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## Return to work after a serious hand injury

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**Abstract.**

*Objectives:* This paper explores factors important for return to work (RTW) in people who have sustained a serious hand injury.

*Participants:* Forty people aged 19-64, with a severe or major hand injury were recruited consecutively during 2005-2007.

*Methods:* A self-administered and study specific questionnaire, including demographic data and standardised questionnaires for function, disability, daily occupations, health, quality of life, sense of coherence and several open questions was sent out by mail twelve months after injury. A few open questions regarding RTW were also included.

*Results:* The results showed that 27 people had returned to work within twelve months and 13 had not. Factors related to RTW and general work motivations were divided into individual factors, and factors related to the work environment and rehabilitation. The most prominent differences between the groups were individual factors, such as higher perceived disability, reduced hand function, and dissatisfaction with daily occupations resulting in a lower physical quality of life. The no RTW group had also more ward days (inpatient care) and lower sense of coherence.

*Conclusions:* These findings support the idea that the RTW process can be more dependent on the person's own ability and motivation than on the severity of the hand injury. Suggestions for intervention and further studies are presented in the discussion.

**Keywords:** Motivation, daily occupations, disability, sense of coherence

## 1. Introduction

Hands are important in almost every working situation. Therefore, a hand injury may limit a person's work performance. Although many hand injuries in Sweden used to occur at work and in some countries still do [1], more safety regulations and better safety equipment in many work places has reduced the incidence of work-related hand injuries. In Sweden the general incidence of a hand injury was estimated to be 3.2/1000 inhabitants/year [2]. In that study, only 22% of the people who had sustained hand injuries and were between 18 and 65 years were injured at work. Of those injured at work, 65% had a manual work [2]. Even if many injuries occur during leisure time, the work, and factors about the work situation become important to study and need to be focused in order to facilitate the return to work (RTW) process.

### *1.1 Factors that affect the RTW*

Work is, for most people, a way to make a living, but it can also be important for the general subjective well-being and satisfaction [3]. Work can, beside an income, offer a healthy structure to life and a social atmosphere that is beneficial to the individual. Absence from work due to any kind of illness or trauma should therefore be dealt with individually. Factors that affect RTW may be similar to those related to the general work motivation, which can be divided into three categories: *individual factors*, *workplace-related factors*, and factors within *rehabilitation* [4]. *Individual factors*, such as the person's own motivation and perception of how the work fits with his/her life circumstances, are especially important for the RTW process [5]. Another individual factor is Sense of Coherence (SOC) [6]. SOC is a salutogenic theory introduced by Antonovsky which consists of three dimensions; comprehensibility, manageability and meaningfulness. With a salutogenic approach, factors influencing health are in focus in contrast to a pathogenic approach that focuses on risk factors for disability. Antonovsky describes SOC as a disposition rather than a personality trait and claims that the way people view their life influences their

health [6]. SOC can thus play a role in the recovery for people with hand injuries [7]. Additional individual factors for this group may be impairment of hand function [8], occurrence of pain [9], and reduced grip strength [10-12]. For people with a severe hand injury, factors related to the severity of the injury have been reported to be directly related to probability for RTW [13-15], and to predict the length of time off work [16]. *Workplace-related* factors are the overall physical job demands [17, 18], psychosocial factors [19, 20], and specifically the importance of the communication and interface between work place engagement and the injured person in the RTW process [21, 22]. The third category of factors affecting RTW is *rehabilitation* and the type of treatment and therapy available. In this study, medical treatment is also included in rehabilitation. The number of surgical sessions has, for example, been seen to be a predictor for the length of time off work [16], while longer duration of rehabilitation was positively associated with RTW in cases of complex hand injuries at work [11].

The objectives of the present study were to compare outcomes in individual, workplace-related and rehabilitation factors important for RTW in a one year prospective study of people who sustained a serious hand injury of those who did, and those who did not RTW.

## **2. Methods**

The study design was a survey using self-administrated questionnaires of consecutive participants who were included in an ongoing longitudinal study of people with a severe or major hand injury being followed up at twelve months.

