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SOMATO-PSYCHO-SOCIAL
ASPECTS OF RECOVERY
AFTER TRAFFIC INJURIES

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TO HANNA AND TOMAS
ABSTRACT

Injuries, including those related to traffic, are an important cause of long-term morbidity among people in productive ages. This thesis focuses on self-perceived recovery after traffic related minor musculoskeletal injuries. The aims of the studies were to characterize the variation in recuperation time using sick-leave and self-perceived non-recovery as markers of residual illness, to identify prognostic factors of delayed recovery (Paper I), to relate self-perceived recovery to functional health status, as measured by the Short Form-36 (Paper II), to develop a new instrument - the Prediction of Prolonged Self-perceived recovery after musculoskeletal injuries questionnaire, the PPS - and to evaluate its predictive ability regarding self-perceived recovery by applying it on a new group of patients (Paper III) and finally, to evaluate the efficacy of a multidisciplinary intervention program in terms of by patient reported recovery at 12 months (Paper IV).

This thesis is based on two prospective studies on patients with traffic related musculoskeletal injuries. In the first study, 318 patients were included (Papers I and II). All patients received medical and surgical treatment according to the hospital routines. Information about the patient’s background and the injuries were collected and the patients were asked to assess their functional health status during the week that had preceded the accident using the SF-36. The patients were followed up at 1 month and at 6 months by means of a mailed questionnaire and asked to report if they felt recovered, to report their duration of sick leave and to rate their functional health status (SF-36). In the second study (Papers III and IV) 387 patients were enrolled and followed up in the same manner. The PPS questionnaire was filled in by all enrolled patients and the ones predicted to have a high risk of non-recovery were randomized to an intervention (n=65) or to a control group (n=62). The intervention program consisted of four group sessions and focused on information about injuries and pain management and called attention to self-care and physical activity. All patients were followed up at 6 months (Paper III) and 12 months (Paper IV).

Self-perceived non-recovery was reported by about 60% at 1 month and by about 40% at 6 months. The injury-type, working status and educational level were associated with self-perceived non-recovery at 1 month, while only working status and educational level were associated with self-reported non-recovery at 6 months (Paper I). Patients who reported recovery had significantly higher SF-36 subscores than those who reported non-recovery, even if not all of the recovered patients had reached their pre-injury levels. The physical dimensions of the SF-36 were more strongly associated with feeling of recovery both at 1 month and at 6 months (Paper II). The PPS questionnaire identified patients at high risk of non-recovery more accurately than a prediction that was based solely on information about the injury (Paper III). A significantly larger proportion of the patients in the intervention group than in the control group reported self-perceived recovery at 12 months (Paper IV).

In conclusion, the injury in combination with, social, and emotional factors interact in the recovery process after an injury. The PPS questionnaire might be useful in identifying patients at risk of delayed recovery. Intervention focusing on somato-psycho-social support in the early phase after an injury seems to enhance self-perceived recovery in selected patient groups but need to be verified in future studies.
LIST OF PUBLICATIONS

This thesis is based on the following papers, referred to as Papers I-IV:

PAPER I
Outcome after Minor Traffic Accidents: A Follow-up Study of Orthopaedic Patients in an Inner-City Area Emergency Room.
Ottosson C, Nyrén O, Johansson SE, Ponzer S
Journal of Trauma, 2005; 58, 553-60

PAPER II
Ottosson C, Pettersson H, Johansson SE, Nyrén O, Ponzer S
Quality of Life Research 2006 Oct 11 (Epub)

PAPER III
A novel Clinical Instrument for Predicting Delayed Recovery after Musculoskeletal Injuries.
Ottosson C, Pettersson H, Johansson SE, Nyrén O, Ponzer S
Accepted Journal of Trauma 2006

PAPER IV
A Multidisciplinary Group Intervention Program to Promote Recovery after Minor Traffic Injuries – a Randomized Controlled Trial
Ottosson C, Pettersson H, Johansson SE, Nyrén O, Ponzer S
Submitted 2006
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INTRODUCTION

BURDEN OF INJURIES

Injuries are an important cause of mortality and long-term morbidity among people in productive ages [1, 2]. It has been predicted that injuries will rank as the third leading cause of premature death and disability as measured by disability-adjusted life years by the year 2020 [3]. The burden of injuries on society is also reflected in the distribution of costs for sick leave and it has been estimated that in Sweden about 9% of the total costs for sick-days relates to injuries [4].

Traffic related injuries (TRI), in many cases caused by motor vehicle collisions (MVC), are common. In Sweden, approximately 50,000 cases of traffic injuries are reported each year [5]. TRI results in large costs and suffering for the individual and it has been reported that the annual sick leave costs in Sweden for neck injuries after MVC alone is about SEK 50 million [5]. Besides individuals with whiplash injuries (WAD) there are other groups of patients with minor or moderate injuries of whom only a minority require hospitalization but that are also at risk for long-term disability and suffering [6]. In a systematic review [7] regarding the prevalence of disability following TRI it was concluded that due to the substantial heterogeneity and methodological problems in the 19 included studies, the prevalence estimates varied between 2% and 87%. They further stressed the need for well-designed epidemiological studies using validated outcome measures.

