and were excluded. Of the 423 patients eligible for entry into the study, five (1%) patients were not included in analyses because FIM data were not available. Thus, 418 patients were included for data analysis. Demographic information is provided in Table 1. Male patients with traumatic SCI composed ~75% of the sample, and $\geq 90\%$ were discharged home. The mean age was 35 ± 17 years though this depended on etiology, with individuals of nontraumatic etiology being older (Table 1).

Time from injury to rehabilitation admission

For individuals with traumatic SCI, time from injury to rehabilitation admission averaged 377 ± 855 days, the median value was 150 days and the range was 4–9820 days (Table 1). The average time from injury to rehabilitation admission was ~100 days lower in individuals with nontraumatic SCI (288 ± 403) (median = 176 and range 5–2211 days).

Rehabilitation LOS

For traumatic SCI, the average LOS in rehabilitation was 84 ± 60 days, median days were 70 and range was 4–419 days. In nontraumatic SCI, average LOS was significantly lower at 64 ± 59 days, a median value of 49 days and a range of 9–449 days (Table 1).

FIM motor score

There was a statistically significant main effect for time ($F(1,416) = 724.2$, $P < 0.0005$, partial eta squared = 0.6) where both individuals with traumatic and nontraumatic SCI exhibited improved FIM motor scores from admission to discharge (Table 2). There was a statistically significant main effect for group ($F(1,416) = 8.0$, $P = 0.005$, partial eta

Table 1 Demographics for individuals with SCI discharged from inpatient rehabilitation

Variable	Traumatic SCI	Nontraumatic SCI
<i>n</i>	312	106
Sex (M/F)	244/68 (78/22)	78/28 (74/26)
Paraplegia/tetraplegia	239/73 (77/23)	95/11 (90/10)
AIS grade (A,B,C,D)	261/25/26/0 (84/8/8/0)	58/12/36/0 (55/11/34/0)
Age, years	31.4 ± 14.4, 26	43.8 ± 19.4, 43
Time to rehabilitation admission, days	377.2 ± 854.8, 150	288.0 ± 402.8, 176
LOS in rehabilitation, days	84.8 ± 59.7, 70	63.9 ± 58.7, 49

Abbreviations: AIS, American Spinal Injury Association Impairment Scale; LOS, length of stay; *n*, number of patients; SCI, spinal cord injury. Values are *n* (%) or mean ± s.d., median.

Table 2 FIM motor scores at admission and discharge from inpatient SCI rehabilitation

Variable	Admission	Discharge	Change
Traumatic SCI	33.6 ± 17.9	58.9 ± 21.2	25.3 ± 16.4
Nontraumatic SCI	40.5 ± 16.9	63.4 ± 21.7	22.9 ± 14.5

Abbreviations: FIM, Functional Independence Measure (Motor score = 13–91); SCI, spinal cord injury. All values are means ± s.d.

squared = 0.02) where individuals with nontraumatic SCI had higher FIM motor scores at admission and discharge than individuals with traumatic SCI (Table 2). As evidenced by the partial eta squared, despite reaching statistical significance, the actual difference in mean scores between groups was quite small.

Predictors of discharge FIM motor score

For traumatic SCI, the largest contributor to discharge FIM motor score in the regression model was admission FIM motor score (which accounted for 44% of the model). Discharge FIM motor score had a significant negative association with tetraplegia compared with paraplegia and with days from injury to rehabilitation admission but these variables explained only a small part of the variance of discharge FIM motor score (6%). Days from injury to rehabilitation admission was a weak predictor of discharge FIM motor score (Table 3). LOS in rehabilitation was not a significant predictor.

For nontraumatic SCI, as for traumatic SCI, the largest contributor to discharge FIM motor score in the regression model was admission FIM motor score (accounting for 56% of the model). Discharge FIM motor score had a significant negative association with age and with AIS grade of A or B compared with AIS C. These variables explained 12% of the variance of discharge FIM motor score. After admission FIM motor score, AIS grade was the strongest predictor of discharge FIM motor score (Table 4). Time from injury to admission and LOS in rehabilitation were not significant predictors.

DISCUSSION

This is one of the few studies to explore time from injury to rehabilitation admission among people with SCI in Saudi Arabia and the first, to our knowledge, to look at predictors of functional outcome among people with nontraumatic SCI in this country.

