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Association of longitudinal changes in patient-reported health status with return to work in the first 2 years after traumatic injury: a prospective cohort study in the Netherlands

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ABSTRACT

Objectives To determine the prognostic value of time driven changes in health status on return to work (RTW) in the first 2 years after traumatic injury.
Design A prospective longitudinal cohort study. All patient-reported outcomes were measured at 1 week, 1, 3, 6, 12 and 24 months after injury.
Setting Ten participating hospitals in the Netherlands.
Participants Employed adult clinical injury patients admitted to the hospital between August 2015 and November 2016 (N=1245 patients).
Main outcome measures Data about (first) RTW were used from the patient-reported questionnaires (1=yes, 0=no). RTW was measured as the first time a patient started working after hospital admission. Time until RTW was calculated in weeks. Health status was measured with the EuroQol Five Dimensions-3 Levels (EQ5D) including a dimension to measure cognition.
Results At 24 months, 88.5% (n=1102) of the patients had returned to work. The median time to RTW was 6.6 weeks (IQR: 2–13). Patients' health status was found to be an independent prognostic factor for RTW: a 0.1-unit increase in EQ5D (scale 0–1) translated into RTW being four times more likely (95% CI 1.60 to 11.94). Patients who had moderate or severe problems (0=no problems, 1=moderate or severe problems) with mobility (HR 0.91, 95% CI 0.84 to 0.98), anxiety/depression (HR 0.86, 95% CI 0.80 to 0.91), usual activities (HR 0.91, 95% CI 0.83 to 0.98), self-care (HR 0.90, 95% CI 0.79 to 0.99) and cognition (HR 0.90, 95% CI 0.85 to 0.94) were significantly less likely to RTW compared with patients with no problems.
Conclusion Increased self-reported health status over time is associated with a higher likelihood of RTW, independent of baseline risk factors, such as injury severity or education. Knowledge on patient-reported outcomes can contribute to the development of tailored RTW treatments. Furthermore, patient-reported outcomes could be used as monitoring tool to guide postinjury care in the clinical setting and RTW process.
Trial registration number NCT02508675; Results.

Strengths and limitations of this study

- ► This study included data of 1245 injury patients, collected at 12 different emergency departments in the Netherlands, combining both rural and urban areas and is therefore considered representative for the total Dutch clinical trauma population.
- ► By employing joint-models on longitudinal data, we were able to examine the hypotheses of interest by appropriately accounting for the special features of the data such as the correlation among measurements within each subject and take full advantage of the information available rather than simply using the baseline values.
- ► For some patients, only the baseline health status could be included in the model and we could not model more complex functions of the slopes.
- ► Responder bias could have occurred: injury severity scores were higher among responders than among non-responders, which could have led to an underestimation of patients returning to work.
- ► Information about return to work (RTW) was limited to the period of absence until first RTW; the study does not include information about sustainable RTW or about work-related factors that hinder or facilitate RTW.

INTRODUCTION

While the number of survivors of severe injuries (ie, physical trauma) has rapidly increased due to substantial improvements in trauma care, injuries still are a major emotional burden to those affected and their families, and cause substantial economic problems for individuals, employers and societies at large.[1–3] Although the majority of injured patients recover and return to work (RTW) quickly, a considerable number of patients experiences long-term ill health, resulting in prolonged sickness absence, reduced productivity at work and unemployment.[1] RTW, therefore, plays an important role during recovery.[4–10]

Earlier studies about RTW after injury included patients with relatively severe injuries, such as spinal cord or traumatic brain injury.[6 10] Surprisingly, these studies have reported much better patient satisfaction and quality of life outcomes than expected for patients with such serious conditions.[11 12] A plausible explanation is an adaptation process that alters a patient's standard of expectations in the face of extreme challenges.[13] Moreover, severely injured patients may be provided with more practical, psychological and social support, which can also affect patient-reported health status.[12 14] If patients do not receive good support, other factors such as being able to self-care, participate in usual activities or maintain social functioning may play a more import role in patient-reported health status than injury severity alone. Therefore, patient reported health status may have important impact on the recovery process once a patient has survived an injury.