OUTCOME AND PREDICTORS OF OUTCOME AFTER TRAFFIC INJURIES

A traffic accident, even one that results only in a minor injury, is always an unexpected event in which the person involved may pass from a healthy state to a more or less disabled state. The injury itself and its treatment have a great impact on the recovery but even if the somatic treatment given is correct and no complications arise, the recovery process in some cases can be slower than expected or a patient may never fully recover[8, 9]. Some studies have highlighted the fact that a broad range of traumatic events, including for example infections and traffic injuries, have the same type of predictors for adverse outcomes such as chronic pain, fatigue, concentration problems and post-traumatic stress disorder (PTSD) [10]. These findings suggest that similar pre-event, event-related, and post-event factors influence the development of chronic disability after any stressful event. In order to better understand the complex recovery process after an injury a research approach including biological, psychological and social aspects seems to be applicable.

Published papers about outcomes after traffic injuries have focused mainly on one specific injury type, namely, the whiplash type of neck injury. The combination of
residual symptoms, known as ‘whiplash-associated disorder’ (WAD), is well defined [11]. WAD grade 0 denotes no complaints or physical signs, grade 1 denotes neck complaints without any other physical signs, grade 2 denotes neck complaints and musculoskeletal signs, and grades 3 and 4 denote neck complaints and neurological signs or fracture/dislocation, respectively. Most published studies focus on injuries of WAD grade 0 – 2. The proportion of chronic complaints (lasting longer than six months) associated with a WAD revealed in international studies lies between 2% and 58% [12, 13]. It has been shown that some WAD patients experience long-term disability, although the nature of the structural lesion and the reason for the persisting pain is not fully established [14-17]. However, some of the symptoms reported by those who do not recover are also common in a normal population. The cumulative incidence of neck pain, for example, has been estimated to be about 75% during a lifetime, and has been reported to result in chronic pain in about 10% of cases [18]. Further, there are some indications that external factors such as the insurance policy can affect the frequency of persisting symptoms [19]. In Lithuania, for example, long term disability after a whiplash injury is uncommon [20]. The time to closure of claims after a TRI and the duration of the litigation process have been used as an outcome measure, but have also been proposed to be one of the major predictors of recovery [19, 21, 22]. It has also been suggested that fear during and directly after the accident negatively affects the outcome [23], this effect seems to be lessened if the person has been briefly unconscious during the acute phase, or if the patient has amnesia for the accident [24].

The systematic reviews regarding predictors of recovery or non-recovery after traffic injuries that have been published deal all with WAD. Coté et al. [12] reviewed 13 papers and concluded that compensation system, age, gender, baseline neck pain intensity, baseline headache intensity and baseline radicular signs and symptoms were the most important factors that predicted recovery. In Scholen-Peeters et al. review [13] 50 papers reporting on 29 cohorts were included (12 were considered to be of 'high quality') but due to the heterogeneity of patient selection, type of prognostic factors and outcome measures, they were not able to do a statistical pooling. They found strong evidence for high initial pain intensity being an important predictor for delayed functional recovery for WAD patients but also that the often mentioned factors like age, gender and compensation did not seem to be of prognostic value in their review.

In summary, the predictors for an adverse outcome that have been presented in the literature deal with pre-event factors such as sociodemographics (gender, education, work type and employed or not) and pre-injury health status (neck pain, psychiatric disorders), accident factors such as crash related factors (position in the car, if anyone was killed) and injury related factors (injury severity, initial pain reaction, initial psychological response) and finally, post-event factors such as compensation (litigation, work compensation, guilt for accident) and symptoms (persisting pain, psychological disturbances).

MEASURING OUTCOME AFTER INJURIES

The variation in the frequency of long term consequences after a TRI probably partly reflects the use of different outcome measures. The main approaches used today
include two different “schools” with two quite different endpoints for recovery, namely, the closure of the claim for compensation [25] (in which case no follow-up is carried out whether symptoms persist), and factors reported by the patient alone or in combination with symptoms and signs based on an examination of the patient. Outcome measures used in the latter case include most often self-reported recovery rate, measurements of pain, rate of return to work, health related quality of life (HRQoL) measurements, functional scales and measures of mental well being. However, there is still a lack of consensus about the outcome measures that should be used in studies of traffic injuries as pointed out in Cochrane report by Verhagen, [26] and also in the report by Ameratunga [7].

