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Health related quality of life and return to work after minor extremity injuries: A longitudinal study comparing upper versus lower extremity injuries

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Abstract

Purpose—To investigate the impact on health related quality of life (HRQL) during the first year after minor extremity injury and to determine whether there is a difference in recovery patterns and return to work between upper extremity injuries (UEI) and lower extremity injuries (LEI).

Method—A total of 181 adults' age 18 years or older randomly selected from patients admitted to an emergency department with minor injuries were studied. HRQL was measured using the Functional Status Questionnaire (FSQ) at 1–2 weeks, 3, 6, and 12-months post-injury. Pre-injury FSQ scores were measured retrospectively at admission. A quasi-least square (QLS) model was constructed to examine differences of FSQ scores at each measuring point for UEI and LEI.

Results—Fractures of the knee/lower leg (25%) were the most frequently injured body area. Slips or falls (57%) and traffic-related events (22%) were the most common injury causes. The mean ISS was 4.2 (SD 0.86). Both groups had significant declines in the FSQ scores physical and social functioning at 1–2 weeks after injury. Patients with UEI made larger improvements in the first 3 months post-injury versus patients with LEI whose improvements extended over the first 6 months. None of the groups reached the pre-injury FSQ scores during the first post-injury year except in the subscale work performance where UEI exceeded the pre-injury scores. At 12 months post-injury, significant lower FSQ scores remained in the LEI group compared to the UEI group in intermediate activities of daily living (p=0.036, d 0.4) and work performance (p=0.004, d 0.7). The return to work at 3 months and 12 months were 76% and 88% for UEI and 58% and 77% for LEI. No significant differences were found between groups in the FSQ scale mental health and social interaction.

Conclusions—LEI had the highest impact on HRQL and return to work during the first year which exceeded the consequences of UEI. These findings contribute to the information about the

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consequences of injury in order to give sufficient prognostic information to patients and different stakeholders. Future investigations should aim to investigate specific minor extremity injuries and identify factors that facilitate recovery and return to work.

Keywords

Injury; Minor injury; Functional status; Trauma; Upper extremity; Lower extremity; Extremity; Recovery; Work; Health-related quality of life

Introduction

Extremity injuries are among the most common injuries in the adult population and are a major source of disease burden and productivity loss in society [1, 2, 3]. Both hospitalized and non-hospitalized patients contribute to this burden. Of the approximately 31 million visits for injuries to emergency departments in the USA, extremity injuries account for approximately half of the visits, most often caused by falls or being struck by or against an object [1]. The majority of extremity injuries are low-acuity and minor with an Injury Severity Score (ISS) below 9 [4, 5]. The most frequently injured body regions in the lower extremities are the ankle and foot and, in the upper extremities, the finger, wrist and lower arm [4, 5]. One of the most costly injury types are hand and wrist injuries ranking before lower extremity injuries and skull-brain injuries; lost work time is the largest contributor to the economic burden [6].

Health-related quality of life (HRQL) is increasingly being used to measure outcomes of the impact of injury on health from the patients' perspective [7, 8]. The patient-reported outcome measure (PROM) is an essential component for accurately calculating the global burden of injury to ensure adequate policy responses to prevention and treatment [7, 8]. HRQL instruments need to be multidimensional and measure aspects of recovery that are meaningful to patients and include physical, psychological, and social functioning [9, 10]. Several studies in hospitalized patients with lower extremity injuries have documented significant impact on short- and long-term disability such as decreased mobility, pain, psychological distress, and decreased social interactions [11–13]. Studies in upper extremity injuries have found similar outcomes [14–16]. Long-term follow-up studies ranging from 3.5 to 10 years after multiple trauma have also identified that injuries to the distal part of the lower extremity are associated with long-term functional disability affecting people's capacity to work and their quality of life [17, 18]. The impact of long-term functional disability has been shown in epidemiological studies where injuries of low severity without threat to life lead to sustained suffering with far more healthy life-years lost then by mortality [6, 7, 19]. Despite the frequency with which minor extremity injuries occur relatively few studies have investigated the impact on people's lives. To date there is a knowledge gap in patient-reported outcomes on the recovery pattern after minor extremity injury and the differential health impact between upper and lower extremity injuries.

The main objectives of this study was: (1) to examine the physical, psychological, social and role function using the Functional Status Questionnaire (FSQ) during the first year after seeking emergency department care for minor extremity injuries, and (2) to determine whether health-related quality of life (HRQL) and return to work varies significantly by upper or lower extremity injuries.

Patents and Methods

This study is a secondary analysis of a longitudinal cohort study of adults presenting to an emergency department at a large, urban university hospital for treatment of minor injuries. The original study was approved by the Institutional Review Board, University of Pennsylvania, and additional approval was obtained for this secondary analysis. Included in this current study are adults aged ≥ 18 years who received treatment for minor extremity injury that occurred within the 24 hours of presentation to the emergency department and who were hospitalized or discharged to home from the emergency department with instructions and referrals to follow-up by specialty services. Patients were excluded: (1) if they were unable to understand English, (2) the current injury resulted directly from a coexisting medical illness, domestic violence, or suicide attempt, (3) if they had a current major depression, psychiatric disorders or cognitive deficit that prevented informed consent, and (4) if a previous physical injury had occurred in the past 2 years that required medical care.

Procedures

All adult patients triaged with a preliminary diagnosis of injury had the Triage-Revised Trauma Scores (T-RTS) and Injury Severity Score (ISS) calculated in the emergency department. Those who fulfilled the criteria of minor injury were approached once medically stable with short information about the study, asked for verbal consent to participate in the study and to complete the pre-injury FSQ questionnaire as a retrospective assessment of preinjury health status based on the week prior to injury. Once verbal consent was obtained, the individual had the potential to be randomly selected for study participation as per a computer-generated randomization schedule stratified by the typical flow of patients in the emergency department over 24 hour a day 7 days a week. If randomly selected, a member of the research team contacted potential participants within approximately 48 hours either during the in-hospital stay or if patients were discharged via telephone to describe the study and answer all questions related to the participation in the study. Interview times were arranged at convenient locations for the participants, at which time written informed consent was obtained. The recovery trajectory was followed by measurements at 4 different time points: within 1–2 weeks (acute phase), and continued at 3 months, 6 months, and at 12-months post-injury [9, 10, 20].