Several studies have used patient-reported outcomes, such as the EuroQol Five Dimensions (EQ5D), to predict patient outcomes after injury.[15–21] The EQ5D is a generic instrument that measures patients' perceptions of health status over a wide range of illnesses and covers aspects of physical, mental and social functioning.[22] These studies show that problems with anxiety, depression, cognition, social support or recovery expectations are more important for recovery and well-being than physical problems for instance.[23] However, according to our knowledge, the prognostic value of EQ5D on RTW is unknown.

To determine prognostic factors of patient outcomes, such as RTW, in the long term, longitudinal designs are needed. Moreover, large, longitudinal studies are scarce but important to understand the common factors that determine RTW across different injury conditions, as often times, specific disease-related determinants are not the main driver for patient outcomes. To address the question how long-term changes in patient-reported health status influence long-term RTW outcomes, this study was conceptualised with two aims in mind.

1. What is the prognostic value of time driven changes in patient-reported health status on RTW in the first 2 years after traumatic injury?
2. What is the prognostic value of time driven changes in patient-reported mobility, self-care, usual activities, pain/discomfort, anxiety/depression and cognition on RTW in the first 2 years after traumatic injury?

METHODS

Study population

In this study, we used data from the Brabant Injury Outcome Surveillance (BIOS) study.[24] The BIOS study is a multicentre prospective cohort study that registered all adult traumatic injury patients (≥18 years) admitted to the emergency department or intensive care unit due to an injury in the region North-Brabant, the Netherlands between August 2015 and November 2016, irrespective of the kind of injury and severity. Patients were excluded if their knowledge of the Dutch language was insufficient, hospital admission was due to pathological fracture, or had no place of residence. If patients were unable to complete the questionnaires themselves, a proxy completed them. All participants or proxy informants signed informed consent. The patient-reported questionnaires were collected at 1 week, 1, 3, 6, 12 and 24 months postinjury. Clinical variables and injury characteristics were retrieved from the Brabant Trauma Registry and joined with data from the participants of the BIOS study.

RTW outcome

Data about (first) RTW was used from the patient-reported questionnaires at 1 week, 1, 3, 6, 12 and 24 months (1=yes, 0=no). For instance, the question at 12 months was asked as follows: 'Did you resume your work after the accident?'. The answering categories were (1) Yes, I returned to work in the first 6 months after the accident, (2) Yes, I returned to work between 6 and 12 months after the accident and (3) No. In addition, patients were asked to provide the exact date of their first RTW. RTW was measured as the first time a patient started working after hospital admission, irrespective of the amount of working hours or task. Time until RTW was calculated in weeks. Whenever an exact date was provided by the patient, we used that to calculate RTW time in weeks. For cases without exact RTW date, we used the best estimate, for example, 36 weeks if a patient returned between 6 and 12 months.

Longitudinal measured patient-reported health status

Health status was measured using the EQ-5D-3 Levels which includes five domains: mobility, self-care, usual activities, pain/discomfort and anxiety/depression.[25] A sixth dimension was included in this study measuring cognition, which is characterised by memory, concentration, coherence and IQ.[26] Each dimension is rated on a 3-point Likert scale: 1 (no problems), 2 (moderate problems) and 3 (severe problems). For the analysis, these scores were dichotomised into 0 (no problems) and 1 (moderate or severe problems). A total score (EQ-5D utility score) was calculated with the Dutch tariffs, based on the first five domains.[27] Scores range from 0 representing death to 1 denoting full health. Because the scores are calculated with country specific tariffs, negative score are possible, which would theoretically denote a health status worse than death.

Patient characteristics

The following baseline and preinjury patient characteristics were considered: sex, age (years), level of education and preinjury health status. Level of education was categorised in low (primary education or preparatory secondary vocational education, or no diploma), middle (university preparatory education, senior general secondary education or senior secondary vocational education) and high (university of applied science or an academic degree).

Social economic status (SES) was based on home postal codes in the Netherlands, which correspond to a specific status score, based on the level of education, income and percentage of unemployment in the neighbourhood. The status score ranges from –6.75 to 3.06, with lower values indicating lower SES. The average Dutch status score in 2014 was 0.28 (SD: 1.09).[28]

Clinical and injury characteristics

The following clinical variables were included: number of comorbidities, length of stay, and the Injury Severity Score (ISS), which was based on the Abbreviated Injury Scale (AIS-90, update 2008).[29 30] AIS was used to create five injury groups with AIS severity ≥2 (moderate and/or severe). Neck and spine injuries included for instance spinal cord injury, brachial plexus lesion or stable vertebral fracture, or disc injury. Lower extremity injuries included among others pelvic injury, hip fracture, tibia fracture, complex foot fracture or distal femur fracture. Upper extremity injuries included injuries such as shoulder and upper arm injury, radius, ulna or hand fractures. Injuries to the torso included for instance thorax injuries, rib fractures or injuries to the abdomen. Head or face injuries included face fracture and traumatic brain injury among others. Patients with multiple injuries were classified in several injury groups.