Self-perceived recovery

Self-perceived recovery can be considered as a global measure of the patients’ feeling of being recovered or not. It has been used in some previous studies and shown to correlate with other more comprehensive measures [27-29]. It gives the patient an opportunity to interpret and relate the recovery to personal expectations and demands such as ability to do things, relief of pain and endurance of physical limitations, as well as social expectations and demands such as work load, acceptance for sick role. **Self-perceived recovery and its relation to other outcome measures have been further studied in this thesis.**

Pain measurements

Pain is one of the most frequent complaints after an injury, and thus the outcome has often been related to different pain measurements. A common way of measuring pain is the visual analogue scale (VAS). The VAS has been widely used both in clinical practice and in scientific studies [30-32]. The VAS is presented as a line on which the patient rates the pain experienced, with the leftmost point representing the absence of pain and the rightmost point representing the worst imaginable pain [33]. Other more comprehensive scales that enable the patient to rate the intensity, the duration, and the frequency of pain have often been used in outcome studies [20, 34-36]. One widely used scale for rating pain is the Multidimensional Pain Inventory (MPI), which is related to cognitive behavioural conditions and takes into account a number of individual aspects of pain perception, including the patient’s perception of the reactions of others towards his or her own pain symptoms, the perception of behavioural limitations, and the impact caused by pain on the patient’s lifestyle [37]. The McGill pain questionnaire (MPQ) [38, 39] is another instrument that has been frequently used. The MPI and the MPQ, however, are more comprehensive and less suitable in an acute situation when the time is limited.

Measures of Sickness Absence

Sickness absence is a measure often used in outcome studies. Unfortunately, the terminology regarding sickness absence has not been standardized, and differences in compensation systems between countries can make the comparisons difficult. Some countries, for example, have a maximal compensation period, while other countries have no limit for the sick spell time. Sickness absence is also by its very nature a
complicated measure to use, since it for example is dependent on the patient’s type of work. Statistics given for patients on extended sick leave or who have delayed their return to work after a traffic injury range between 5% and 63% in the published studies[11, 40-43].

Measures of sickness absence are often defined as 1) return to work (which is suitable for evaluating persons who already are on sick leave), 2) duration (days, weeks) of sick leave (which is suitable to estimate recuperation time) and which may be derived from self-reported information or information obtained from registers; or 3) number of persons (obtained either from self-reports or from registers) on sick leave (which is suitable to compare different groups). Self-reported sick leave (days off work) was used as an outcome measure in this thesis. We chose to rely on by patient reported sick leave days, which have been reported as reliable a measure as information obtained from register records [44].

**Measures of mental well-being**

*Visual analogue scale (VAS)*

VAS is most often used for pain ratings but this technique has also been applied as a measurement of mental well-being. The VAS is shown to have a good reliability and validity compared to multi-item measures of depressive moods [45][46] and anxiety disorders [47]. A VAS can be easily used in an acute care setting since it is simple and quick.

*Hospital depression and anxiety scale (HAD)*

The HAD is a 14-item, self-administered questionnaire that consists of seven items that focus on signs of anxiety (HADS-A) and seven items that focus on depression (HADS-D). Each item is scored on a Likert scale from 0 to 3, and the item scores are added, giving subscale scores that range from 0 (minimum symptom level) to 21 (maximum symptom level). A cut-off point of 10 is often used to detect individuals with “probable” depression or anxiety disorder [48]. The HAD score has also been used to measure the outcome of patients injured in traffic accidents [9, 49].

*Post Traumatic Symptom Scale (PTSS-10)*

Post-traumatic stress disorder (PTSD) is known to occur in traumatized persons but is not uncommon after motor vehicle injuries [23]. A short instrument for measuring PTSD, the PTSS-10, consists of 10 questions to be answered with a gradient from 1, “no problems”, to 7, “very severe problems”, which thus gives a total score that ranges from 10 to 70. A score above 50 can be considered as an indication of clinically significant PTSD [50, 51].

**HRQoL and functional health status**

The term “quality of life” [52] emphasises the complexity of health and well-being. It includes the complete situation in which the individual exists, including the expectations of that individual himself or herself has, and the expectations of society.
This definition includes physical health, psychological health, and socioeconomic well-being.

Health-related quality of life (HRQoL) is related to the health of the person, and includes physical and psychological well-being. Several HRQoL measures have been developed with the aim of measuring the patient’s own experience of health and illness in a broad perspective. The different types of HRQoL measures can be categorized as: domain-specific measures that focus on special aspects of health (depression, for example), disease-specific or population-specific measures that focus on particular health problems (arthritis of the hip joint, for example) and generic measures that can be used for different patient populations independently of the injury or disease for measuring general health. Utility measures are also generic measures but allow also economic evaluations, between, for example, different treatment options. The established HRQoL measurements are well validated and can be used when detecting changes in health [53-55].