Time from injury to rehabilitation admission

With means above 280 days and median values at or > 150 days from injury to admission into SCI rehabilitation for both traumatic SCI and

nontraumatic SCI, our values are notably larger than that of other countries where mean and median values for time in acute care often do not exceed 2 months.^{7,8,11,13} Our findings also differ from a recent investigation in a rehabilitation hospital in Jeddah, Saudi Arabia, by Abdul-Sattar¹² who reported a much shorter time between injury and rehabilitation admission of 37.7 ± 17.4 days. This difference may result from that study's inclusion criteria, as patients were only included if they were referred from acute hospitals. In many countries, individuals are admitted to acute care upon injury and are then, if appropriate, directly admitted to inpatient rehabilitation once they are stable enough, so time in acute care and time from injury to inpatient admission would be effectively synonymous. However, it is important to note that time from injury to rehabilitation admission is not necessarily the same as time spent in acute care.

In our study, although some individuals were admitted to inpatient rehabilitation directly after acute care, others may not have been admitted directly as the criteria for admission to rehabilitation at King Fahad Medical City–Rehabilitation Hospital is governed by impairment and function status and not acuity of the SCI. However, the Rehabilitation Hospital does not generally accept patients who report receiving comprehensive rehabilitation services at any other known rehabilitation facilities. Instead, they are encouraged to return to the facility where they had previously accessed rehabilitation should they require additional services. Some patients may come from home after being discharged from acute medical care during which time they may have received homecare services or attended other health care facilities that include some rehabilitation elements, but this does not include individuals who have previously received comprehensive rehabilitation at another site, as mentioned above. In the absence of a national registry, it is also possible that patients do not report rehabilitation services received in another facility. This may happen in an effort to avoid denial of additional services if they consider previous services insufficient. Although this likely affected a small number of patients, this may have artificially inflated the time from injury to rehabilitation reported here.

Rehabilitation LOS

Individuals with traumatic SCI in our study had a significantly longer LOS than individuals with nontraumatic SCI, which reflects findings from other countries.^{19,37} The average rehabilitation LOS for traumatic SCI of 85 (median, 70) days in our study is higher than the average 29–59 days¹⁴ and median value of 38 days⁷ observed in the United States, similar to that reported in Greece (mean, 88 days),³⁸ and much lower than that seen in a number of countries including Japan (267 days),²⁴ and the Netherlands (205–240 days).^{16,39} For nontraumatic SCI, the average LOS in rehabilitation in our study (64 days) was shorter than that seen in Italy (92 days),¹¹ and the Netherlands (~86 days).^{13,39} In Saudi Arabia, Al-Jadid and Robert¹⁸ reported values of rehabilitation LOS for patients with traumatic SCI (59 days) and nontraumatic SCI (46 days) that were ~3 weeks shorter than values in our study. However, Abdul-Sattar¹² reported a LOS of 123 days for individuals with traumatic SCI, which is some 40 days longer than in our study. Given that Abdul-Sattar's study excluded more complex patients (those who had additional central nervous system lesions or peripheral nervous system pathology) and our study excluded patients with AIS D, these differences may well reflect substantial regional or rehabilitation center differences.

A prolonged stay in a specialized center may be positively associated with improved rehabilitation outcomes.⁴⁰ Notwithstanding more recent estimations of even shorter rehabilitation LOS,^{7,14} data from 1990 to 1998 in the United States showed that the reduction in LOS

Table 3 Hierarchical regression for FIM motor score at discharge from rehabilitation in individuals with traumatic SCI

	Model 1				Model 2				Model 3			
	b	s.e.	β	95% CI	b	s.e.	β	95% CI	b	s.e.	β	95% CI
Constant	32.58	1.93		28.80–36.37	34.66	4.73		25.36–43.96	35.71	5.026		25.82–45.60
FIM motor score at admission	0.78	0.051	0.66	0.68–0.88	0.71	0.052	0.59	0.60–0.81	0.73	0.054	0.62	0.63–0.84
Age (years)					–0.093	0.062	–0.06	–0.22–0.030	–0.090	0.062	–0.061	–0.21–0.032
Male/female					0.85	2.13	0.016	–3.35–5.04	1.09	2.10	0.021	–3.05–5.23
Paraplegia/tetraplegia					9.26	2.17	0.19	4.99–13.53	8.00	2.17	0.16	3.73–12.28
AIS A					–4.54	3.21	–0.08	–10.84–1.77	–4.27	3.19	–0.075	–10.54–2.01
AIS B					–5.75	4.35	–0.07	–14.31–2.82	–5.69	4.32	–0.073	–14.19–2.82
Time to admission (days)									–0.003	0.001	–0.14	–0.005–0.001
Length of stay (days)									–0.003	0.016	–0.008	–0.033–0.028
R ²			0.44				0.48				0.50	