### *2.1. Participants*

All people with a serious hand injury referred to the department of Hand Surgery, Skåne University Hospital Malmö, Sweden, during 2005-2007 were considered eligible for the study. The Hand Injury Severity Score (HISS, MHISS) was used to classify the severity of the injury [23, 24]. HISS is an objective anatomical assessment specifically designed for hand injuries. The hand injuries can be divided into four categories, such as Minor (least injury), Moderate, Severe, and Major (worst injury). The inclusion criteria to the longitudinal research study were people with *major* (HISS >100) or *severe* (HISS >50 - ≤100) hand injury. Originally all people with a *major* injury were recruited consecutively, but as the inclusion of people with a major hand injury to the study during the two years was slow, a number of randomly selected people with severe injury (approximately every tenth person) were also included. The participants were between 19-64 years old and had a job at the time of the injury. Exclusion criteria were people with injuries caused by a suicide attempt or with a known severe psychiatric disorders or drug abuse. Examples of the severity of injuries in this study are total and subtotal amputation of fingers requiring re-plantation, laceration or crush injury of hand and full-house injury or nerve injury of hand or forearm. The individual participants were treated according to the extent and nature of the injury and the decision of the consultant. Rehabilitation included occupational- and physical therapy according to general practice at the clinic and contact with a social worker. A total of 40 participants; 30 with a major and 10 with a severe hand injury were included in the study; 32 men and 8 women. For demographic data on age, gender, severity of injury, dominant or non-dominant hand injury, and occupation see Table 1.

## 2.2. Assessment instruments

A self-administered and study specific questionnaire, including demographic data, perceived hand- and body functions, and a number of standardised questionnaires were sent out to the participants by post

at twelve months post trauma. They were asked to rate their perceived pain, grip strength, joint mobility, sensibility, dexterity, cold sensitivity, satisfaction in daily occupations, health status, disability, and physical and mental quality of life. The study specific questionnaire also covered the participants' descriptions of their job and working environment, cause of injury, medical treatment and rehabilitation. For details of the different variables concerning individual factors included in the questionnaires, see Cederlund et al. [7]. In the present study, the questions concerning individual, workplace-related and rehabilitation factors, at 12 months post trauma were used in comparison to the outcome of return to work (RTW).

#### *2.2.1. Physical work demand and work place factors*

The participants' description of the job situation was used for classification of the work demand according to Office of Administration Law Judges (OALJ) Law Library (US Department of Labor) [25], into sedentary, light, medium, heavy and very heavy by two of the authors (ER, RC) separately. Open questions developed specifically for this study were asked in the questionnaire about the accident, equipment and protective devices.

#### *2.2.2. Hand function, sleep disturbance and cold sensitivity*

Five questions regarding hand function: such as pain, joint mobility, sensibility, grip strength, and dexterity were quantified using a visual analogue scale (VAS). The questions were formulated for example as "Describe your grip strength ". The 10 cm scale extremes were 0=best possible grip strength to 10=worst possible grip strength. A hand function summed score was achieved by adding the five separate symptom items into one score (0-50). Sleep disturbance was measured with VAS (0-10). Cold sensitivity was measured using the Cold

Sensitivity Severity (CSS) scale [26, 27]. Higher scores indicate more impairment.

### *2.2.3. Satisfaction with daily occupations, disabilities of the arm, shoulder and hand, health, and quality of life*

Satisfaction with daily occupations was measured with the *Satisfaction with Daily Occupations (SDO)* instrument [28]. The *disabilities of the arm, shoulder and hand (DASH)* questionnaire was used to measure disability outcome [29, 30]. To measure health outcome, the *Euroqol EQ-5D* was used [31, 32]. The *Medical Outcome Study (MOS) 36-item short form health survey (SF-36)*, a self-administered generic instrument, was used to measure health-related quality of life [33].

### *2.2.4. Sense of coherence*

Sense of coherence (SOC) was assessed with Antonovsky's short 13-item scale in order to reflect a person's capacity to cope in a stressful situation [6]. Normative data from published studies using SOC-13 ranges from mean values (SD) 58.5 (12.1) to 68.7 (10.0) [34]. A pre-injury measure of SOC was not relevant in the present study as the participants were referred acutely. Therefore, we chose to assess SOC at six months when they no longer had any restrictions in using their hands and half of the participants were back at work.