The Short Form 36 (SF-36)

The SF-36 is a generic measure that consists of 36 questions and it enquires into the following eight subscores: physical functioning (PF), limitations in usual role activities due to physical health problems (RF), bodily pain (BP), general health (GH), vitality (VT), social functioning (SF), limitations in usual role activities due to emotional problems (RE), and mental health (MH). Each of the eight subscores ranges from 0 to 100 (optimal). The SF-36 has been widely used, and its validity and reliability have been shown to be acceptable in a Swedish population [56]. It has also been shown to be particularly suitable for measuring health changes [53].

The eight SF-36 subscores can be categorized into two domains (physical and mental health) [54]. The sum of the eight scores divided by 8 has been used as a global SF-36 score [57, 58], although the use of the SF-36 in this manner was not recommended originally.

It has been questioned whether the SF-36 measures functional health status or whether it is a measure of health-related quality of life. The original paper in which the SF-36 was described stated that the instrument should not be considered as a quality of life instrument [54], however, the SF-36 reflects a wide range of aspects of health and is often regarded as a HRQoL instrument in the literature.

The Short Musculoskeletal Function Assessment (SMFA)

The Short Musculoskeletal Function Assessment (SMFA) measures general musculoskeletal function and can be used in patient populations with different injuries or diseases [59]. It has been validated for Swedish conditions [60]. The SMFA is a 46-item questionnaire; 34 of these items assess the patient’s function (and are components of the ‘dysfunction index’), while 12 of these items assess the degree to which the patient is bothered by the functional problems (and are components of the ‘bother index’). The responses to the questions are summed and the score obtained is then scaled to a value between zero and 100, where a higher score indicates a poorer function.
Impairment, Disability and Handicap

Impairment and disability are important measures of health status. Since this thesis focus on somato-psycho-social aspects of recovery, the WHO classification was chosen as a platform when discussing the different aspects of recovery. The International Classification of Impairment, Disability and Handicap [61] defines impairment as any loss or abnormality of psychological, physiological, or anatomical structure or function, while disability is understood as any restriction or lack (resulting from an impairment) of ability to perform an activity in the manner or within the range considered normal for a human being. Finally, handicap is defined as a disadvantage for a given individual, resulting from impairment or a disability that limits or prevents the fulfilment of a role that is normal (depending on age, sex, and social and cultural factors) for that individual. Even if this classification has been criticized for being dependent on a definition of ‘normality’ [62] and that it takes for granted that disability can be explained fully by impairment it is still often used.

Classification of injuries

In order to discuss outcomes after injuries, the injuries leading to a possible change of health status need to be defined and classified. There are several well validated classification systems for musculoskeletal injuries [63]. However, most of them focus on a specific injury or fracture type, and are therefore less appropriate for use in groups of patients with mixed types of injuries. The Injury Severity Score (ISS) is a classification system often used to score the severity of injuries [64]. The ISS relates mainly to mortality but it also indicates the overall severity of an injury and hence does provide some information about the risk for subsequent morbidity.

TREATMENT METHODS FOR ENHANCING RECOVERY

It has been suggested that psychosocial and other support programs, given in addition to the correct medical and surgical treatment and rehabilitation, will enhance recovery after traffic injuries. This additional support has been provided in several ways and forms but has almost exclusively focused only on WAD patients. Two Cochrane reports [26, 65] on conservative treatment methods for WAD patients have been published. The first report concluded that “rest makes rust”, although the second report cast doubt on this conclusion by showing that it lacked statistical significance. Even if there are some studies on treatment to enhance recovery, there still is a great need of additional knowledge in how the intervention program should be designed and the appropriate time to address and evaluate the intervention.

Early mobilisation

Early mobilisation after any musculoskeletal injury or disease is a well accepted concept, for example after hip surgery [66] or ankle sprains [67]. Several studies have also shown that immobilisation generally worsens the outcome for WAD patients and published reviews of the different treatment strategies have revealed the importance
of early mobilization as an essential part of the treatment [68-71]. A rather recent Cochrane report [26], could not with statistical significance prove that mobilization gives a better prognosis than rest or immobilization, but as the trend was in favour for mobilisation, the authors recommend that mobilization should be included in the treatment strategy in future studies.

Educational interventions

Some educational strategies have been proposed to promote recovery among WAD patients. In a randomized controlled trial by Ferrari et al. [27] it was shown that information pamphlets given at the emergency room did not alternate the outcome regarding the severity of symptoms, ability to carry out daily activities, length of sick leave, or severity of litigation during the follow-up period of three months.

Educational videos have also been used for the same purpose. In a RCT by Brison et al. [34] a video that provided reassurance, and advice about posture, return to regular activities, exercises, and pain-relief methods was used as intervention. The primary outcome in their study was presence of persistent WAD symptoms (frequency and severity of neck, shoulder, or upper back pain) at 24 weeks post-injury. They concluded that the video group demonstrated a trend toward less severe WAD symptoms and they recommended evaluating other educational interventions that could reduce WAD symptoms.