Abbreviations: β , standardized coefficients; AIS, American Spinal Injury Association Impairment Scale; b, unstandardized coefficients; CI, confidence interval; FIM, Functional Independence Measure; s.e., standard error.
Bold = $P \leq 0.05$.

Table 4 Hierarchical regression for FIM motor score at discharge from rehabilitation in individuals with nontraumatic SCI

	Model 1				Model 2				Model 3			
	b	s.e.	β	95% CI	b	s.e.	β	95% CI	b	s.e.	β	95% CI
Constant	24.48	3.71		17.13–31.83	45.88	7.93		30.15–61.61	43.95	8.61		26.85–61.04
FIM Motor score at admission	0.96	0.084	0.75	0.79–1.13	0.72	0.09	0.56	0.54–0.9	0.76	0.093	0.59	0.57–0.94
Age (years)					–0.19	0.07	–0.17	–0.33 to –0.06	–0.19	0.07	–0.17	–0.33 to –0.049
Male/female					–1.20	2.97	–0.02	–7.09–4.7	–1.20	2.96	–0.03	–7.09–4.68
Paraplegia/tetraplegia					7.44	4.26	0.11	–1.01–15.89	6.65	4.35	0.094	–1.99–15.29
AIS A					–15.5	3.22	–0.36	–21.89 to –9.12	–15.84	3.23	–0.37	–22.25 to –9.43
AIS B					–4.71	4.59	–0.07	–13.82–4.41	–4.27	4.59	–0.06	–13.38–4.82
Time to admission (days)									0.00	0.00	–0.07	–0.01–0.003
Length of stay (days)									0.032	0.023	0.085	–0.014–0.077
R ²			0.56				0.67				0.68	

Abbreviations: β , standardized coefficients; AIS, American Spinal Injury Association Impairment Scale; b, unstandardized coefficients; CI, confidence interval; FIM, Functional Independence Measure; s.e., standard error.
Bold = $P \leq 0.05$.

from 74 to 60 days for individuals with traumatic SCI was associated with negative outcomes including increased hospital readmissions and discharge to nursing homes instead of discharge to the community.²² Given the LOS we observed was similar to the reduced number of days reported by Eastwood *et al.*,²² it is possible patients in our study did not receive sufficient time in rehabilitation.

FIM motor score

The improvement in FIM motor score from rehabilitation admission to discharge for individuals with traumatic SCI is similar to that seen in the study by Abdul-Sattar¹² who reported a change score of 30 ± 21 . Although values from that study were higher, our sample did not include patients with AIS D injury, who are expected to have higher function at discharge.

This is the first report of FIM motor score for individuals with nontraumatic SCI in Saudi Arabia. Our results are similar to those of McKinley *et al.*¹⁹ in the United States, who reported an admission and discharge FIM motor score of 37 and 56, respectively, and a change score of 19.

We found that those with nontraumatic SCI had higher FIM scores at admission and discharge than individuals with traumatic SCI, which is contrary to the findings of McKinley *et al.*¹⁹ who showed no

difference at admission and a higher score for traumatic SCI at discharge. Yet, in a study from Turkey, Ones *et al.*²¹ found that individuals with nontraumatic SCI had higher FIM motor score at admission and no difference between groups at discharge. The conflicting findings may reflect differences in the inclusion/exclusion criteria of study samples. For example, in the study by Ones *et al.*,²¹ the majority of participants had incomplete paraplegia and functional status was better at the time of the hospitalization in the nontraumatic SCI group. Furthermore, the patients were only referred to rehabilitation therapy after being neurologically stabilized. In our study, a greater proportion of individuals with paraplegia in the nontraumatic group may have contributed to higher FIM motor scores. Study design may also have a role. Our retrospective review may have allowed for more variability in results compared with the longitudinal matched block control design utilized by McKinley *et al.*¹⁹

Predictors of discharge FIM motor score

Previous research on functional outcome in traumatic SCI in Saudi Arabia¹² has shown FIM motor change scores are negatively associated with total FIM score at admission, time to rehabilitation admission, and severity of injury and anxiety/depression score, whereas LOS in

rehabilitation is the only factor positively associated. Our findings for traumatic SCI were similar as we found predictors of higher FIM motor score at discharge were higher FIM motor score at admission, lower level of injury and shorter time between injury and admission.