Measurements

The patient reported outcome measure of HRQL was assessed using the Functional Status Questionnaire (FSQ). The FSQ is a generic multidimensional measure initially developed and validated for use in ambulatory patients and was subsequently used in a variety of settings, with established psychometric validity and reliability, and sensitive to change over time [21]. The FSQ includes two daily living scales assessing physical functioning; items in the ‘activity of daily living’ scale (basic ADL 3 items) range from taking care of oneself to walking indoors and the ‘intermediate activities of daily living’ scale (intermediate ADL 6 items) range from household works, grocery shopping, driving a car or using public transportation to vigorous activities. The scale 'mental health' (5 items) assesses psychological functioning ranging from being a happy person to feeling so down in the dumps that nothing could cheer the person up. Three scales assess social and work activities; the 'work performance' scale (6 items) focuses on those employed full time or part-time during the previous month. Items range from doing as much work as others in similar jobs to fear of losing job related to the current health situation. Items in the 'social activity' scale (3 items) range from visiting with relatives or friends to participating in community activities, and 'social interaction' scale (5 items) assesses interpersonal relationships ranging from isolating oneself, being affectionate towards others to making unreasonable demands on family and friends. The sub-scales consist of three Likert scales: 5 point Likert scale for 'basic ADL', 'intermediate ADL' and 'social activity' ranging from "usually did not do for other reasons" to "usually did with no difficulty"; 6 point Likert scale for 'mental health' and 'social interaction' ranging from "all of the time" to "none of the time"; 4 point Likert scale for 'work performance' ranging from "all of the time" to "none of the time". Raw scores on each scale are transformed to a scale that ranges from 0 to 100, with higher scores indicating better perceived HRQL.

Patients were asked additional questions (additional HRQL items) about days spent in bed related to disability in the past month, days cut down from usual normal activities, satisfaction with sexual relationships (5 choices ranging from very satisfied to did not have any sexual relationship), frequencies of social interactions (6 choices ranging from every day to not at all), and feelings of overall health status (5 choices from very satisfied to very dissatisfied) [21–23].

Hospital medical records were reviewed to obtain injury-related characteristics. Patient were identified as having minor extremity injury if they had a Triage-Revised Trauma Score (T-RTS) of 12 and Injury Severity Score (ISS) between 2 to 8. The T-RTS is a physiological injury severity indicator used in general trauma populations for triage and clinical decision-making in the prehospital field or emergency departments [24]. Physiological parameters used are Glasgow Coma Score (GCS), systolic blood pressure, and respiratory rate. The score range from 0 to12, where a score of 12 demonstrates normal physiology [24]. Injury severity was measured with ISS which is the sum of the squared scores of the most severe injuries in three different body systems. Scores range from 1 to 75, where the higher score indicate higher overall severity [25, 26]. The extremity injuries were defined following the recommendations by the Eurocost model for classification of diagnostic groups on upper and lower extremity injuries to maximize the possibility of comparison between investigations [27]. Patients with more than one injury to the upper or lower extremities were categorized in the same diagnostic group, e.g. fractured tibia and fibula were grouped in the 'fracture knee/lower leg', or in the diagnostic group of the most severe injury, e.g. fracture wrist and sprained fingers were grouped in 'fracture wrist'.

Data Analysis

Categorical variables are presented as frequencies and percentages. Continuous variables – if normally distributed – are presented as means and standard deviation (SD), or as median and interquartile range (IQR), if not normally distributed. Chi-square tests for frequencies and independent samples *t*-test or Mann-Whitney U-tests for continuous or ordinal variables were used to compare patient characteristics and answers on additional HRQL items between groups. If the expected count of the cells was less than five, the Fisher's exact test was used. The pre-injury and post-injury FSQ subscales scores were calculated for each group and presented as means (95% confidence intervals [CI]). For group comparisons effect size was measured using the Cohen's d (small=0.2, median=0.5, large 0.8) [28]. Statistical significance was set at a *p* value of <0.05. Data analyses were conducted using IBM SPSS Statistics 22.0 (IBM Corp., Armonk, NY, USA) and Stata® 14.0 (StataCorp SP, College Road, Texas, USA).

QLS was used to compare FSQ scores at each measuring point between UEI and LEI. The QLS models regressed each outcome on covariates that included indicator variables for time of measurement, an indicator variable for upper (versus lower) extremity injury, and time by upper extremity interaction terms. The interaction terms were constructed as the product of the upper extremity and time of measurement indicator terms. The QLS models were fitted using the xtqls command in Stata 14.0. QLS is a computational approach for estimation of the correlation parameters in the framework of generalized estimating equations (GEE) [29]. We implemented QLS because it allowed for application of the Markov correlation structure that is appropriate for analysis of longitudinal data that are unequally spaced in time. After fitting a QLS model for each outcome, we used the lincom command in Stata to test the hypothesis that the mean values of each FSQ sub-scale were equal for upper versus lower extremity injuries at each measurement occasion. For each test, the lincom command allowed us to test the hypothesis that the appropriate linear combination of covariates was equal to zero.