Oliveira et al. [72] demonstrated in a RCT that a 12-minute psycho-educational video shown in the ER shortly after the whiplash injury reduced pain ratings at a 1-month follow-up and this pattern held for the 3- and 5-month follow-up period. They concluded that a brief psycho-educational video had an effect on subsequent pain and medical utilization.

Psychosocial interventions

Recovery after trauma includes not only physical healing but also mental well-being. A RCT of trauma patients who were treated with individual psychosocial support showed that the intervention had a positive effect on psychiatric complaints and on the HRQoL measured by the SF-36 [73]. Mayou, in contrast, showed that an intervention group who had received debriefing had a worse outcome when measured by general psychiatric symptoms, travel anxiety when a passenger, pain, physical problems, overall level of functioning, and financial problems [74]. Mayou’s study, however, has been criticized for using debriefing strategies that were intended to diminish the effects of a situation that is expected to be stressful and was originally developed for people working under stressful circumstances. Therefore this type of debriefing may not be suitable for patients who have experienced an unexpected event, such as a TRI.

Multidisciplinary interventions

It is most likely that the recovery process after an injury relates to physical, social as well as mental factors, and thus some researchers have proposed a bio-psycho-social and multidisciplinary approach in order to promote recovery [75]. Multidisciplinary treatment includes most often strategies in which the healthy profile is encouraged
and where educational aspects and physical exercises are included. A multidisciplinary team often consist of physicians, physiotherapists, psychologists and experts on pain management. Provinciali et al. showed that a multidisciplinary program consisting of postural training, manual technique and psychological support had a significant effect on return-to-work in WAD patients [76]. In a study by Vendrig et al. [77] it was also shown that multidisciplinary treatment with physical training, graded physical activity, occupational therapy and pain behaviour therapy was effective for patients with chronic WAD symptoms. The positive effects of multidisciplinary treatments have also been confirmed in metaanalyses [26, 78].
AIMS OF THE THESIS

This thesis focused on self-perceived recovery in patients with traffic related minor musculoskeletal injuries and aimed to:

- Characterize the variation in recuperation time by using sick-leave and self-perceived recovery as markers of residual illness (non-recovery)

- Identify antecedents of self-perceived non-recovery

- Relate self-perceived recovery to functional health status, as measured by the Short Form-36 (SF-36)

- Develop a novel instrument, the Prediction of Prolonged Self-perceived recovery after musculoskeletal injuries questionnaire - the PPS, and to evaluate its predictive ability by applying it on a new group of patients

- Evaluate the efficacy of a multidisciplinary intervention program for patients with acute traffic related minor musculoskeletal injuries in terms of by patient reported recovery at 12 months
PATIENTS AND METHODS

STUDY 1 (PAPERS I AND II)

Patients

Consecutive patients treated in an emergency room (ER) who had sustained a traffic-related minor musculoskeletal injury were asked during a nine-month period, from July 1998 until April 1999, to participate in the study. Exclusion criteria were: age < 16 years, inability to communicate in Swedish, and residence outside of the hospital’s catchment area.

A total of 811 patients (Figure 1) meeting the inclusion criteria passed through the ER during the inclusion period. Three hundred and eighteen patients (39%) gave their informed consent to participate, and completed the questionnaires at the time of inclusion.

Figure 1

Flow chart of patients in Study 1

Methods

All patients received medical and surgical treatment according to the hospital routines. Details of age, gender, diagnosis, injury type, treatment and planned follow-up visits were collected from the patient records. The severity of the injury was calculated according to the Injury Severity Score [64]. The injuries were classified as whiplash-associated disorder (WAD), minor injuries, or major injuries. The patients were asked to complete a questionnaire at the time of inclusion giving additional sociodemographic information, injury-related information, and also their view of the cause of the collision. In order to obtain baseline values the patients were asked to assess their state of health during the week that had preceded the accident (a retrospective rating) using the SF-36.
Follow-up

Participating patients \( n = 318 \) were followed up at 1 month and 6 months after the ER visit by means of a mailed questionnaire. A total of 286 patients (90\%) participated in the 1-month follow-up, and 246 patients (77\%) also participated in the 6-month follow-up, while 240 (75\%) participated in both the 1-month and the 6-month follow-ups. Patients were asked on both follow-up occasions to answer a single question regarding their self-perceived recovery (“Do you feel recovered?” Yes/No). They were also asked to report the duration of sick leave, if any. Further, they were asked if the injury still affected their working capacity (Yes/No) or leisure time activity (Yes/No), if they had had any insurance problems, and if they were involved in any legal actions on account of the accident (Yes/No). The answers were used as secondary assessments of outcome. The patients were asked on both follow-up occasions assess their state of health using the SF-36.

STUDY 2 (PAPERS III AND IV)

Patients

Patients were recruited during a 16-month period from September, 2002 until January, 2004. Exclusion and inclusion criteria were the same as those used in Study 1. Figure 2 shows that the inclusion criteria were met by 937 consecutive patients during the recruitment period. This study was designed as a two-part study, and thus the patients were firstly asked whether they were willing to participate in the intervention study (Paper IV). Patients who were unwilling to do so were then asked whether they were willing to participate in the validation study (Paper III). Three hundred and eighty-seven patients accepted of whom 169 participated only in the validation study and 218 both in the validation study and the intervention study.

