

A prediction model for return to work after injury in Hong Kong: abridged secondary publication

KKC Hung #, LY Leung #, JHH Yeung, TK Wong, TY Yiu, YK Leung, D Chan, CT Lui, WK Ng, HF Ho, CH Cheng, NK Cheung, CA Graham *

Contributed equally

KEY MESSAGES

1. In Hong Kong, 54% of injured patients were able to return to work within 12 months.
2. Factors independently associated with return to work within 12 months of injury were length of hospital stay of ≤ 8 days, discharge home directly, non-heavy physical work of job nature, higher educational level, and better 1-month health status.
3. Our prediction model for return to work within 12 months achieved an area under the receiver operating characteristic curve of 0.850.
4. Future studies should focus on the external validation of this prediction model and interventions that could potentially modify

return-to-work outcomes.

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^{1,2} KKC Hung, ¹ LY Leung, ^{1,2} JHH Yeung, ¹ TK Wong, ¹ TY Yiu, ¹ YK Leung, ³ D Chan, ⁴ CT Lui, ⁵ WK Ng, ⁶ HF Ho, ^{1,2} CH Cheng, ^{1,2} NK Cheung, ^{1,2} CA Graham

¹ Accident and Emergency Medicine Academic Unit, The Chinese University of Hong Kong

² Trauma & Emergency Centre, Prince of Wales Hospital

³ Department of Surgery, The Chinese University of Hong Kong

⁴ Accident & Emergency Department, Tuen Mun Hospital

⁵ Trauma Committee, Princess Margaret Hospital

⁶ Accident & Emergency Department, Queen Elizabeth Hospital

* Principal applicant and corresponding author: cagraham@cuhk.edu.hk

Introduction

Trauma is a leading cause of death and disability worldwide. In Hong Kong, trauma ranks sixth as a cause of death for all age groups. The aim of trauma care for the injured person is to restore patients to the best possible health status and, if applicable, to return to work (RTW). This study aims to evaluate the RTW status of Hong Kong adult patients 1 year after moderate and major trauma, and to derive a reliable prediction model for RTW.

Methods

Patients aged ≥ 18 years who were working or seeking employment before admitted with moderate and major trauma to the Prince of Wales Hospital, Queen Elizabeth Hospital, Tuen Mun Hospital, or Princess Margaret Hospital in Hong Kong between 2017 and 2019 were recruited. Patients with isolated hip or pathological fractures were excluded, as were those with an injury severity score of 1 (very minor injuries).

The primary outcome was the RTW status. Secondary outcomes were health-related quality of life assessed by the Short Form-12 and the EQ-5D-5L. Functional outcome was assessed using the extended Glasgow Outcome Scale (GOSE). Pain was assessed using a numeric rating scale ranging from 0 to 10. Patients were assessed in person or through telephone on admission, at discharge/30 days after injury, and at 3, 6, 9, and at 12 months after injury.

The RTW status was censored, and the earliest RTW was used, no matter whether the patient was still at work at 12 months.

Chi-squared test or Fisher's exact tests was used for categorical variables, whereas the t-test was used for continuous variables. All tests were two tailed. A P value of <0.05 was considered statistically significant. Univariate logistic regression was performed, with variables including patient characteristics, injury-related parameters, hospital treatment received, and clinical outcomes at discharge and 1-month post injury. Variables with $P < 0.25$ were included in the multivariable logistic regression analysis. The prediction model was then established, and the relative weighting calculated. The model was tested using the area under the receiver operating characteristic curve, which reflects the discriminative ability of the model.