Statistical analysis

We compared patient characteristics of responders and non-responders, with Mann-Whitney U tests and χ^2 tests for continuous and categorical variables, respectively. To determine the association of patient-reported health status (EQ-5D utility) and its six dimensions with RTW, we worked under the framework of Bayesian joint models for longitudinal and time-to-event data.[31 32]

To answer research question 1, for the repeated measurements of health status (EQ-5D utility), we used a linear mixed-effects regression model with time as independent variable to assess the change over time. Furthermore, we adjusted the model for the following factors: sex, age, education, length of hospital stay, SES, number of comorbidities (no/at least one), ISS, neck/spine injury (yes/no), lower extremity injury (yes/no) and head/face injury (yes/no). To allow for subject-specific trajectories, we used random intercepts and slopes. Residual diagnostics, such as normal Q-Q plots and residuals vs fitted values plots, were used to validate the assumptions of the models.

Similarly, to answer research question 2, for the repeated measurements of each of the six health status dimensions (mobility, anxiety/depression, pain, usual activities, self-care and cognition), we used a logistic mixed-effects regression models with time as independent variable. The models were further adjusted for the same factors as above. For the logistic mixed-effects models, we employed random intercepts to allow for subject-specific variation. Each mixed-effects models estimates the true underlying subject-specific trajectory over time of the utility score (EQ-5D utility) (actual scale) and the separate dimensions (in the log-odds scale).

For the analysis of time-to-RTW, we used Cox regression models in which the true underlying subject-specific profiles, as estimated by each of the mixed-effects models, were included as time-varying covariates. For the Cox regression submodel subjects who did not RTW were considered as censored at the last time of follow-up. Unlike the common Cox regression model, the baseline risk function is modelled as a spline function. The Cox regression models were further adjusted for the same factors as mentioned above. Joint models allow accounting for measurement error during follow-up, that is, biological variation, quantification of the association between endogenous covariates (covariates of which their future path is directly related to the event status), and the event of interest, and the correlations in the repeated measurements of the utility score or the different dimensions, respectively.

We report posterior estimates of HRs with 95% credibility intervals (CIs). For the utility score (EQ-5D) these HRs correspond to the increase in risk to RTW for one unit increase (eg, from 0 to 0.1), whereas for the separate domains the HRs correspond to the increase in risk to RTW for one unit increase on the log-odds scale. All analyses were conducted in R (V.4.0.3) using the JMbayes package and SPSS (V.24).

Patient and public involvement

No patient or public involved.

RESULTS

Research population

Of all patients admitted to the emergency departments (N=9774), 3785 patients (39%) completed at least one follow-up questionnaire (online supplemental figure 1). The mean age of responders was 64.2 years (SD: 18.9) and about half of them were women (N=1911, 50.5%). The median ISS (IQR) was 5 (4–9) and the median (IQR) length of stay at the hospital was 4 (2–8) days. Considering the ISS, responders 5 (4–9) were more often severely injured than non-responders 5 (2–9). Moreover, responders had significantly more spine and neck injuries (264, 7%) compared with non-responders (343, 5.7%). Additionally, torso injuries were more common in responders (359, 9.5%) compared with non-responders (443, 7.4%) (table 1).

Working population and RTW

Of the responders (N=3785), 1245 patients (32.9%) of the adult population (≥18 years) were employed prior to injury. The average age was 47.3 years (SD: 13.2) and 36.5% of the patients was female. The median status score was 0.18 (IQR: –0.4–0.7) and about one-third of the patients had a university of applied science or university degree. The median length of stay was 3 days (IQR: 2–5). The median ISS was 4 (IQR: 2–9) and about one-third