Results

Study population

Two-hundred and nine adult patients were eligible for this study, a total of 28 were excluded due to having sustained injuries in both the upper and lower extremities (n=15) and due to minor external injuries (n=13) not included in the Eurocost model [27] of upper and lower extremity injuries. One hundred and eighty one patients constituted the study cohort of which 94 sustained injuries to the upper extremities and 87 to the lower extremities. The subjects in the cohort were slightly more females (51%), African-American (54%), single, never married (48%), and employed (72%) with a yearly income under $40,000 USD (51%). Half of the participants was under 40 years of age and 12% were 65 years or older (range 18–93 years). The most common causes of injury were slip or fall (57%) and traffic related incidents (motor vehicle 13%, bicycle 4%, pedestrian 4%). The mean ISS was 4.2 (SD 0.86). Table 1 displays demographic and injury characteristics for the upper and lower extremity injury groups. Statistically significant differences were found between groups; participants with lower extremity injuries were more likely to self-identify as African-American (*p*=<0.001), reported fewer educational years (*p*=0.05) and had a higher incidence of more than one injury to the extremity (*p*=<0.001). Table 2 presents injury type and locations for the upper and lower extremity groups. The most common type of injury for upper extremity injuries (n=94) where fractures of the elbow or forearm (11.6%) and fracture wrist (8.3%), and in the lower extremity group fractures of the knee or lower leg (24.9%) followed by fractures of the ankle (9.9%).

Pattern of recovery

Ninety participants (96%) in the upper extremity injury group completed the 3 months interview, 87 (93%) completed the interview at 6 months and 88 (94%) at 12 months. In the lower extremity injury group, 83 (97%) completed the 3 month interview, 82 (94%) at 6 months and 83 (95%) at 12 months. Figure 1 shows the recovery pattern measured using the Functional Status Questionnaire (FSQ) at 1–2 weeks, 3, 6, and 12-months post-injury in upper and lower extremity injury. Both groups reported reductions in FSQ sub-scales 1–2 weeks after injury compared to the pre-injury scores. The most extensive HRQL declines were observed in the sub-scale scores for 'basic ADL' (upper extremity injury −19.26; lower extremity injury −38.57), 'intermediate ADL' (−38.11; −58.54), and 'social activity' (−30.73; −55.94). The largest improvement in the group with upper extremity injury was in the first 3 month post-injury and stabilized thereafter when compared to pre-injury scores (basic ADL −2.68; intermediate ADL −6.40; social activity −8.64; work performance −3.63). The recovery trajectory for the group with lower extremity injury occurred over the first 6 months (basic ADL −4,58; intermediate ADL −12.91; social activity −11.40). Both groups improved but none of the groups reached the pre-injury FSQ scores during the first post-injury year. At 12 month post-injury patients with lower extremity injury continued to show declines in the subscales 'intermediate ADL' (8.97), and 'social activity' (−12.86) compared to their reported pre-injury scores. Minor declines were observed in both groups in the FSQ sub-scales 'mental health' and 'social interaction' at each measuring points after injury compared to pre-injury scores.

Table 3 summarizes the mean pre-injury FSQ sub-scale scores and post-injury FSQ sub-scale scores at 1–2 weeks, 3 months, 6 months and 12 months by upper and lower extremity injury groups. Patients with lower extremity injuries had significantly lower FSQ sub-scale scores compared to patients with upper extremity injuries at several of the post-injury follow-ups in the sub-scales 'basic ADL', 'intermediate ADL', and 'social activity'. The estimates generated for the sub-scale scores from the QLS model were adjusted for the differences found between the groups in race, years of education, and more than one injury to extremity that were statistically significant as presented in Table 1. At 12 months post-injury, significantly lower FSQ scores remained in the lower extremity injury group compared to the upper extremity injury group in 'intermediate ADL' (p=0.036, d 0.4). No statistically significant differences were found between groups in pre-injury FSQ sub-scales scores and in the FSQ sub-scale scores 'mental health' and 'social interaction' at any of the measuring time points.

Work status and work performance

In the upper extremity injury group 67 participants reported working full time or part-time prior to the injury event, of those 27 (40%) reported working at 1–2 weeks post-injury, 51 (76%) at 3 months, 55 (82%) at 6 months, and 59 (88%) at 12 months. In the lower extremity injury group of the 64 participants working prior to the injury event, 10 (16%)

reported working at 1–2 weeks, 37 (58%) at 3 months, 43 (67%) at 6 months, and 49 (77%) at 12 months. No significant differences were found between group reports of working full or part-time in the month prior to the injury event (p=0.542) and working at 12 month post-injury (p=0.811).

Figure 1 shows the recovery pattern in 'work performance' from 1–2 weeks to 12 months post-injury. Both groups had declines in the FSQ sub-scale score at 1–2 weeks (upper extremity injury −14.17; lower extremity injury −23.61) compared to pre-injury scores. Improvements in work performance were observed up to 3 months in the upper extremity group and up to 6 month in the lower extremity group. Table 4 summarizes the mean FSQ scores in the sub-scale 'work performance' pre-injury and throughout the post-injury year. Patients with lower extremity injuries reported significant health effects on their work performance at 3 months (p<0.001, d 0.8) and at 12 months (p=0.004, d 0.7) compared to the group with upper extremity injuries. In comparing pre-injury work performance scores with post-injury scores at 12 months the group with upper extremity injuries reported slightly higher scores at 12 months post-injury (+1.36) and the group with lower extremity injuries reported scores that were slightly lower (−2.94).

Additional HRQL Items

Participants with injuries to lower extremities reported spending significantly more days in bed related to injury at 1–2 weeks post-injury (p<0.001), cutting down more days usually spent on activities at 3 months (p=0.012) and 6 months (p=0.022), and reported lower satisfaction with their own health at 6 month (p=0.014) and 12 months (p=0.047) compared to the group with upper extremity injury. No significant differences were found between groups throughout the post-injury year in satisfaction with sexual relationships and frequencies of social interactions. The majority of participants in both groups reported being satisfied to very satisfied with their sexual relationships (upper extremity injury pre-injury 63%, 1–2 weeks 35%, 3 months 56%, 6 months 47%, 12 months 61%; lower extremity injury pre-injury 61%, 1–2 weeks 44%, 3 months 52%, 6 months 54%, 12 months 48%) and getting together with family and friends once a week to every day (upper extremity injury pre-injury 77%, 1–2 weeks 85%, 3 months 73%, 6 months 71%, 12 months 70%; lower extremity injury 75%, 1–2 weeks 74%, 3 months 68%, 6 months 63%, 12 months 67%).