## *2.3. Data Analysis*

Descriptive statistics with mean and standard deviation, median and range or percentage, was used for demographic data. For comparison between continuous outcome variables between the two groups RTW and no RTW at twelve months the Mann Whitney U-test was used. For comparison between dichotomised



variables at twelve months the Fisher's Exact test was used. The values from three months follow up were only used in the logistic regression analysis to predict RTW. The VAS scores for pain, joint mobility, sensibility, grip strength and dexterity were summed up and the mean value for each patient created a hand function summed scores (VAS 0-50). Analysis of job demand was scored separately by two authors (ER, RC) according to OALJ Law Library (US Department of Labor). When disagreement occurred (17 cases) it was by one step in the classification only (sedentary/light or light/medium), and a consensus was reached by discussion. The variable job demand was then dichotomized into sedentary/light/medium versus heavy/very heavy for further analysis. A manifest content analysis was performed [35] for two open questions in the questionnaire regarding RTW. These two questions were (English translation of questions in Swedish): "Describe any changes that have been made to your work environment after one year" and "How has the hand injury influenced your ability to work"? The text was read and reread and statements that were interpreted as reflecting strategies used by the participants were identified. The statements were then grouped and clustered into themes previously described in Cederlund et al. [36]. For this study these results are presented with selected citations for the reader to judge its application to other participants and settings. Peer debriefing was used by the first and second authors (ER, RC).

A binary logistic regression analysis was used to study the results at three months follow up to find out which factors could predict RTW. A first step was to choose variables at three months showing statistical differences between RTW and no RTW and p-values  $p < 0.05$  (Tables 4 and 5). The variables were also tested if they showed strong correlations with each other ( $r \geq 0.6$ ); then one representing the measured area of interest was selected. A strong correlation was found between DASH and Physical QoL. As DASH had the lowest p-value it was therefore chosen to be the representative variable for the analysis. The number of total ward days and number of emergency ward days were also strongly correlated; total ward days was chosen for the analysis as it had the lowest p-value thus being the stronger explanatory factor. If p-values were lower than 0.20 in the univariate analysis, the variable was included in the final multiple logistic regression analysis.

The final analysis included the three variables DASH, SOC and total ward days.  $P < 0.05$  was considered statistically significant.

#### *2.4. Ethics*

Study approval was obtained from Ethics Committee, Lund University, Sweden (714/2004).

### **3. Results**

The results are presented relative to individual factors, workplace-related factors and factors within rehabilitation.

#### *3.1. Demographics*

Approximately 118 people with major and severe hand injuries according to classification with HISS and MHISS [23, 24] were referred to the Department of Hand Surgery during the inclusion period. Forty-five people who had sustained major or severe hand injuries were included for the main study. For this study about RTW, forty people who were of working age and had been working at the time of the injury were included. Their mean age (SD) was 40 years (SD 14.0) (Table 1). Men (80%) experienced serious hand injuries more than women and the non-dominant hand (52%) was affected somewhat more often than the dominant hand. Forty percent of the injuries occurred at work. Twenty-seven participants (67 %) had RTW after one year. Of the 33 participants who had worked 100 % before injury, 21 had returned to 100 % after one year and nine had not been able to RTW at all after one year (Table 2).

### 3.1. Individual factors and RTW

In the self-administered questionnaires 19 of the participants indicated that the cause of the injury in different ways was due to their own fault; such as lack of awareness or attention, loss of balance or not enough expertise for the task. Those who RTW and considered the injury was due to personal factors were 14/27 compared to 5/13 in the no RTW group (Table 1).

The statistical analysis of the self-assessed questionnaires indicated that the participants who did not RTW after 12 months experienced significantly; higher disability (DASH) and were less satisfied with their daily occupations (SDO). They claimed less physical quality of life (SF-36), perceived lower health (EQ05 VAS), and had lower sense of coherence (SOC) (Table 3) than the group who had RTW within 12 months. They also expressed poorer hand function (grip strength  $p < 0.001$ , dexterity  $p < 0.001$ , joint mobility  $p = 0.001$ , hand function summed score  $p = 0.002$ ), and more sleep disturbances (VAS) than the RTW group.