Table 1 Characteristics of the research population

	Responders	Non-responders	P value
No	3785	5989	
Age, mean (SD)	64.2 (18.9)	64.4 (22.5)	0.529
Sex female n, (%)	1911 (50.5)	3127 (52.2)	0.097
ISS, median (IQR)	5 (4–9)	5 (2–9)	<0.001
ISS, mean (SD)	6.6 (5.0)	6.2 (4.7)	
Length of hospital stay in days, median (IQR)	4 (2–8)	4 (2–8)	0.537
Injury classifications with AIS severity ≥2* n (%)			
Head or face injury, n (%)	405 (10.7)	624 (10.4)	0.659
Spine or neck injury, n (%)	264 (7.0)	343 (5.7)	0.013
Upper extremity injury, n (%)	542 (14.3)	785 (13.1)	0.088
Torso injury, n (%)	359 (9.5)	443 (7.4)	<0.001
Lower extremity injury, n (%)	1742 (46.0)	2279 (38.1)	<0.001

Responders versus non-responders; Student's t-test with unequal variance for age, Mann-Whitney U tests for ISS, and χ^2 tests for sex and injury classifications.
*Patients can have multiple injury categories.
AIS, Abbreviated Injury Scale; ISS, Injury Severity Score.

of the patients (N=409) presented with lower extremity injuries (AIS severity ≥2). Almost one-third of the patients had two or more comorbidities (N=405), about two-thirds of the patients had no comorbidities (N=836) (table 2).

Including the baseline measurement, the number of EQ5D measurements per patient ranged from 1 to 6, with a median of 2 (IQR: 1–3) (327 patients (39.1 %) had only one measurement, 296 (35.4 %) two measurements, 137 (16.4%) three measurements, 55 (6.6 %) four measurements and 21 (2.5 %) five measurements or more) (figure 1). Patients with at least 1 measurement of EQ5D before RTW (N=836) were included in the joint-models. The median EQ5D at baseline was 0.43 (IQR: 0.3–0.7).

EQ5D and RTW

At 24 months, 88.5% (n=1102) of the patients had returned to work and 12.6% (n=120) of the patients had not returned to work or retired (n=23, 1.8%; table 2). The median time between hospital admission and RTW was 8 weeks (IQR: 2.4–15). The observed mean curve trajectory for EQ5D (against time) varied according to RTW status; it had a steeper slope towards the occurrence of RTW (figure 1). In patients who did not RTW, EQ5D scores remain relatively stable. In contrast, in patients who did RTW, EQ5D scores increased considerably over time, closer to the event (RTW).

Patient's health status (EQ5D utility) was an independent prognostic factor for RTW. A 0.1-unit increase in EQ5D, all other factors being equal, translated into RTW being four times more likely (HR 4.00, 95% CI 1.60 to 11.94). Tables 3 and 4 show the results of the JM-survival models with HR estimates for the association between RTW and repeated measures of EQ5D, adjusted for the listed covariates.

Education, injury and RTW

Regarding the covariates, patients with high education compared with low education were 2.5 times more likely to RTW than patients with low education (HR 2.49, 95% CI 1.99 to 3.13). Equally, patients with a middle level of education were 1.35 times more likely to RTW compared with patients with low education, all other factors being equal (HR 1.35, 95% CI 1.12 to 1.64). Patients with head or face injuries were half as likely to RTW compared with patients that did not have head or face injuries (HR 0.49, 95% CI 0.37 to 0.65). None of the other injury types, age, sex, SES, ISS, length of hospital stay and comorbidity showed a significant association with RTW.

EQ5D domain scores and RTW

Additionally, we assessed Joint Model-survival models with HR estimates for the association between RTW and repeated measures of the EQ5D domain scores, adjusted for the listed covariates (table 4). The complete results, including covariates are available in online supplemental table 1A-F. For the domain scores (0=no problems, 1=moderate or severe problems), we see that patients who had moderate or severe problems with anxiety/depression, were 14% less likely to RTW compared with patients with no anxiety/depression (HR 0.86, 95% CI 0.80 to 0.91). Furthermore, having moderate or severe pain issues decreased a patients' probability of returning to work by 5%, compared with patients experiencing no issues with pain (HR 0.95, 95% CI 0.86 to 1.03). Additionally, patients who experienced moderate or severe problems with usual activities (HR 0.91, 95% CI 0.83 to 0.98), self-care (HR 0.90, 95% CI 0.79 to 0.99), mobility (HR 0.91, 95% CI 0.84 to 0.98. or cognition (HR 0.90, 95% CI 0.85 to 0.94) were about 10% less likely to RTW,