Discussion

To the our best knowledge this is the first study that has investigated HRQL after minor extremity injury and compared upper and lower injured body regions. Substantial loss of HRQL was observed in the acute phase measured within 1–2 weeks after injury, followed by improvements in the recovery trajectory during the first year after injury. Patients with upper extremity injury improved during the first 3 months and nearly reached their pre-injury HRQL at 12 months. In contrast, patients with lower extremity injury had significantly lower FSQ scores, the mean scores improved more slowly (over the first 6 months) and did not reach the pre-injury HRQL during the first post-injury year. Earlier studies have identified extremity injuries as particularly disabling. Meerding et al. in a study of HRQL after different types of injuries found that most non-hospitalized patients recovered within 2 months with the exception of patients with injuries to the vertebral column and to lower extremities that showed similar recovery trajectory as hospitalized patients with improvement up to 5 months but stabilizing at suboptimal levels [30]. In another study by De Putter and colleagues, non-hospitalized patients with upper extremity injury had substantial loss of HRQL at 2.5 months which improved by 9 months post-injury to the same level as general population norms, whereas hospitalized patients with upper extremity injury remained far below the general population norms at 24 months [14]. In their study the overall health impact of upper extremity injury exceeded the effects on all other injured patients non-hospitalized and hospitalized, and the more proximal injuries, such as upper arm fractures, had slower recovery compared to distal injuries [14]. Other studies considering specific subcategories of the most common extremity injuries such as of wrist or ankle/foot fractures have found pain and functional disabilities long time after care, specifically after treatment with internal fixation [13, 17, 18, 31, 32]. The differences in the results from the present study and other studies may be related to time of follow-up, method of data collection, different diagnosis groups and injury severity, and cultural differences.

We found a major decrease in both groups in physical functioning in basic ADLs (self-care tasks) and intermediate ADLs such as limitations in climbing stairs, cooking, grocery shopping, and driving a car or using public transportation. The impact on intermediate ADLs was larger in both groups compared to basic ADLs. Substantial physical difficulties were also reported by both groups in social activities, such as visiting with relatives and friends, taking care of other people, and participate in different community activities. Patients who sustained lower extremity injuries were more likely to report significantly worse scores in ADLs and social activities compared to patients with upper extremity injury. These differences continued throughout recovery with significant differences in intermediate ADLs remaining at 12 months. Despite the physical problems, the majority of participants in both groups reported getting together with family and friends weekly to every day throughout the first year after injury. None of the groups reported major changes in their mental health status and in social interactions such as being able to be affectionate to others and getting along well with other people. Previous literature have found changes in sexual satisfaction after lower extremity and pelvic injuries [33]. Our study did not find any significant changes and it is likely related to that we did not include patients with ISS >8 which exclude more severe injuries such as femoral shaft fractures and pelvic fractures.

Work status and performance

The present study shows that minor extremity injury have a major effect on time away from work. The group with lower extremity injury had a slower return to work and reported larger health effects on their work performance up to three months post-injury compared to patients with upper extremity injury. By three months, 76% of those with upper extremity injury had returned to work and 58% in the group with lower extremity injury, increasing to 88% versus 77% at study completion at 12 month. In the present study we define working as the observed frequency of employment full time or part-time during the previous month, and compared pre-injury observations with post-injury observations at each follow-up visit. Our result concurs with one earlier study of lower extremity injury in which one-half of the sample were minor injuries, 48% returned to work at six months, two-thirds of these had difficulty performing their present jobs because of the injury [34]. The same sample was followed for 30 months and by 12 months 72% had return to work, increasing to 82% at study completion (30 months post-injury) [35]. Reed et al in their study of lower extremity injury identified patients with ankle/foot fracture as a sub-group experiencing great difficulties, 58% of the patients return to work at 12 months compared to 87% of patients without ankle/foot injuries [13]. The literature on upper extremity injury and return to work is scarce. One study on spaghetti wrist injury, an extensive volar wrist laceration with several structures involved, showed that 55% returned to work at 12 months and that the mean sick leave time was 35 weeks. Social support after injury has been described earlier as an important factor in return to work and in influencing other functional outcomes. One study in Australia found that hospitalized orthopaedic patients with high social functioning were 2.58 times more likely to return to work than those with low social functioning [36]. Work disability and return to work are considered multi-determined outcomes that cannot be accurately predicted just from the severity of the injury or functional limitations [37]. Several determinants have been identified such as medical and rehabilitation interventions, physical and psychosocial job characteristics, workplace factors, insurance or workers compensation scheme and societal factors [37]. Facilitators of and barriers to return to work after injury is an area that needs further research.

The results from our study can be described using the World Health Organization (WHO) categories of functional status in three levels: (1) dysfunction in an organ (impairment) can translate into (2) dysfunction in everyday activities (disability), which can in turn translate into an (3) altering of societal role (handicap) [38]. The findings in the present study show that the group with lower extremity injuries suffered impairments that resulted in larger disabilities compared to the group with upper extremity injuries, after 1 year the differences between the groups were moderate to minor. On a group level no changes in HRQL were found during the first year that could be interpreted as translation into changes of participant's social roles. Further research is warranted for more information about the consequences and recovery after minor extremity injuries.

Strength and limitations

There are several strengths and limitations to the present study. One strength is that the study population derives from a cohort that was randomly selected from a well-defined population and study area. The upper extremity injuries of the study population represents the type and locations of upper extremity injuries presented in national data presenting to emergency departments in the U.S. [4]. The lower extremity injuries had a higher frequency of injuries to fracture knee/lower leg compared to national data were ankle/foot injuries were more common [5]. It is important to emphasize that the results cannot be generalized to all persons presenting to an emergency department for treatment for extremity injuries. The data were prospectively collected over a 1 year follow-up period and the response rates were high at all data collection points.