In the RTW group 17/27 participants described in their reply to the open questions that they had experienced specific difficulties in performing their work. Seven participants described physical factors, such as grip function and dexterity, as limitations. They expressed for example that *“My grip is too poor and there is a risk that something will happen again”*. Five participants expressed that cold sensitivity and pain were limiting factors with a description as *“I have difficulties working in a cool room when I’m at work. I get such pain in my hand that I have to reduce my work speed”*. Four participants had problems with grip strength and one participant answered: *“In my work I have to be able to hold instruments and objects in my left hand, but now I cannot do that because I have no grip function and strength”*. Four participants had problems with impaired sensibility, which was expressed as: *“I cannot carry so many heavy plates and glasses can slip out of my hand because I still have bad sensibility”*. Problems with one-handedness was mentioned by three participants as a problem and expressed as:

*"You need two arms and hands if you work as a builder". A "mental factor" was described by one participant with the following answer: "The mental; it's difficult to be near the machine I was caught in during so many hours without help. One behaves like a coward which is not good".*

### *3.2. Factors related to the job and working environment and RTW*

Forty percent of the (16/40) participants were injured at work and nine (9/27) were able to RTW within one year (Table 1). The cause of the injury was in 53% of the (21/40) participants considered to be external factors, such as faulty machinery, tripping over unexpected obstacles, or because of broken glass. Those who RTW and considered the injury was due to external factors were 13/27 compared to 8/13 in the no RTW group. There were no statistical differences between the two groups (Table 1)

According to the physical job demands before the trauma, one participant (1/1) with very heavy physical job demands was able to RTW within a year compared to none (0/4) in the no RTW group (Table 1). When the material was dichotomised (Table 4) it showed that in the group with Sedentary/Light/Median physical job demands 19/27 were able to RTW compared to 7/13 in the no RTW group. There were no statistical differences between the two groups

A total of 15/40 participants reported that they used protective devices when they were injured. Seven out of 27 RTW participants described they used normal protective devices and equipment, such as gloves, helmet, steel-capped shoes and spectacles. Three did not use any protective equipment and 17 did not answer the question. Eight out of 13 no RTW described they used normal protective devices and equipment. One did not use protective equipment and four did not answer the question. There were statistical differences between the two groups

( $p=0.041$ ).

The participants who RTW ( $n=27$ ) were asked to describe any changes that had been made to their work environment within one year in an open question. Fifteen participants who RTW expressed no changes had been necessary in their work environment. Two did not answer the question. Ten participants described several changes. *Change of working technique* was mentioned by a few and expressed for example as *"I must carry the logs in a different way, I have become left handed"*. *Asking for assistance* was another technique that was mentioned and expressed by one person as *"I ask for help if I cannot do the task"*. As some hand injuries ( $n=13$ ) had occurred at work due to external factors, such as faulty machinery, or tripping over unexpected obstacles, *improved work routines* had been necessary to be introduced by the company. This was expressed by one person as *"The accident was rather tragic, but it resulted in more guarding eyes"*. To *compensate with objects in the environment*, such as a headset for the telephone or a van with automatic engine, were other examples of changes. A number of participants had to *choose other occupations* within the company to be able to continue to work. This was described as *"I have had to change to do other tasks"* and *"I have been transferred to another post and will try office work instead"*.

### 3.3. Factors within rehabilitation and RTW

The number of total ward days for the whole group of participants during the follow up at 12 months was a mean (SD) of 14 days (SD 13.7) and number of emergency ward days had a mean of 9 days (SD 7.9). The participants in the no RTW group had, in comparison with the group RTW, twice as many ward days, and twice as many days off work (Table 5). The total number of ward days included the emergency phase, later secondary surgery and intensive hand rehabilitation. The total number of visits to the outpatient clinic was a mean of 26 (SD 18.7) times. The visits to the outpatient clinic included visits to

surgeons, nurses and rehabilitation personnel. Almost half of the participants only had surgery once as an emergency operation (n=21), seven had two operations, five had three operations, one had four operations, three had five operations, two had eight operations and one had nine operations.

The majority of participants expressed they had received enough rehabilitation during the period up to twelve months. Seven 7/40 participants expressed a need for more medical- and work rehabilitation at the twelve months follow up. Some experienced for example difficulties with collaboration between their work and The National Insurance Office (Försäkringskassan), too little rehabilitation opportunities at the department of Hand Surgery, but also not enough rehabilitation in the community. They also wanted more follow-ups and more information about injury prognosis, home exercise, and how to perform daily occupations. One participant expressed difficulties in communicating with The National Insurance Office and expressed it like this *“I would like to be helped to find out what I can do in spite of the injury”*.