The length of time between injury and admission for rehabilitation in this setting is of potential concern, given that early admission to a comprehensive SCI trauma center (that is, including both acute care and subacute inpatient rehabilitation) has been found to result in shorter acute care LOS and fewer complications,⁴¹ whereas our study highlights a notably longer time to rehabilitation than previously reported¹² in Saudi Arabia. This finding suggests a potential area to improve efficiency in the course of SCI rehabilitation.

Research by van der Putten *et al.*²⁸ showed that admission FIM motor score and time from onset to rehabilitation admission were predictors of discharge FIM motor score in nontraumatic SCI, whereas there was no association with age. Similarly, we found that admission FIM motor score was the most powerful predictor. In contrast, we found discharge FIM motor score was negatively associated with age and not affected by time from onset to rehabilitation admission or LOS in rehabilitation. Notable differences in the sample group between studies may account for this disagreement. For example, individuals with AIS D were not included in our sample and this likely contributes to an admission FIM motor score of 41 in our study and a score of 64 in that of van der Putten *et al.*²⁸ Also, rehabilitation LOS in our study was twice that of van der Putten *et al.*²⁸ who reported an average of 32 days. A small but significant negative relationship with increasing age not seen in van der Putten's work may result from a difference in age where our sample was >10 years younger. To improve outcomes in older adults, further investigation is needed to determine if our findings reflect negative expectations on the part of staff, or age-related effects that could be addressed through changes in policy or practice.

It must be considered that other factors not included in this analysis may affect change in FIM motor score over the course of therapy. Though often used and easily collected, the LOS in rehabilitation may not be an ideal metric for assessing how rehabilitation affects FIM motor score at discharge. Instead, assessing the role of therapy time received during rehabilitation may be more insightful. Although inpatient services at our centre indicate that 5–6 h (with physical therapy = 2–3 h, occupational therapy = 1 h, recreational therapy = 1 h, group therapy = 45 min, art therapy = 1 and other services based on patient needs) of intensive rehabilitation is provided 5 days a week, measuring the actual delivered amount has not been performed in Saudi Arabia. Measuring therapy intensity⁴² (that is, amount of therapeutic activity engaged in over time) would provide a better understanding about how the rehabilitation received affects FIM motor score. Relatedly, accounting for incidents that cause therapy to be missed (pressure ulcers, transfers to acute care, patient non-adherence) that occur during inpatient rehabilitation may offer further refinement of factors affecting discharge FIM score.

Limitations

As this was a retrospective cohort study design from a single rehabilitation hospital, any generalization about the results with regard to other facilities or countries should be made with caution.

Although individuals who have received rehabilitation elsewhere are not eligible to receive services at the King Fahad Medical City–Rehabilitation Hospital, some patients may have not disclosed this information. This may have artificially inflated rehabilitation wait times for some patients.

CONCLUSION

This study explored predictors of FIM motor recovery among patients with traumatic and nontraumatic SCI in a rehabilitation setting in Riyadh, Saudi Arabia. Decreasing the notably long time from injury to rehabilitation admission may improve outcomes for those with traumatic SCI. As time spent in rehabilitation was shorter than many countries, a change in practice in this area may be warranted. Developing new strategies to improve outcomes for older patients with nontraumatic SCI would also be beneficial. In addition, in light of the difficulties we encountered obtaining patient's previous medical history and information of any previously received treatment, we highlight the need for a national registry that documents the continuity of care in Saudi Arabia. Developing partnerships between major neurotrauma centers and intensive rehabilitation facilities to communicate this information could be the first step in the development of this system. Such a national registry could help reduce the very long time from injury to rehabilitation admission we highlight in this study and decrease duplication of services, thus expediting reintegration into the community. Ultimately, such a national continuum of care system could inform the development of SCI prevention, management, rehabilitation programs and extended care services, and additionally provide more accurate information on the epidemiology of SCI in Saudi Arabia, facilitating research in this area.

CONFLICT OF INTEREST

The authors declare no conflict of interest.

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