Results

A total of 1115 trauma patients were recruited. Their median age was 47 years and 81% of them were men (Table 1). 3.4% of patients had a history of psychiatric illness, and 38% had a pre-existing comorbidity. The median working experience of patients was 8 years; 67% of patients had physically demanding jobs before injury. 68% of injuries were work related. Blunt trauma was most common (89%). The two commonest causes of injury were traffic crashes (43%) and falls (30%). The median

TABLE I. Characteristics of patients

Variable	Prince of Wales Hospital (n=401)*	Queen Elizabeth Hospital (n=359)*	Tuen Mun Hospital (n=319)*	Princess Margaret Hospital (n=36)*
Age, y	48 (34-58)	46 (33-58)	49 (37-58)	44 (30.8-54.3)
Sex				
Male	319 (79.6)	280 (78)	272 (85.3)	28 (77.8)
Female	82 (20.4)	79 (22)	47 (14.7)	8 (22.2)
Ethnicity				
Asian	398 (99.3)	356 (99.2)	316 (99.1)	36 (100)
Non-Asian	3 (0.7)	3 (0.8)	3 (0.9)	0 (0)
Trauma type				
Non-blunt	54 (13.5)	37 (10.3)	26 (8.2)	2 (5.6)
Blunt	347 (86.5)	322 (89.7)	293 (91.8)	34 (94.4)
Mechanism of injury				
Traffic	170 (42.4)	159 (44.3)	127 (39.8)	21 (58.3)
Fall	129 (32.2)	103 (28.7)	88 (27.6)	11 (30.6)
Penetrating	36 (9)	30 (8.4)	22 (6.9)	2 (5.6)
Burn	17 (4.2)	7 (1.9)	4 (1.3)	0 (0)
Others	49 (12.2)	60 (16.7)	78 (24.5)	2 (5.6)
Work-related injury				
No	259 (64.6)	261 (72.7)	209 (65.5)	34 (94.4)
Yes	142 (35.4)	98 (27.3)	110 (34.5)	2 (5.6)
Psychiatric disease				
No	391 (97.5)	341 (95)	311 (97.5)	34 (94.4)
Yes	10 (2.5)	18 (5)	8 (2.5)	2 (5.6)
Pre-existing comorbidity				
No	287 (71.6)	126 (35.1)	265 (83.1)	18 (50)
Yes	114 (28.4)	233 (64.9)	54 (16.9)	18 (50)
Injury severity score	10 (5.00-20.50)	10 (6.0-21.0)	9 (4.0-17.0)	12 (4.3-18.8)
Abbreviated Injury Scale for head				
<3	264 (65.8)	240 (66.9)	239 (74.9)	26 (72.2)
≥3	137 (34.2)	119 (33.1)	80 (25.1)	10 (27.8)
Operation performed				
No	204 (50.9)	138 (38.4)	151 (47.3)	17 (47.2)
Yes	197 (49.1)	221 (61.6)	168 (52.7)	19 (52.8)
Intensive care unit admission				
No	302 (75.3)	318 (88.6)	245 (76.8)	15 (41.7)
Yes	99 (24.7)	41 (11.4)	74 (23.2)	21 (58.3)
Intensive care unit length of stay	0 (0.00-0.00)	0 (0.0-0.0)	0 (0.0-0.0)	1 (0.0-2.0)
Length of hospital stay	6.4 (3.20-12.10)	10 (5.0-17.0)	9 (5.0-18.0)	8.5 (5.0-19.0)
Extended Glasgow Outcome Scale on discharge				
Good recovery	319 (79.8)	330 (91.9)	273 (85.8)	33 (91.7)
Moderate/severe disability	81 (20.3)	29 (8.1)	45 (14.2)	3 (8.3)
Discharge destination				
Home	316 (78.8)	230 (64.1)	270 (84.6)	29 (80.6)
Non-home	85 (21.2)	129 (35.9)	49 (15.4)	7 (19.4)
30-day mortality				
No	401 (100)	359 (100)	318 (99.7)	36 (100)
Yes	0 (0)	0 (0)	1 (0.3)	0 (0)
No. of years worked	9 (2.0-23.0)	7.5 (2.5-20.0)	8 (2.0-20.0)	6.5 (2.5-20.0)

* Data are presented as mean±standard deviation, median (range) or No. (%) of participants

TABLE I. (cont'd)