Another strength in this study is the use of the patient's recalled pre-injury HRQL status. The method of obtaining baseline data retrospectively after an injury event can create the potential for recall bias. Earlier studies have recommended the use of population norms of

HRQL instruments to overcome this issue [39, 40]. Two later studies based on large samples found that the general population may not be representative of populations of injured patients in terms of pre-injury HRQL status [41, 42]. Gabbe et al. [41] found that self-reported preinjury physical and mental HRQL status of orthopaedic trauma patients exceeded the general population thus using population norms as baseline could result in a minor but significant underestimation of the impact of injury. Wilson et al. [42] included all injury types and severity and found similar results but also some evidence for a small upward bias in recalling pre-injury health status. We conclude that evaluation of pre-onset HRQL is more appropriate than applying population norms with an awareness of the potential for a small upward bias. One limitation is that the presence of pain and pain severity was not measured. Pain is one of the most common symptoms seen in acute orthopaedic injuries and studies have found that pain can possibly impair function [11–14].

Conclusion

The study shows a major impact on HRQL after minor extremity injury. Substantial loss of physical and social functioning was observed at 1–2 weeks after injury, followed by improvements in the recovery trajectory during the first year after injury. Patients with upper extremity injury made significant improvement in the first 3 months. A more dramatic decline was observed in patients with injuries to lower extremities with a longer recovery – over the 6 months post-injury. The impact of lower extremity injury on HRQL exceeded the health consequences of the group with upper extremity injury in physical functioning and work performances. At 12 months 88% of the group with upper extremity injuries had return to work, and 77% for the group with lower extremity injuries. These findings contribute to the growing body of knowledge about the consequences of injury in order to give sufficient prognostic information to patients, their families, insurance companies, and government agencies. Our findings give rise to future research on minor extremity injuries to reveal causal relationship between injury types/location, treatment and recovery.

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References

1. Bergen, G.; Chen, LH.; Warner, M.; Fingerhut, LA. Injury in the United States: 2007 Chartbook. Hyattsville, MD: National Center for Health Statistics; 2008.
2. Corso P, Finkelstein E, Miller T, Fiebelkorn I, Zaloshnja E. Incidence and lifetime cost of injuries in the United States. Inj Prev. 2006; 12(4):212–4. [PubMed: 16887941]
3. Banerjee M, Bouillon B, Shafizadeh S, Paffrath T, Lefring R, Wafaisade A. German Trauma Registry Group. Epidemiology of extremity injuries in multiple trauma patients. Injury. 2013; 44(8): 1015–21.10.1016/j.injury.2012.12.007 [PubMed: 23287554]
4. Ootes D, Lambers KT, Ring DC. The epidemiology of upper extremity injuries presenting to the emergency department in the United States. J Hand. 2012; 7:18–22.10.1007/s11552-011-9383-z
5. Lambers K, Ootes D, Ring D. Incidence of patients with lower extremity injuries presenting to US emergency departments by anatomic region, disease category, and age. Clin Orthop Relat Res. 2012; 470(1):284–90.10.10007/s11999-011-1982-z [PubMed: 21785896]

6. de Putter CE, Selles RW, Polinder S, Panneman MJM, Hovius SER, van Beck EF. Economic impact of hand and wrist injuries: Health-care costs and productivity cost in a population-based study. J Bone Joint Surg Am. 2012; 94:e56(1–7). [PubMed: 22552678]
7. Lyons RA, Kendrick D, Towner EM, Christie N, Macey S, Coupland C, et al. UK burden of injury study group. Measuring the population burden of injuries – implications for global and national estimates: a multi-center prospective UK longitudinal study. PLoS Med. 2011:8e1001140.
8. Pollinder S, Haagsma JA, Lyons RA, Gabbe BJ, Ameratunga S, Cryer C, et al. Measuring the population burden of fatal and nonfatal injury. Epidemiol Rev. 2012; 34:17–31. [PubMed: 22113244]
9. Bouillon B, Kreder HJ, Eypasch E, Holbrook TL, Kreder HJ, Mayou R, et al. Quality of life in patients with multiple injuries-basic issues, assessment, and recommendations. Restor Neurol Neurosci. 2002; 20(3–4):125–34. [PubMed: 12454361]
10. van Beeck EF, Larsen CF, Lyons RA, Meerding WJ, Mulder S, Essik-Bot ML. Guidelines for the conduction of follow-up studies measuring injury-related disability. J Trauma. 2007; 62:534–50. [PubMed: 17297349]
11. Clay FJ, Newstead SV, Watson WL, Ozanne-Smith J, Guy J, McClure RJ. Bio-psychosocial determinants of persistent pain 6 months after non-life-threatening orthopedaedic trauma. J Pain. 2010; 11(5):420–30. [PubMed: 20439055]
12. Mock C, MacKenzie E, Jurkovich G, et al. Determinants of disability after lower extremity fracture. J Trauma. 2000; 49:1002–11. [PubMed: 11130480]
13. Read KM, Kufera JA, Dischinger PC, Kerns TJ, Ho SM, Burgess AR, Burch CA. Life-altering outcomes after lower extremity injury sustained in motor vehicle crasches. J Trauma. 2004; 57:815–23. [PubMed: 15514536]
14. de Putter CE, Selles RW, Haagsma JA, Polinder S, Panneman MJM, Hovius SER, Burdorf A, van Beeck EF. Health-related quality of life after upper extremity injuries and predictor for suboptimal outcome. Injury. 2014; 45:1752–58. [PubMed: 25150751]
15. Williams AE, Newman JT, Ozer K, Juarros A, Morgan SJ, Smith WR. Post-traumatic stress disorder and depression negatively impact general health status after hand injury. J Hand Surg Am. 2009; 34:515–22. [PubMed: 19258151]
16. Jaquet JB, van der Jagt I, Kuypers PD, Schreuders TA, Kalmijn AR, Hovius SE. Spagetti wrist trauma: functional recovery, return to work, and psychological effects. Plast Reconstr Surg. 2005; 115:1609–17. [PubMed: 15861065]
17. Zelle BA, Brown SR, Panzica M, Lohse R, Sittaro NA, Krettek C, Pape HC. The impact of injuries below the knee joint long-term fuctional outcome following polytrauma. Injury. 2005; 36:169–77. [PubMed: 15589937]
18. von Rüden C, Woltmann A, Röse M, Wurm S, Rüger M, Hierholzer C, Bühren V. Outcome after severe multiple trauma: A retrospective analysis. J Trauma Management Outcomes. 2013; 7(1): 4.10.1186/1752-2897-7-4
19. Pollinder S, Haagsma JA, Toet H, van Beeck EF. Epidemiological burden of minor, major and fatal trauma in a national injury pyramid. Br J Surg. 2012; 99(Suppl 1):114–21. [PubMed: 22441864]
20. Castillo RC, MacKenzie EJ, Bosse MJ. The LEAP Study Group. Orthopaedic trauma clinical research: Is 2-year follow-up necessary? Results from a longitudinal study of severe lower extremity trauma. J Trauma. 2011; 71(6):1726–31. [PubMed: 22182880]
21. Cleary PD, Jette AJ. Realibility and validity of the functional status questionnaire. Qual Life Res. 2000; 9:747–53.
22. Jette AM, Davies AR, Cleary PD, Calteins DR, Rubenstein LV, Fink A, et al. The functional Status Questionnaire: reliability and validity when used in primary care. J Gen Intern Med. 1986; 1:143–49. [PubMed: 3772582]
23. Jette AM, Cleary PD. Functional disability assessment. Physical Assessment. 1987; 67:1854–58.
24. Champion HR, Sacco WJ, Copes WS, Gann DS, Gennarelli TA, Flanagan ME. A revision of the Trauma Score. J Trauma. 1989; 29(5):623–29. [PubMed: 2657085]
25. Baker SP, O'Neill B, Haddon W Jr, Long WB. The injury severity score: A method for describing patients with multiple injuries and evaluating emergency care. J Trauma. 1974; 14:187–96. [PubMed: 4814394]