Table 2 Characteristics of the study sample (N=1245)

Return to work status	Total sample	RTW	No RTW/retired
No (%)	1245 (100)	1102 (88.5)	143 (11.5)
Age (years), mean (SD)	47.3 (13.2)	46.7 (12.7)	51.2 (15.9)
Sex (female), n (%)	454 (36.5)	408 (37.0)	46 (32.2)
Follow-up time (weeks), median (IQR)	8 (2.4–15)	6.6 (2–13)	26 (13–52)
Length of hospital stay (days), median (IQR)	3 (2–5)	3 (2–5)	4 (2–9)
Missing, n (%)	74 (5.9)	63 (5.7)	11 (7.7)
Patient deceased (yes), n (%)	6 (0.5)	4 (0.4)	2 (1.4)
Injury Severity Score			
Median (IQR)	4 (2–9)	4 (2–9)	6 (4–10)
1–3, n (%)	353 (28.4)	327 (29.7)	26 (18.2)
4–8, n (%)	502 (40.3)	454 (41.2)	48 (33.6)
9–14, n (%)	298 (23.9)	249 (22.6)	49 (34.3)
15–75, n (%)	83 (6.7)	65 (5.9)	18 (12.6)
Missing, n (%)	9 (0.7)	7 (0.6)	2 (1.4)
Education			
Low, n (%)	367 (29.5)	296 (26.9)	71 (49.7)
Middle, n (%)	480 (38.6)	427 (38.7)	53 (37.1)
High, n (%)	382 (30.7)	365 (33.1)	17 (11.9)
Missing, n (%)	16 (1.3)	14 (1.3)	2 (1.4)
Social economic status median (IQR)	0.18 (–0.4 to 0.7)	0.19 (–0.3 to 0.7)	0.12 (–0.6 to 0.6)
Missing, n (%)	21 (1.7)	18 (1.6)	3 (2.1)
Injuries with AIS ≥0.2*			
Head or face injury, n (%)	158 (12.7)	134 (12.2)	24 (16.8)
Spine or neck injury, n (%)	116 (9.3)	94 (8.5)	22 (15.4)
Upper extremity injury, n (%)	224 (18.0)	189 (17.2)	35 (24.5)
Torso injury, n (%)	177 (14.2)	157 (14.2)	20 (14.0)
Lower extremity injury, n (%)	409 (32.9)	349 (31.7)	60 (42)
No of comorbidity			
0 comorbidities, n (%)	836 (67.1)	752 (68.2)	84 (58.7)
1 or more comorbidities, n (%)	405 (32.5)	346 (31.4)	59 (41.3)
Missing, n (%)	4 (0.3)	4 (0.4)	0 (0)

*Patients can have multiple injury categories.
AIS, Abbreviated Injury Score; RTW, return to work.

compared with patients with no problems in these domains.

DISCUSSION

The main finding of this study is that longitudinally patient-reported health status after injury was a strong and independent prognostic factor (after adjusting for covariates) of RTW, in patients admitted to the hospital with traumatic injury in the Netherlands, 2 years after hospital admission. In addition, the domain scores of the EQ5D were examined as longitudinal prognostic factors for RTW. Although not as strong as the EQ5D total score, nearly all domain scores were independent prognostic factors of RTW, with EQ5D anxiety and depression being the strongest.

EQ5D longitudinal trajectory and RTW

To our knowledge, no previous studies have examined the pattern of changes in patient-reported health status (EQ5D) during the follow-up after physical injury. A few studies, however, have evaluated patient-reported outcome measures (shortly) after injury as a risk factor for decreased physical and mental functioning,[15–21] reduced well-being[17] and chronic pain,[16] using a pre–post design. The results of these studies highlight the advantages of using short-term changes in patient-reported outcomes, such as patients' expectations about recovery,[21] health