Variable	Prince of Wales Hospital (n=401)*	Queen Elizabeth Hospital (n=359)*	Tuen Mun Hospital (n=319)*	Princess Margaret Hospital (n=36)*
Job nature				
Heavy physical work	242 (63)	250 (70.8)	207 (66.6)	25 (69.4)
Medium physical work	80 (20.8)	57 (16.1)	51 (16.4)	4 (11.1)
Low physical work	62 (16.1)	46 (13)	53 (17)	7 (19.4)
Monthly individual income, HK\$				
<20 000	184 (56.4)	177 (51.9)	133 (50.4)	15 (48.4)
≥20 000	142 (43.6)	164 (48.1)	131 (49.6)	16 (51.6)
Education level				
Primary	82 (20.4)	64 (17.9)	59 (18.5)	5 (13.9)
Secondary	241 (60.1)	219 (61.2)	202 (63.3)	20 (55.6)
Post-secondary	78 (19.5)	75 (20.9)	58 (18.2)	11 (30.6)
Living status				
Alone	60 (15)	46 (12.8)	46 (14.4)	7 (19.4)
With family	340 (85)	313 (87.2)	273 (85.6)	29 (80.6)
Compensation				
No	118 (36.8)	88 (26.2)	64 (25.5)	6 (31.6)
Yes	203 (63.2)	248 (73.8)	187 (74.5)	13 (68.4)
Pre-injury physical component summary	55.1±4.7	56.4±4.6	55.7±4	56±3.4
Pre-injury mental component summary	54.6±6.5	54.5±5.2	54.6±6.4	53.6±6
Pre-injury EQ-5D-5L	1±0.1	1±0.1	1±0.1	1±0
1-month extended Glasgow Outcome Scale				
<6	240 (72.9)	286 (85.4)	231 (86.2)	14 (87.5)
≥6	89 (27.1)	49 (14.6)	37 (13.8)	2 (12.5)
1-month physical component summary	38.8±10.9	33±10.4	35.4±10	34.6±11.3
1-month mental component summary	50±10.4	52.6±8.4	48.8±12.3	49.4±14.1
1-month numeric rating scale for pain				
<1	66 (20.9)	50 (16.1)	27 (10.4)	0 (0)
≥1	250 (79.1)	260 (83.9)	233 (89.6)	15 (100)
1-month EQ-5D-5L	0.6±0.3	0.6±0.3	0.5±0.3	0.5±0.3

injury severity score was 10. The Abbreviated Injury Scale score for head was ≥3 in 31% of patients. 54% of patients underwent surgery, and the median length of hospital stay was 8 days. 21% of patients were admitted to intensive care unit. On discharge, 86% of patients reported good recovery and 76% were discharged directly home. 70% patients had applied for compensation after injury.

Overall, 607 (54%) patients had RTW within 12 months of injury. Compared with those who did not RTW, patients who RTW were younger (44 vs 51 years, $P<0.001$) and had a lower injury severity score (10 vs 11.5, $P<0.001$), a shorter length of hospital stay (6 vs 11 days, $P<0.001$), fewer surgery performed (46% vs 65%, $P<0.001$), and fewer intensive care unit admissions (15% vs 28%, $P<0.001$).

Patients who RTW had a lower proportion

of pre-injury heavy physical work (57% vs 79%, $P<0.001$), a higher proportion of attaining post-secondary education (28% vs 11%, $P<0.001$), and a lower proportion of primary level education as highest educational attainment (12% vs 27%, $P<0.001$). They also had fewer work-related injuries (23% vs 42%, $P<0.001$) and fewer pre-existing comorbidities (35% vs 41%, $P<0.034$). With respect to GOSE, 92% of patients who RTW reported good recovery on discharge, whereas 78% of patients who did not RTW had good recovery. In addition, 84% of patients who RTW were discharged home directly, but this was the case in only 66% of patients who did not RTW.