Figure 2
Flow chart of patients in Study 2
Methods

Baseline data included information about age, sex, injury type, educational level, working status, current diseases, and previous traffic injuries. This information was collected at inclusion at the ER and before randomization. The patients were asked to consider the week before the accident, and retrospective ratings of anxiety and depression were calculated (using the hospital anxiety and depression scale, HAD [48, 79]). We were also able in this manner to detect signs of existing post-traumatic stress syndrome (PTSS-10 [51]). We also asked the patients to rate their functional health status (SF-36 [56] and their level of physical functioning (SMFA) [59, 60]) the week before the injury. Finally, we asked the patients to rate their current physical distress (“Rate the level of your injury-related physical discomfort/pain”) and mental distress (“Rate the level of your psychological discomfort/feelings of depression or anxiety”), and their degree of ability to cope [46, 47, 80] (“How well do you think you can handle your current situation?”) on visual analogue scales.

Construction of the PPS Questionnaire

We compiled a historic cohort of 557 patients (the model building set) with various musculoskeletal injuries, to be used for the design of the Prediction of Prolonged Self-perceived recovery after musculoskeletal injuries questionnaire (The PPS). We used logistic regression analysis to determine the predictor variables that were correlated with reporting non-recovery at follow-up. Variables considered for the analysis were chosen after considering previous work [12, 23, 30, 43]: age (continuous), gender, marital status (married/cohabiting or single), working status (working/studying or unemployed/retired), educational level (university education or lower), current illness at time of injury (yes/no) [81], type of trauma (fall, traffic-related, sports injury or other injury), type of injury (neck pain after a whiplash type of injury, contusion, dislocation/distortion or fracture/multitrauma) and the Injury Severity Score [64]. Self-ratings of physical complaints (pain) and mental complaints (depression/anxiety) during the first few days after the injury determined on visual analogue scales were used as tentative predictor variables in the model. Variables were first studied in univariate models and subsequently studied in a multivariate model, in order to identify the essential predictors.

The variables that predicted self-perceived non-recovery included type of injury, educational level, working status and self-ratings of pain and of mental complaints during the first week after the injury and were used when constructing in the PPS questionnaire. Variables that did not have any significant correlation with non-recovery were gender, age, family situation, current medical illness and injury severity measured by ISS.
The PPS Questionnaire

Please answer the questions below by placing an X in the appropriate box.

1. What is the highest level of your education?
   - Secondary school/upper secondary school
   - University/college of higher education

2. What is your current employment status?
   - Working
   - Retired
   - Studying
   - Unemployed
   - On sick-leave
   - Other

3. Rate the level of your injury-related physical discomfort/pain during the last 2-3 days by placing a mark (X) on the line below.

   No discomfort                      Maximum discomfort

4. Rate the level of your psychological discomfort (feelings of depression or anxiety) during the last 2-3 days by placing a mark (X) on the line below.

   No discomfort                      Maximum discomfort

5. To filled in by the staff
   - Whiplash-related injury (rear-end collision)
   - Minor contusion or sprain (not requiring any specific medical treatment)
   - Distortion/minor fracture (out-patient treatment)
   - Multi-trauma or major fracture (all hospitalized patients)

Intervention

Eligible patients were randomized to an intervention group or to a control group. Since the PPS classified 83 of the 218 patients who had agreed to take part in the intervention study as having a low risk of non-recovery, these patients were therefore excluded from the intervention study, as specified by the study design (Figure 2). Of the remaining patients, 73 were randomized into the intervention group and 62 into the control group. Eight of the patients were excluded since they had been misclassified by the PPS (as a result of technical errors).

Patients in both groups received standard medical treatment according to the routines at the department. The intervention offered was based on principles discussed by Fordyce [82], Linton [83], and Vendlig [77], and adapted for patients with acute injuries. The intervention was designed to be simple and clinically practicable, and it consisted of four group sessions. The first (inclusion meeting) was given every week.
and thereafter once a week in three-week cycles (three different sessions), each lasting for approximately 1½ hours. The intervention aimed to provide general information about tissue healing after injury and about pain management, to call attention to the importance of self-care, and to propose exercises in relaxation and postural control [77]. Participants were encouraged to share their experiences with each other during the sessions. The session leaders acted as group facilitators, and they met regularly to coordinate their activities.

Follow-up

All patients rated their self-perceived recovery at the follow-up at 6 months (Paper III) and at 12 months (Paper IV) by the single question: “Do you feel recovered after the injury? (Yes/No)”. Secondary outcome measures were the SF-36, the SMFA, the VAS ratings of physical distress, of mental distress, and the ability to cope, and the self-reported duration of sick leave were also measured at 6 and 12 months. The patients were followed up by a mailed questionnaire. The patients were contacted by telephone by the study nurse if no mailed answer was received, and asked to report whether he/she felt recovered or not.