26. Association of the Advancement of Automotive Medicine. Committee on Injury Scaling. The Abbreviated Injury Scale, 1990 Revision (AIS-90). Des Plaines, IL: Association of the Advancement of Automotive Medicine; 1990.
27. Lyons RA, Polinder S, Larsen CF, Mulder S, Meerding WJ, Toet H, et al. Eurocost Reference Group. Methodological issues in comparing injury incidence across countries. Int J Inj Contr Saf Promot. 2006; 13:63–70. [PubMed: 16707341]
28. Cohen, J. Statistical Power Analysis for the Behavioral Sciences. 2. Lawrence Erlbaum Associates, Publishers; Hillsdale, New Jersey:
29. Shults, J.; Hilbe, J. A Chapman & Hall Book. New York: CRC Press Taylor & Francis Group; 2014. Quasi-Least Squares Regression. Monographs on Statistics and Applied Probability.
30. Meerding WJ, Looman CWN, Essik-Bot M-L, Toet H, Mulder S, van Beek EF. Distribution and determinants of health and work status in comprehensive population of injury patients. J Trauma. 2004; 56:150–161. [PubMed: 14749582]
31. Van Son MAC, De Vries J, Roukema JA, Den Oudsten BL. Health status and (health-related) quality of life during the recovery of distal radius fractures: a systematic review. Qual Life Res. 2013; 22:2399–2416.10.1007/s11136-013-0391-z [PubMed: 23519976]
32. Van Son MAC, De Vries J, Roukema JA, Den Oudsten BL. Health status, health-related quality of life, and quality of life following ankle fractures: A systematic review. Injury. 2013; 44:1391–1402. [PubMed: 23490315]
33. McCarty ML, MacKenzie EJ, Bosse MJ, Copeland CE, Hash CS, Burgess AR. Functional status following orthopedic trauma in young women. J Trauma. 1995; 39(5):823–37.
34. McKenzie EJ, Cushing BM, Jurkovich GJ, Morris JA, Burgess AR, deLateur BJ, et al. Physical impairment and functional outcomes six months after severe lower extremity fractures. J Trauma. 1993; 34(4):528–38. [PubMed: 8487338]
35. Butcher JL, MacKenzie E, Cushing B, Jurkovich G, Morris J, Burgess A, et al. Long-term after lower extremity trauma. J Trauma. 1996; 41(1):4–9. [PubMed: 8676422]
36. Clay FJ, Newsted SV, Watson WL, Ozanne-Smith J, McClure RJ. Bio-psychosocial determinant of time lost from work following non life threating acute ortopaedic trauma. BMC Musculoskeletal Disorders. 2010; 11(6):2–11. [PubMed: 20044944]
37. Foreman, P.; Murphy, G.; Swerissen, H. Facilitators and barriers to return to work: A literature review. Australian Institute for Primary Care, La Trobe University; Melburne: 2006.
38. The World Health Organization. International Classification of Impairment, Disability, and Handicap: A manual of Classification Relating to the Consequence of Disease. Geneva: World Health Organization; 1980.
39. Cameron C, Purdie D, Kliemer E, McClure R. Differences in prevalence of pre-existing morbidity between injured and non-injured populations. Bull World Health Organ. 2005; 83:345–52. [PubMed: 15976875]
40. Watson W, Ozanne-Smith J, Richardson J. An evaluation of the assessment of quality of life utility instrument as a measure of the impact of injury on health-realted quality of life. Int J Inj Contr Saf Promot. 2005; 12:227–39. [PubMed: 16471155]
41. Gabbe BJ, Cameron PA, Graves SE, Williamson OD, Edwards ER. Preinjury status: are orthopaedic trauma patients different than the general population? J Ortop Trauma. 2007; 21:223–28.
42. Wilson R, Derrett S, Hansen P, Langley J. Retrospective evaluation versus population norms for the measurement of baseline health status. Health and Quality of Life Outcome. 2012; 10:68.10.1186/1477-7525-10-68