Fewer patients had applied for compensation in the RTW group than in the non-RTW group (63% vs 81%, $P<0.001$). There were no differences in pre-

TABLE 2. Factors associated with return to work within 1 year of injury

Variable	Univariate analysis		Multivariable analysis			
	Odds ratio (95% CI)	P value	Before backward		After backward	
			Adjusted odds ratio (95% CI)	P value	Adjusted odds ratio (95% CI)	P value
Age, y						
18-34	1		1			
35-50	0.71 (0.51-0.98)	0.04	0.88 (0.52-1.5)	0.64		
>50	0.47 (0.35-0.64)	<0.001	0.75 (0.42-1.35)	0.34		
Sex						
Female	1					
Male	0.92 (0.69-1.25)	0.60				
Trauma type						
Non-blunt	1					
Blunt	0.99 (0.68-1.45)	0.97				
Mechanism of injury						
Traffic	1		1			
Fall	0.8 (0.61-1.06)	0.13	0.74 (0.43-1.29)	0.29		
Penetrating	0.78 (0.5-1.23)	0.29	0.84 (0.39-1.79)	0.64		
Burn	1.11 (0.51-2.41)	0.80	1.04 (0.28-3.89)	0.96		
Others	0.65 (0.46-0.91)	0.010	0.84 (0.45-1.59)	0.60		
Work-related injury						
No	1		1		1	
Yes	0.43 (0.33-0.55)	<0.001	0.47 (0.28-0.78)	0.003	0.41 (0.28-0.61)	<0.001
Psychiatric disease						
No	1		1			
Yes	0.53 (0.28-1.04)	0.06	1 (0.31-3.28)	1.00		
Pre-existing comorbidity						
No	1		1			
Yes	0.77 (0.6-0.98)	0.030	0.91 (0.61-1.36)	0.65		
Injury severity score						
	0.97 (0.96-0.98)	<0.001	1 (0.98-1.02)	0.90		
Abbreviated Injury Scale for head						
<3	1					
≥3	1.08 (0.84-1.4)	0.55				
Operation performed						
No	1		1			
Yes	0.45 (0.36-0.58)	<0.001	0.8 (0.51-1.24)	0.31		
Intensive care unit admission						
No	1		1			
Yes	0.46 (0.34-0.61)	<0.001	0.87 (0.51-1.47)	0.5		
Length of hospital stay						
≤8 days	1		1		1	
>8 days	0.35 (0.28-0.45)	<0.001	0.52 (0.34-0.81)	0.004	0.48 (0.33-0.72)	<0.001
Extended Glasgow Outcome Scale on discharge						
Good recovery	1		1			
Moderate/severe disability	0.3 (0.21-0.43)	<0.001	0.86 (0.45-1.64)	0.65		
Discharge destination						
Home	1		1		1	
Non-home	0.36 (0.27-0.48)	<0.001	0.63 (0.38-1.06)	0.08	0.55 (0.35-0.85)	0.007
No. of years worked						
	0.99 (0.98-1)	0.24	1.01 (0.99-1.03)	0.41		

TABLE 2. (cont'd)

Variable	Univariate analysis		Multivariable analysis			
	Odds ratio (95% CI)	P value	Before backward		After backward	
			Adjusted odds ratio (95% CI)	P value	Adjusted odds ratio (95% CI)	P value
Job nature						
Heavy physical work	1		1		1	
Medium physical work	2.6 (1.85-3.64)	<0.001	1.81 (1.02-3.21)	0.043	1.86 (1.07-3.24)	0.029
Low physical work	3.13 (2.16-4.53)	<0.001	1.54 (0.81-2.93)	0.19	1.62 (0.87-3.03)	0.13
Monthly individual income, HK\$						
<20 000	1					
≥20 000	0.97 (0.75-1.26)	0.84				
Education level						
Primary	1		1		1	
Secondary	2.06 (1.5-2.84)	<0.001	1.57 (0.93-2.67)	0.09	1.61 (1-2.6)	0.05
Post-secondary	5.6 (3.69-8.5)	<0.001	3.63 (1.61-8.19)	0.002	3.91 (1.86-8.25)	<0.001
Living status						
Alone	1		1			
With family	1.49 (1.06-2.08)	0.021	1.32 (0.75-2.34)	0.34		
Compensation						
No	1		1			
Yes	0.42 (0.31-0.57)	<0.001	0.91 (0.58-1.44)	0.70		
Pre-injury physical component summary	1.01 (0.98-1.04)	0.54				
Pre-injury mental component summary	0.98 (0.96-1)	0.11	0.99 (0.96-1.03)	0.65		
Pre-injury EQ-5D-5L	0.44 (0.06-3.11)	0.41				
1-month extended Glasgow Outcome Scale						
<6	1		1		1	
≥6	46.03 (16.91-125.27)	<0.001	41.32 (5.51-309.81)	<0.001	40.22 (5.46-296.39)	<0.001
1-month numeric rating scale for pain						
<1	1		1			
≥1	0.42 (0.28-0.62)	<0.001	1.12 (0.6-2.11)	0.72		
1-month physical component summary						
≤34	1		1		1	
>34	4.01 (3-5.37)	<0.001	1.91 (1.22-3)	0.005	1.86 (1.21-2.88)	0.005
1-month mental component summary						
≤49	1		1		1	
>49	3.13 (2.35-4.17)	<0.001	2.86 (1.9-4.29)	<0.001	2.91 (1.96-4.33)	<0.001
1-month EQ-5D-5L						
≤0.49	1		1		1	
>0.49	5.65 (4.23-7.55)	<0.001	1.51 (0.97-2.37)	0.07	1.5 (0.97-2.31)	0.07