STATISTICAL METHODS

Comparing groups

We used the \( \chi^2 \) test and Fisher’s exact test to test differences in proportions with categorical baseline characteristics and the outcome variable “Do you feel recovered after the injury?”, and we used ANOVA with the post hoc Bonferroni adjustment to analyse differences in age. The Mann-Whitney U-test was used to compare the SF-36 subscores and the secondary outcome variables in Paper IV.

Regression analysis

Logistic regression was used to estimate the odds ratios for reporting non-recovery (Yes/No), for requiring a period of sick leave longer than four weeks, and to determine the predictor variables that were associated with the risk of reporting non-recovery at follow-up. Logistic regression was also used to explain the shift from a feeling of not being recovered to a feeling of self-perceived recovery, and to disentangle the independent effects of changes in the various SF-36 domains.

Sensitivity and specificity

The predictivity of the model to classify patients correctly was measured by determining its sensitivity (the true degree of non-recovery, i.e. the proportion of patients that the model predicted would report non-recovery among those that did report non-recovery) and its specificity (the true degree of recovery, i.e. the proportion of patients that the model predicted would report recovery among those that did report recovery). A model with a high or perfect sensitivity identifies patients with a high chance of recovery and can hereby rule out patients, while a model with a high or perfect specificity identifies patients with a high risk of non-recovery and can hereby rule in patients. We used the efficient-score method (corrected for continuity) to calculate the 95% confidence intervals (CI) for the sensitivity and specificity. We
calculated the area under the ROC curve (using the trapezoid rule) to evaluate the ability of the model to discriminate, i.e. its ability to predict correctly which patients would report recovery and non-recovery.

**Significance**
The results were regarded as significant if $p$ was less than 0.05, two-tailed. The $p$-values are presented without any adjustment for multiple comparisons. All analyses in Paper 4 were performed according to intention-to-treat (ITT) principle. The statistical analysis was performed in SPSS, version 13.0.

**ETHICAL CONSIDERATIONS**
Informed consent was obtained from all participating patients in both studies and both studies were approved by the local Research Ethics Committee and the studies were conducted according to the Helsinki declaration.
RESULTS

STUDY I (PAPERS I AND II)

Paper I

The most common cause of injury was a MVC in city area and the most common injury was a whiplash-type of neck injury (48%) followed by other minor injuries (38%). Most of the patients were of working age (mean age 39 years), 55% were males and 42% had high school education (but not above), 25% less than high school, and 33% had an educational level above high school. Sixty nine percent were employed, 11% studied, and 20% were not working for various reasons. After receiving treatment in the ER 84% were discharged and 16% were hospitalized.

The information concerning the injury sustained and basic social factors showed that the participating patients (n=318) differed from the non-participating patients (n=493) regarding age and gender: the participating patients were somewhat younger and more often females. Patients with a WAD were more likely to agree to participate, while patients with contusions were more likely to decline to participate. Patients with more severe injuries were also more common among those who actively refused to participate in the study.

Ninety percent of the patients took part in the 1-month follow-up of whom 69% reported self-perceived non-recovery, and 53% reported that the injury still affected their work capacity. Restricted leisure-time activities were reported by 63%. At the 6-month follow-up, 78% participated, of whom 44% reported non-recovery, 32% reported impaired work capacity, and 40% reported restricted leisure-time activities.

The risk of still feeling non-recovered at the 1-month follow-up was higher among patients with major injuries than it was among those with WAD or other minor injuries; the adjusted odds among patients with major injuries was 4.5 times higher than it was among patients with WAD and other minor injuries. At 6 months only working status (OR 3.2) and education (OR 2.3) were associated with the risk of reporting non-recovery. Gender and age were essentially unrelated to the rate of self-perceived recovery.

The odds of having a prolonged sick-leave period was 5.4 times higher for those with more severe injuries than it was for those with WAD or other minor injuries, while the odds was 2.7 times higher for those with an educational level less than high school than it was for those with education beyond high school, and 3.3 times higher for those not working than it was for those working at the time of the accident.

Figure 3 shows Kaplan-Meier curves of sick-leaves by injury type and self-perceived health status at 6 months.
Figure 3
Kaplan-Meier curves describing the proportion of patients on sick leave by injury type and by self-perceived recovery.

Paper II

After 1 month, 28% of the 318 patients reported self-perceived recovery, while 62% reported non-recovery and 10% had been lost to follow-up. Another 55 patients had recovered after 6 months, and a further 46 had been lost to follow-up. Hence, 45% of the patients reached the endpoint of self-perceived recovery during the follow-up period, while 31% had not recovered by the end of the period. No information about recovery for 25% patients was available. Thus, the proportion of patients with known outcome status who reported recovery during follow-up was 143/240 (60%).