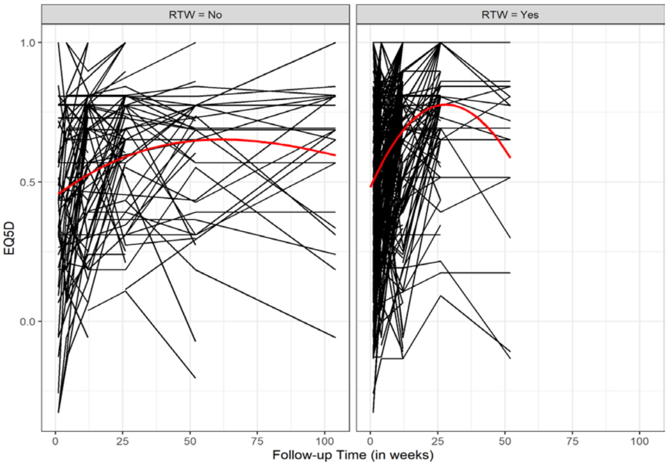

Figure 1 Observed subject-specific longitudinal trajectories of EQ5D (utility) for patients who did/did not return to work (RTW). Red lines represent the groups' average evolution of EQ5D score over time and are calculated as loess smooth curves. Black lines represent each individual patient's EQ5D observed score over time, postinjury. EQ5D, EuroQol Five Dimensions.

status[17] or social and physical functioning[19] for predicting long-term physical, mental and social functioning. With the design used in this study, we provided additional information about the course of patient-reported health status (EQ5D) during 2 years postinjury follow-up. We found that EQ5D course trajectories differ according to RTW status, with higher levels over time in those patients who did RTW and with a steeper slope near its occurrence.

Table 3 EQ5D utility score associated with RTW; Joint Model survival regression estimates

Variable	HR (95% CI)	P value
Sex (female)	0.90 (0.72 to 1.08)	0.266
Education middle	1.35 (1.12 to 1.64)	0.004
Education high	2.49 (1.99 to 3.13)	<0.001
ISS 2	1.10 (0.86 to 1.38)	0.426
ISS 3	1.03 (0.78 to 1.41)	0.878
ISS 4	1.22 (0.76 to 1.86)	0.402
Head and face injuries	0.49 (0.37 to 0.65)	<0.001
Lower extremity injuries	0.88 (0.70 to 1.10)	0.264
Spine neck injuries	0.83 (0.60 to 1.11)	0.260
Age	0.99 (0.99 to 1.00)	0.044
Status score	0.99 (0.91 to 1.09)	0.888
Length of stay (days)	0.97 (0.95 to 0.99)	0.006
Comorbidity one or more	1.09 (0.91 to 1.33)	0.386
EQ5D utility score (0.1 unit)	4.00 (1.60 to 11.94)	<0.001

EQ5D, EuroQol Five Dimensions; ISS, Injury Severity Score; JM, Joint models; RTW, return to work.

Table 4 EQ5D domains: Joint Model survival regression estimates for return to work (RTW)

Model*	HR (95% CI)	P value
EQ5D mobility	0.91 (0.84 to 0.98)	0.008
EQ5D anxiety/depression	0.86 (0.80 to 0.91)	<0.001
EQ5D pain	0.95 (0.86 to 1.03)	0.224
EQ5D usual activity	0.91 (0.83 to 0.98)	0.012
EQ5D self-care	0.90 (0.79 to 0.99)	0.046
EQ5D cognition	0.90 (0.85 to 0.94)	<0.001

*The association between the domain scores and RTW was assessed in separate models (see online supplemental table 1). EQ5D domain scores were dichotomised (0=no problems, 1=moderate/severe problems). All models were adjusted for sex, age, education, length of hospital stay, status score, number of comorbidities (no/at least one), ISS, neck and spine injury (yes/no), lower extremity injury (yes/no) and upper extremity injury (yes/no). EQ5D, EuroQol Five Dimensions; ISS, Injury Severity Score; JM, Joint models.

EQ5D as a prognostic longitudinal factor for RTW

Recent studies have increasingly shown the importance of patient-reported outcomes, such as the EQ5D, to identify risk factors in various patient populations.[15–21] This study is in alignment with earlier research on RTW in the injured population, but additionally provides novel insights. Many of the previous studies have focused on major trauma[33 34] or traumatic brain injury.[35 36] Thus, it was valuable to see that in our study of patients encompassing a range of injury types and severity, the association between EQ5D-trajectory and RTW was strong, while controlling for other potential risk factors such as injury severity and education. The longitudinal nature of this study suggests that the link between elevated EQ5D and likelihood of RTW continues over a longer period postinjury. Therefore, joint models allowed herein a novel insight into understanding the impact of (longitudinal) health status as a prognostic factor of RTW.[32] In addition, the results of this study are strengthened by the following factors: First, the dataset included all patients that were admitted to the emergency care units, and therefore highlights the usefulness of the EQ5D variable for patients with various kinds of injuries. Second, in this longitudinal analysis not only the EQ5D total score, but also its subscales were tested as prognostic factors for RTW. Last, the methodology used for this analysis adjusts for measurement error in EQ5D and non-ignorable dropout.