A question was asked *“When did you get in contact with The National Insurance Office for the first time after the hand injury?”* and the results showed a similar response between the groups. At a median (range) two weeks (1 day-15 weeks) after the injury they had their first contact with the Office. Another question concerned *“How long after the hand injury The National Insurance Office had made a Rehabilitation plan together with the participant?”*. The no RTW group had the rehabilitation plan made a median of 24 weeks (12-48 weeks) after the injury and 8 had not yet had a plan made at the twelve months follow up. This was different from the RTW group who had the rehabilitation plan made a median of 19 weeks (8-48 weeks) after the injury and 11 had not yet had a plan made at one year follow up. There were no statistical differences between the two groups (p=0.295).

### *3.4. Prognostic factors associated with RTW*

DASH was significantly associated with the likelihood for RTW in the logistic regression analysis (OR 0.9; CI 95% 0.83-0.98;  $p=0.02$ ). This means that the odds for RTW can be expected to increase with a factor 0.90 for every unit decrease in DASH score. The two other variables included in the final multiple logistic regression analysis, SOC (OR 1.1; CI 95% 0.96-1.17;  $p=0.228$ ) and total ward days (OR 1.0; CI 95% 0.90-1.05;  $p=0.420$ ), were not significantly associated with RTW.

### *3.5. Summary of results*

The present study of 40 participants with a severe or major hand injury, whereof 40% had been injured at work, showed that 27 of the participants had RTW at twelve months and 13 patients had not RTW. There were differences between the group of participants who RTW and those who did not, especially due to individual factors. A perceived disability in daily activities, including worse symptoms, reduced hand function, as well as dissatisfaction in daily occupations resulting in a lower physical quality of life, were factors influencing RTW (Table 6). The no RTW group had also more total ward days and lower sense of coherence. The most important factor influencing RTW was the outcome measure of disability (DASH).

## **4. Discussion**

### *4.1. Individual factors*

The participants perceived disability and health (DASH, EQ05VAS), daily occupations (SDO), physical quality of life (SF 36), sense of coherence (SOC), hand function (summed VAS), sleep disturbance (VAS),

were significantly better experienced in the group that RTW compared to those who were not able to RTW twelve months after injury. These factors may indicate the extent to which the participants was able to cope with the injury and capable of RTW, but may also reflect the consequences of the injury on the whole life situation. However, other ways to judge severity of injury, which might be considered more objective, such as HISS/MHISS, presence of a peripheral nerve injury and total length of surgery, did not differ between the groups. These findings support the idea that the success in RTW can be more dependent on the participants own perception [5] rather than on how the injury is classified. In contrast to previous studies [14, 38-40], we found no association between HISS and RTW, which can be explained by our relative small study population and only participants with HISS scores higher than 50 were included. However, SOC differed between the groups ( $p= 0.027$ ) with a higher score in the RTW group, which is in line with our earlier suggestion that it is important to individualize the rehabilitation and give extra support to those people with a lower SOC in order to strengthen their self-belief and motivation [23]. Contrary to earlier findings [9], experience of pain did not differ between the present groups.

Interestingly, more participants in the no RTW group were injured at work and they also more often claimed that the injury happened due to external factors. Whether this may be because they considered themselves as victims and not able to control their own situation can only be speculated on, but these patients also showed a lower SOC. Therefore, the SOC-13 assessment could also help in identifying people who need extra coaching in order to successfully RTW. Sense of Coherence (SOC) [6] is considered to play an important role in the recovery for people with hand injuries [7] and seems to be related to RTW. One may speculate that the general mental health is lower in people that are not able to RTW. However, the present data did not support such a notion since the variable focusing on mental health in SF36 (vitality, social functioning, role emotional, mental health) did not differ between the groups. On the other hand, outcome after hand injuries in a larger population of the present group of patients showed significant differences in mental health 3-6-12 months after hand injury [7].