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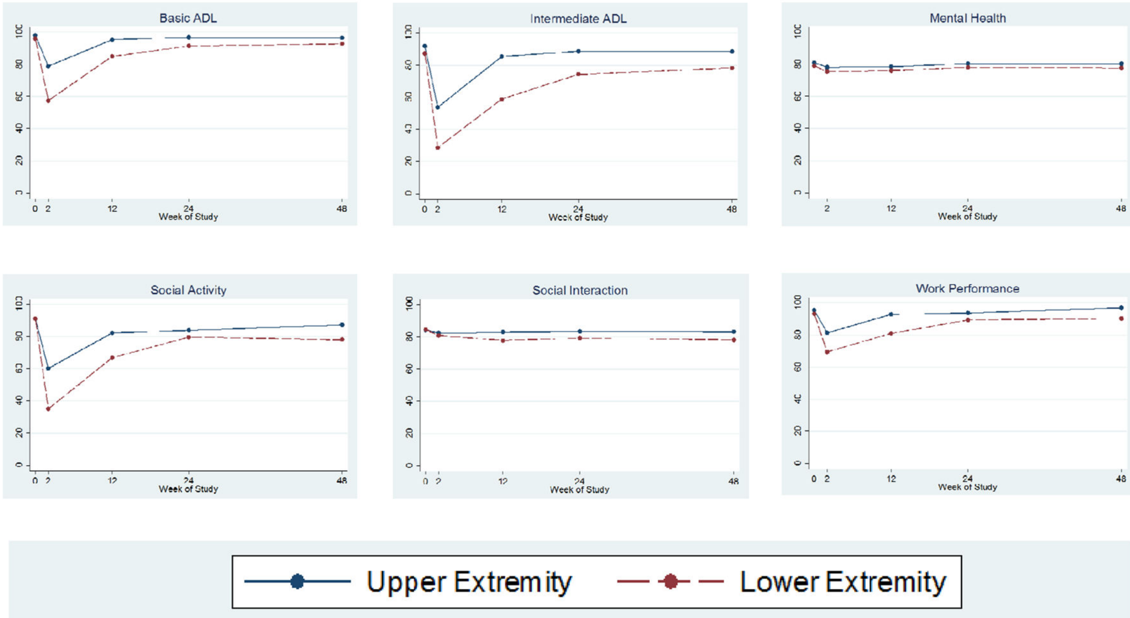

Figure 1.
The recovery pattern measured using the Functional Status Questionnaire (FSQ) at 1–2 weeks, 3, 6, and 12-months post-injury in upper and lower extremity injury

Table 1

Comparison of demographic and injury characteristics between patients with upper extremity injuries and patients with lower extremity injuries.

Characteristics	Upper extremity n=94 (51.9%)	Lower extremity n=87 (48.1%)	*p*
Age (years), mean (SD)	41.6 (18.3)	42.2 (15.4)	0.801
Gender, n (%)			0.326
Male	49 (52.1)	39 (44.8)	
Female	45 (47.9)	48 (55.2)	
Race, n (%)			<0.001
African-American	36 (38.3)	61 (70.1)	
White	55 (58.5)	23 (26.4)	
Asian	2 (2.1)	3 (3.4)	
Multiracial	1 (1.1)	0 (0)	
Ethnicity, n (%)			0.672
Hispanic or Latino	2 (2.1)	3 (3.4)	
Not Hispanic or Latino	92 (97.9)	84 (96.6)	
Marital status			0.979
Single, never married	46 (48.9)	40 (46.0)	
Married/Cohabitating	27 (28.7)	27 (31.0)	
Divorced/Separated	16 (17.1)	16 (18.3)	
Widowed	5 (5.3)	4 (44.4)	
Education in years, mean (SD)	14.3 (2.9)	13.5 (2.3)	0.050
Pre-injury employment status, n (%)			0.543
Employed	65 (69.1)	65 (74.7)	
Unemployed	8 (8.5)	7 (8.0)	
Retired/Disable	8 (8.5)	8 (9.2)	
Housework/student	13 (13.8)	7 (8.0)	
Income (USD), n (%)			0.352
<20,000	30 (31.9)	17 (19.5)	
20,000–39,000	19 (20.2)	26 (29.9)	
40,000–59,000	12 (12.8)	11 (12.6)	
>59,000	25 (26.6)	21 (24.1)	
Intent of injury, n (%)			0.374
Unintentional injury	92 (2.1)	81 (93.1)	
Intentional injury	2 (97.9)	6 (6.8)	
ISS, mean (SD)	4.3 (1.1)	4.2 (0.5)	0.170
More than one injury to extremity, n (%)	9 (9.6)	27 (31.0)	<0.001
External cause, n (%)			0.089
Auto/Pedestrian/Bike	20 (21.2)	19 (21.7)	
Slip or Fall	49 (52.1)	54 (62.1)	
Sports	14 (14.9)	7 (8.0)	
Assault	3 (3.2)	5 (5.7)	

Characteristics	Upper extremity n=94 (51.9%)	Lower extremity n=87 (48.1%)	*p*
Other	8 (8.6)	2 (2.2)	

Abbreviations: ISS, Injury Severity Scale scores (1–75); SD, Standard Deviation.

p-values χ^2-test for frequencies and independent sample t-test for continuous or ordinal variables.