injury health status (physical component summary [PCS] and mental component summary [MCS] of Short Form-12 and the EQ-5D-5L) between the two groups, but the 1-month health status were better in patients who RTW than in those who did not RTW. A higher proportion of patients had GOSE of ≥6 (upper moderate disability) in the RTW group than in the non-RTW group at 12 months after injury (32% vs 1%, P<0.001).

In the multivariable logistic regression analysis, RTW within 12 months of injury were independently associated with non-work-related injury, length of hospital stay of ≤8 days, discharge home directly, non-heavy physical work of job nature, higher educational level, and better 1-month health status (Table 2). A prediction model was established using

TABLE 3. Proposed prediction model for return to work within 12 months of injury

Variables	Score
Non-work-related injury	2
Job nature	
Medium physical work	1.5
Light physical work	1
Education level	
Secondary	1
Post-secondary	3.5
Length of hospital stay of <9 days	2
Discharge directly home	1.5
1-month extended Glasgow Outcome Scale of >5	9
1-month physical component summary of >34	1.5
1-month mental component summary of >49	2.5
1-month EQ-5D-5L of >0.49	1
Score range	0-24.5
Area under the receiver operating characteristic curve (95% CI)	0.850 (0.824-0.875)

these factors; the area under the receiver operating characteristic curve was 0.850 (95% confidence interval=0.824-0.875) for discriminating RTW and not RTW (Table 3).

Discussion

Predictors for not RTW within 12 months of injury were primary education levels, heavy physical work, work-related injury, length of hospital stay of ≥9 days, not discharge directly home, poorer health-related quality of life measures, and poorer functional outcome at 1 month following injury.

For those who RTW at 12 months, 63% returned to original work at full capacity, 26% returned with reduced work capacity, and 12% changed job nature. In the Victorian State Trauma Registry cohort,¹ 51.6% of respondents had early and sustained RTW, 15.5% had delayed RTW, 13.3% failed RTW, and 19.7% did not RTW. Predictors of delayed and no RTW included having a manual occupation and injuries sustained in motor vehicle crashes. Older age and receiving compensation predicted both failed and no RTW patterns. Severity of injury and treatment factors were not significant predictors for RTW status.

In our prediction model, higher education level

and non-manual labour occupations were predictors for RTW, as were length of hospital stay of <9 days, discharge home directly, and 1-month scores of PCS, MCS, EQ-5D-5L, and GOSE. Three-month pain and physical functioning scores have also been suggested to be important.²

Although receiving compensation was not a predictor, non-work-related injury was a predictor for RTW in our study, which may remove disincentive for recovery through indirectly receiving compensation and benefits.^{3,4}

It is important to routinely collect data relating to longer term outcomes including RTW. Future studies should investigate the role of early dedicated rehabilitation interventions on 1-year RTW rate.

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Disclosure

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