Post injury depression or post traumatic stress disorder (PTSD) is not unusual after a hand injury [41] although most people do not meet the criteria for the full diagnosis of PTSD [42, 43]. Although PTSD was not in focus for the present study, a few participants, who for example had been caught in machines by accident, expressed anxiety to come closer to the machine causing the injury. It is therefore suggested that PTSD assessment instruments should be used in routine clinical care at a specialist hand surgery unit and such disorders dealt with accordingly early in the rehabilitation

As DASH includes 21/30 questions about daily occupations one can conclude the instrument has a strong focus on occupational performance and the ability or disability of a person to perform daily activities. DASH scores at three months after hand injury in the present study could predict RTW after one year it could therefore be a useful instrument to identify those people who need extra support and for individualizing the rehabilitation and the RTW process. Higher SDO was associated with successful RTW and we also found that work was important for quality of life, which is in line with previous studies [3] where RTW after stroke was identified as the major factor for high subjective well-being and life satisfaction. It is suggested that occupational therapists working with people during the middle rehabilitation phase who meet people in their RTW process should focus more on how to help people to improve or adapt to specific occupational tasks during treatment. Useful coping strategies after a serious hand injury have been studied earlier [36] and could be incorporated in a specific programme enabling occupation for RTW. Such a programme could also focus on people's whole lifestyle, occupational performance and occupational balance [44]. DASH is recommended to be used in the RTW process and an improvement of DASH with more than 10 points is considered clinically relevant [45].

The no RTW participants experienced worse hand function, not only in grip strength but also in dexterity and joint mobility compared to the RTW group. Similar results have been presented [10] showing strong differences between such groups concerning grip strength. Chang et al. [12] also showed

a strong correlation between no RTW and impaired hand function with grip strength as a significant predictor for RTW. This is in accordance with the present data, where the participants had several problems, poor grip strength and grip function, and problems with exposure to cold, reduced work speed due to pain, which prevented them to RTW. An optimal hand function is vital for RTW and an impaired hand function, such as cold sensitivity [8], pain [9] and reduced grip strength [10-12], can greatly hinder recovery and reduce successful functional outcome. Some people may benefit from more intensive exercises to improve grip strength. They may also benefit from knowledge in hand ergonomics in order to improve in skills in daily occupations in spite of a reduced hand function.

#### *4.2. Factors related to the job and working environment.*

A third of the RTW participants were injured at work (9/27) while more than half of the participants who did not RTW (7/13) had been injured at work. This is in accordance with previous findings [9], where people with work injuries returned to work later and no relation with severity of injury was found. The fact that the injury occurred at work may have an impact on the individual's motivation to RTW.

Even if 40% of the serious hand injuries in this study occurred at work, which is almost twice as many as when all hand injuries are included in Sweden [2], the serious hand injuries still occurred more often during leisure activities (24/40, 60%) than at work. During the last half a century, over all work related hand injuries have decreased in Sweden and most probably also in other developed countries [2], mainly due to safer work places. Thus, nowadays injuries take place during leisure when performing different sport activities and during do-it-yourself (DIY) work [2]. Such injuries do not only induce personal suffering, but also substantial costs to the society for several reasons [46]. It is obvious that better safety instructions and knowledge about safety precautions for specific work machines used for

DIY work (i.e. log splitters) is necessary, to reduce the number of injuries during leisure activities.

#### *4.3. Factors within rehabilitation*

There was a difference in time to set up a rehabilitation plan between the two groups of participants, which is an interesting observation but difficult to interpret. In Sweden, since 2008 there is a new regulation compelling the National Insurance System to set up a rehabilitation plan within 90 days after a person is sick listed [47]. In the present study, and although these participants were injured before 2008, it was surprising that people with such serious injuries even at twelve months, still had no rehabilitation plan made. Such knowledge has to be communicated to the authorities in order to improve the rehabilitation of people as the present ones. It is important that the rehabilitation personnel, is updated in the National Insurance policy documents for RTW. It is suggested that guidelines for RTW should be incorporated in collaboration with acute health care, primary health care, occupational health care and National Insurance Office for better coordination. A future challenge is to develop methods to assess each person's level of activity and work ability, in consideration of medical prerequisites and a job. This was expressed by the participant who wrote *"I would like to be helped to find out what I can do in spite of the injury"*.

The number of ward days among participants who did not RTW was twice as many compared to the RTW group, both as emergency ward days and total length of surgery (minutes). This could indicate that either such people had more severe injuries, which was not shown in the analysis, or that other individual factors such as SOC, may influence the total ward days. It is important to study this further to find evidence if sense of coherence can be an indicator for future rehabilitation focus [23]. People having several operations, and many days spent in in-patient care may indicate a need for more coaching and support as well as intensive treatment and rehabilitation.