Table 2

Proportion of type of injury in patients with upper extremity injury and patients with lower extremity injury.

	n	%
Upper and lower extremity	181	100
Type of injury upper extremity *	94	51.9
Fracture clavicle/scapula	9	5.0
Fracture of upper arm	10	5.5
Fracture of elbow/forearm	21	11.6
Fracture wrist	15	8.3
Fracture hands/fingers	13	7.2
Dislocation, sprain or strain shoulder/elbow	13	7.2
Dislocation, sprain or strain wrist/hand/fingers	4	2.1
Complex soft tissue injury	9	5.0
Type of injury lower extremity *	87	48.1
Fracture hip	2	1.1
Fracture knee/lower leg	45	24.9
Fracture of ankle	18	9.9
Fracture of foot (excludes ankle)	7	3.9
Dislocation/sprain/strain of hip	1	0.6
Dislocation/sprain/strain of knee	4	2.2
Complex soft tissue injury	10	5.5

Note:

*Injury diagnostic groups in the Eurocost model for upper and lower extremity injuries.

Table 3

Comparison of FSQ subscale scores at pre-injury, 1–2 weeks, 3, 6, and 12 months between patients with upper extremity injury and patients with lower extremity injury.

FSQ subscale	**Upper extremity** (pre-injury n=94, 1–2 weeks n=94, 3 months n=90, 6 months n=87, 12 months n=88)	**Lower extremity** (pre-injury n=87, 1–2 weeks n=87, 3 months n=83, 6 months n=82, 12 months n=83)	***p***	***d***
Basic ADL, mean (95% CI)				
Pre-injury	97.99 (96.01, 99.96)	95.91 (93.41, 98.42)	0.270	0.2
1–2 weeks	78.73 (75.36, 82.09)	57.34 (52.44, 63.24)	<0.001	0.9
3 months	95.31 (93.00, 97.62)	84.92 (80.25, 89.58)	<0.001	0.6
6 months	96.68 (94.63, 98.73)	91.33 (86.85, 95.80)	0.029	0.3
12 months	96.44 (93.63, 99.25)	92.64 (88.82, 96.45)	0.144	0.2
Intermediate ADL, mean (95% CI)				
Pre-injury	91.77 (87.72, 95.82)	87.15 (82.31, 91.99)	0.412	0.2
1–2 weeks	53.66 (48.48, 58.85)	28.61 (21.93, 35.28)	<0.001	0.8
3 months	85.37 (81.14, 89.60)	58.84 (52.34, 65.33)	<0.001	0.9
6 months	88.57 (84.76, 92.38)	74.24 (67.91, 80.58)	0.001	0.6
12 months	88.45 (83.80, 93.09)	78.18 (72.43, 83.93)	0.036	0.4
Mental health score, mean (95% CI)				
Pre-injury	80.94 (77.92, 83.96)	79.03 (74.94, 83.13)	0.944	0.1
1–2 weeks	78.13 (74.60, 81.65)	75.31 (71.48, 79.14)	0.793	0.2
3 months	78.40 (74.81, 81.99)	76.02 (71.36, 80.67)	0.989	0.1
6 months	80.37 (76.28, 84.46)	78.00 (73.88, 82.12)	0.936	0.1
12 months	80.36 (76.99, 83.73)	77.59 (73.22, 81.96)	0.822	0.2
Social activity score, mean (95% CI)				
Pre-injury	90.90 (86.36, 95.44)	90.93 (86.62, 95.24)	0.519	0.0
1–2 weeks	60.17 (52.94, 67.39)	34.99 (27.37, 42.62)	<0.001	0.7
3 months	82.22 (76.44, 88.01)	66.80 (59.65, 73.95)	0.004	0.5
6 months	83.70 (77.34, 90.07)	79.53 (72.59, 86.47)	0.631	0.1
12 months	87.12 (81.42, 92.82)	78.05 (70.93, 85.26)	0.148	0.3
Social interaction score, mean (95% CI)				
Pre-injury	84.18 (80.68, 87.69)	84.37 (81.04, 87.69)	0.236	0.0
1–2weeks	82.35 (79.26, 85.44)	80.78 (77.19, 84.37)	0.596	0.1
3 months	82.80 (78.89, 85.71)	77.76 (74.08, 81.44)	0.388	0.3
6 months	83.37 (79.99, 86.74)	79.17 (75.40, 82.94)	0.677	0.3
12 months	83.05 (79.84, 86.25)	78.07 (74.17, 81.97)	0.426	0.3

Abbreviation: ADL, activities of daily living score; Mean (95% CI), 95% Confidence Interval; *p*, quasi-least squares (QLS) model test; *d*, Cohen's *d*.

Note: *p* values from the QLS model are adjusted for the covariate race, education in years and more than one injury to the extremity.

Table 4

Comparison of FSQ subscale work performance scores at pre-injury, 1–2 weeks, 3, 6, and 12 months between patients* with upper extremity injury and patients with lower extremity injury.

FSQ subscale work	Upper extremity	Lower extremity	*p*	*d*
	(pre-injury n=67, 1–2 weeks n=27, 3 months n=51, 6 months n=55, 12 months n=59)	**(pre-injury n=64, 1–2 weeks n=10, 3 months n=37, 6 months n=43, 12 months n=49)**		
Pre-injury	95.44 (93.10, 97.77)	93.06 (90.11, 96.00)	0.683	0.2
1–2weeks	81.27 (72.01, 90.54)	69.45 (57.56, 81.33)	0.097	0.5
3 months	92.81 (89.35, 96.27)	80.90 (75.81, 86.00)	<0.001	0.8
6 months	93.53 (90.51, 96.56)	89.28 (85.30, 93.25)	0.272	0.4
12 months	96.80 (95.20, 98.39)	90.12 (86.94, 93.30)	0.004	0.7

Abbreviation:

*Mean, 95% Confidence Interval; *p*, quasi-least squares (QLS) model test; *d*, Cohen's *d*.