EQ5D domain scores and RTW

Overall, the effect of the EQ5D domains on RTW was not as strong as the effect of the EQ5D total score. The strongest association was found for the EQ5D anxiety and depression subscale on RTW, which showed a decreased likelihood of RTW when having moderate to severe problems in these domains. This finding is in line with previous research and may be explained by more complex psychosocial factors such as patient expectation about recovery and social functioning and support.[37] In practice, patients may benefit from more psychosocial support for managing expectation about recovery or psychotherapy to help with adapting to new circumstances and developing effective coping strategies after injury.[5 38 39]

Practical implications

Building on the present findings using health status questionnaires as tool to monitor patient-reported health during the RTW/recovery process may be a feasible goal in the near future. The potential use that we envision is to identify those injury patients who may benefit from advanced physical, mental or social support, such as psychological interventions to promote coping with injury and RTW. Moreover, it may identify patients in need for additional treatment, for example, for mental health problems such as anxiety and depression, or the negative consequences of not returning to work (eg, financial problems) at an earlier stage, before the more severe consequences such as long-term ill health or unemployment present. A possible way to monitor patient reported health after being dismissed could be accomplished with an e-health application. The outcomes could be screened by a general/nurse practitioner, possibly focused on mental health or a physical therapist. Previous research suggests to appoint a RTW coordinator or create a transmural rehabilitation network.[5 40] The EQ5D is a widely used tool and routine use of the EQ5D is currently implemented in the national Dutch trauma registry. Although the EQ5D is mainly used in population-based cost studies, it would be clinically interesting if it could also be used at the individual level to monitor a patient's health status over time in combination with specific RTW questionnaires for individual follow-up and targeted RTW guidance.

Strengths and limitations

This is the first study to examine the prognostic effect of repeated measures of patient reported health status (EQ5D) and its subscales on RTW in patients with all types of physical injury admitted to a hospital. We were able to examine the hypotheses of interest by appropriately accounting for the special features of the data such as the correlation among measurements within each subject and take full advantage of the information available rather than simply using the baseline values. Besides, since all available information is used with this approach, the possibility of getting biased results due to measurement error and/or regression to the means is significantly diminished. Likewise, there are several limitations to our study. First, due to the high prevalence of missing values in the EQ5D variable, for some patients only the baseline values could be included and we could not model more complex functions of the slopes. Second, responder bias could have occurred as the ISS was higher among responders compared with non-responders. This could have led to an underestimation of patients returning to work and could influence the generalisability of the study. Last, information about RTW was limited to the period of absence until first RTW. As the RTW process is complex, recurrent sick leave and RTW is common. It is important to be aware of such variability. Hence, this study did not examine information about sustainable RTW, various RTW patterns, productivity and other work-related factors that hinder or facilitate RTW.

Future research and conclusion

Further studies are needed to elucidate the potential impact that these findings may have on clinical practice and in particular if EQ5D could be used as a monitoring tool in the clinical setting to guide injury patients during recovery and the RTW process.

In conclusion, analysing longitudinal data from a population-based dataset, we found that increased EQ5D over time is associated with a higher likelihood of returning to work, independent of baseline risk factors. Moreover, although the association between the subscales of EQ5D and RTW was not as strong as the EQ5D total score, five of the six scales were independently associated with RTW; most distinct was the subscale on EQ5D anxiety and depression. The potential impact of the findings for clinical practice, such as advanced support postinjury, needs to be clarified in further research. Furthermore, patient-reported outcomes could be used as monitoring tool to guide postinjury care in the clinical setting and RTW process.

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Data availability statement Data are available on reasonable request. Data cannot be shared publicly because data from this study can contain potentially identifying or sensitive patient information. Data are anonymised, but due to relatively few severe cases, patients could be identified (Medical Ethics Committee Brabant). Therefore, data from the BIOS-study will be made available for researchers who meet the criteria for access to confidential data. Requests may be sent to secretariaat@nazb.nl.

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