#### *4.5. Methodological considerations*

The study sample was small, although we included participants for two years. Also the severity and the rather unique character of each individual's injury make it difficult to generalize to other groups of patients. In addition, one has to consider that these patients, all with severe or major injuries according to HISS, received individualized treatment of their specific injuries, which may also influence the outcome. However all participants were treated in the same Department of Hand Surgery with the latest and most up-to-date evidence in medical treatment and hand rehabilitation.

#### **Conclusion**

We conclude that different aspects of general work motivation as proposed by Gard and Larsson [4], divided into individual, workplace-related and rehabilitation factors, makes a clear description of the RTW process for people with a serious hand injury. The differences between the groups RTW and no RTW in this study were mainly due to individual factors. We conclude that success in RTW can be dependent on peoples own perception of the consequences of the injury and motivation. Therefore it is important to individualize the rehabilitation and give extra support to those with extra needs. Sense of coherence is an indicator for rehabilitation focus and should be studied further in intervention studies. DASH could also help in identifying those people who need extra attention. As disability and dissatisfaction in daily occupations were associated with RTW it is recommended that more focus should be put on how to improve or adapt to specific tasks in the patient's occupations during the treatment. A future challenge is to develop methods to assess each patient's level of activity (occupational performance) related to work ability in collaboration with the patient, the rehabilitation actors, the workplace and The National Insurance Office.

## **Recommendations**

- Many operations and days spent in in-patient care may indicate the need to organize for lengthy and intensive rehabilitation
- Guidelines for RTW to be incorporated in collaboration with acute-, primary- and occupational health care and National Insurance Office for better coordination.
- DASH is recommended to be used in the RTW process.
- Include PTSD assessment instruments in routine clinical care.
- Extra support to people with lower SOC in order to strengthen their self-belief and motivation
- More focus on people's whole lifestyle, occupational performance and occupational balance and how to help people to improve or adapt to specific occupational tasks.
- Better safety instructions and knowledge about safety precautions for specific work machines used for DIY work to reduce injuries during leisure activities.
- A future challenge is to develop methods in the rehabilitation process to assess each person's level of activity and work ability, in consideration of medical prerequisites and a job

## **Acknowledgement**

[edited for review process]

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Table 1. Characteristics of the patients with a severe and major hand injury (n=40).

Characteristics of the subjects	Whole group n=40	RTW n=27	No RTW n=13	Group differences <sup>3</sup> p-value <sup>4</sup>
Age (y), mean (SD)	40 (14.0)	38 (14.2)	42 (12.2)	
HISS severe/major (dik) <sup>1</sup>				0.124
Gender, n (dik)				1.000
Male	32	22	10	
Female	8	5	3	
Dominant hand injury, n (dik)	19	13	6	1.000
Physical job demand, (dik)				0.480
Physical job demand, n				
Sedentary	5	3	2	

Light	7	6	1	
Medium	14	10	4	
Heavy	9	7	2	
Very Heavy	5	1	4	
Employment status, n (dik)				1.000
Paid employment	34	23	11	
Self employed	6	4	2	
Place of injury, n (dik)				0.305
Work injury	16	9	7	
Leisure injury	24	18	6	
Cause of injury, n (dik) <sup>2</sup>				0.305
External factors	21	13	8	

Personal factors

19

14

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<sup>1</sup>Dichotomised into sedentary/light/medium and heavy/very heavy job demand. <sup>2</sup>The cause of injury was expressed as external factors: faulty machinery, tripping over unexpected obstacles, because of broken glass and personal factors: clumsiness, loss of balance and not enough expertise for the task. <sup>3</sup>Dichotomised variables. <sup>4</sup>Fisher's Exact' test.

Table 2. Employment rate before and after injury (n=40).

Employment rate before injury	Number of injured patients	RTW to same employment rate after one year	RTW to limited employment rate after one year	No RTW after one year
100%	33	21		9
75%	2	1	2	1
50 %	1	0	1	1
25 %	4	2		2
Sum	40	24	3	13

100 % employment rate is full time work.

Table 3. Differences in outcome between the groups RTW and no RTW to work at 12 months with the values of the groups collected at three and twelve months follow up (n=40).

	RTW	No RTW		RTW	No RTW	
	at 3 months <sup>1</sup>	at 3 months <sup>1</sup>		at 12 months	at 12 months	
	n=27	n=13		n=27	n=13	
	Median (range)		P-value <sup>2</sup>	Median (range)		P-value <sup>2</sup>
Disabilities in the arm, shoulder, hand (DASH)	27 (1.7-52.0)	42 (20.0-79.2)	<0.001	10 (0-39.2)	38 (7.5-56.7)	<0.001
Sleep disturbance (VAS)	0 (0-8.0)	6 (0-10.0)	<0.001	0 (0-7.4)	2 (0-8.8)	0.013
Hand function (Summed VAS score)	28 (12-36)	34 (18-47)	0.005	24 (5-39)	37 (10-50)	0.002
Physical Component Scale (SF-36)	44 (32.4-57.3)	36 (25.6-49.3)	0.016	52 (42-66.9)	41 (31.7-56.3)	<0.001
Health status (EQ-05VAS)	70 (30-100)	55 (1-85)	0.039	80 (49-100)	73 (14-90)	0.023
Satisfaction in daily occupations (SDO)	37 (12-50)	27 (12-48)	0.066	44 (29-58)	30 (12-40)	<0.001

Mental Component Scale (SF-36)	52 (20.9-60.8)	47 (12.7-61.5)	0.168	54 (19.9-58.6)	50 (19.5-63.2)	0.628
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<sup>1</sup>The variables at three months were only used in the logistic regression analysis to predict RTW. <sup>2</sup> Mann Whitney U-test.

Table 4. Work status one year after hand injury (n=40) dichotomised into two physical job demand groups.

Physical job demand,	Whole group	RTW	No RTW
	n=40	n=27	n=13
Sedentary/Light /Medium	26	19	7
Heavy/Very Heavy	14	8	6



Table 5. Differences in independent variables between groups, RTW and no RTW at 12 months follow up (n=40).

	RTW	No RTW	
	n=27	n=13	
	Mean (SD), median (range), no.		P-value <sup>2</sup>
Total ward days, n	10 (10.9)	22 (15.7)	0.005
Sense of coherence (SOC)	71 (48-91)	64 (40-75)	0.027
Emergency ward days, n	7 (6.1)	12 (9.9)	0.060
HISS/MHISS (score)	144 (52-310)	168 (84-414)	0.073
HISS/MHISS (severe/major), n	9/18	1/12	0.124
Surgery (total length, min)	274 (86-943)	679 (104-7468)	0.142
Peripheral nerve injury (yes/no), n	13/14	3/10	0.177
Work injury/leisure injury, n	9/18	7/6	0.305

Age (Years)	38 (14.2)	42 (12.4)	0.424
Physical Job Demand (dik <sup>1</sup> ), n	19/8	7/6	0.480
Injury to dominant/non-dominant hand, n	13/14	6/7	1.000

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<sup>1</sup>Dichotomised into sedentary/light/medium and heavy/very heavy job demand. <sup>2</sup> Mann Whitney U-test.

Table 6. Summary of results showing differences between the groups RTW and no RTW.

RTW (n=27)	No RTW (n=13)
<i>Individual factors of a global character and RTW</i>	
More injuries due to personal factors	Less injuries due to personal factors
Better total hand function (VAS 0-50)*	Worse total hand function (VAS 0-50)*
Less sleep disturbances (VAS)*	More sleep disturbances (VAS)*
More satisfaction with daily occupations (SDO)*	Less satisfaction with daily occupations (SDO)*
Less disability (DASH)*	More disability (DASH)*
Higher health status (EQ05VAS)*	Lower health status (EQ05VAS)*
Higher sense of coherence (SOC)*	Lower sense of coherence (SOC)*
Higher physical QoL (SF36)*	Lower physical QoL (SF36)*
<i>Factors related to the job and working environment and RTW</i>	

Less heavy/very heavy job demand

More heavy/very heavy job demand

More injuries occurred during leisure

More injuries occurred at work

Less external causes of injury

More external causes of injury

Less used protection devices

More used protection devices

*Factors within rehabilitation and RTW*

Less total operation time (274 minutes)

More total operation time (679 minutes)

Less emergency ward days (7 days)

More emergency ward days (12 days)

Less total ward days (10 days)\*

More total ward days (22 days)\*

More satisfied with amount of rehabilitation

Less satisfied with amount of rehabilitation

Rehabilitation plan made earlier (19 w)

Rehabilitation plan made later (24 w)

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\*Indicates statistical differences between the groups (Tables 4 and 5). All other variables show no statistical differences.