The eight SF-36 subscores for the patients with known recovery status in the three injury categories (recovered at 1 month, recovered at 6 months, not recovered at 6 months) were similar in all groups for the retrospective baseline ratings. At follow-up the patients who reported self-perceived non-recovery at 1 month and at 6 months had significantly lower scores for all eight dimensions than the scores of those reporting recovery.

Analysis of the SF-36 subscores showed that more than 60% of the patients who perceived themselves as recovered had values that were the same or better than their baseline values. This proportion, however, did not reach 100% on any dimension. The subscores with the highest proportions (exceeding 80%) were those that reflected mainly disability (“Role limitation due to physical function”, “Role limitation due to emotional problems”, and “Social functioning”). The proportion of patients in the non-recovered group with the SF-36 scores that were the same or better than their baseline values was less than 40% in six of the eight SF-36 subscores. The
differences between recovered and non-recovered patients tended to be greater on dimensions related to pain and physical function than they were in social, mental, and emotional dimensions (Figure 4).

**Figure 4**
Proportions with same or better SF-36 subscores. Recovered patients (n = 143) are represented by grey bars, and each patient’s final ratings are those given at the follow-up occasion at which he or she first reported self-perceived recovery (at 1 month for 88 patients and at 6 months for 55 patients). The non-recovered patients (n = 97) are represented by black bars, and their final ratings are all from the 6-month follow-up occasion.

Multivariate logistic regression showed that only the subscales “Bodily pain” (BP) and “Role limitation due to physical function” (RP) were independently associated with self-perceived recovery, with 7.2 times and 5.3 times higher odds for the recovered compared to non-recovered, respectively. There was no association between the feeling of recovery and a sense of guilt for causing the accident. A larger proportion of the non-recovered patients (56%) reported insurance problems 6 months after the collision than the proportion of recovered patients (44%) (p = 0.02). A total of 10% had legal problems, with no significant difference between the group of recovered patients and that for the non-recovered patients.

**STUDY 2 (PAPERS III AND IV)**

**Paper III**

The **model building set**
The patients in the model-building set (n=517, Figure 2) had similar distributions of most background variables as those of the patients in the validation set (n=306, Figure 2), except for the variable related to injuries: a fairly large proportion of the patients in the model-building set had major musculoskeletal injuries (50%), while patients in the validation set tended to have less severe injuries, with whiplash-related neck injuries as the dominating type (60%). There was also a higher proportion of women in the model-building set than in the validation set, but there were no
differences in the recovery rate at 6 months between the females 71/125 (57%) and the males 91/154 (59%) in the validation set.

A cut-off score of 0.56 maximised sensitivity and specificity for the patients in the model-building set. Patients in the model-building set with an estimated risk above 0.56 were defined as having high risk of non-recovery, while those with a risk below or equal to 0.56 were defined as having a low risk of non-recovery. The sensitivity of the prediction was 86% (95% CI: 82-89), and the specificity was 55% (95% CI: 48-63). The overall percentage of correct predictions was 77%. Injury type alone was a poor classifier for recovery or non-recovery: the area under the ROC curve decreased significantly ($p < 0.05$), from 0.80 (95% CI: 0.76-0.84) to 0.67 (95% CI: 0.64-0.74).

**Evaluation of the PPS using the validation set**

The PPS model predicted that 112 (40%) of the 279 patients in the validation set ran a high risk of reporting non-recovery while 167 (60%) were predicted to have a low risk of non-recovery. The observed proportions of the patients in the validation set were: 69 of the 112 patients (62%) with a predicted high risk of non-recovery also reported non-recovery at 6 months, while only 48 (29%) of the 167 patients predicted to have low risk of non-recovery also did report non-recovery ($p < 0.001$).

The sensitivity of the PPS questionnaire for non-recovery at a cut-off point of 0.56 was 59% (95% CI: 49-68) and its specificity was 73% (95% CI: 66-80) among the validation-set patients, corresponding to an overall percentage of correct predictions of 67%. The area under the ROC curve was 0.70 (95% CI: 0.63-0.76) when all predictor variables were included in the model, while it was 0.55 (95% CI: 0.49-0.62) ($p < 0.05$) when the prediction was based exclusively on type of injury.

**Paper IV**

**Baseline values**

The background variables of patients in the intervention group were similar to those of patients in the control group, with respect to signs of depression (5 in intervention and 4 in control group), anxiety (15 versus 11) and PTSD (5 versus 8) at the time of the injury. Subscores on the SF-36, VAS and SF-12 were also similar. Complete follow-up data was available for 75% of the patients in the intervention group and for 71% of the patients in the control group. Primary follow-up data (i.e. self-perceived recovery) was available for 97% and 95%, respectively, when an abbreviated telephone interview had been carried out. Of the 65 patients in the intervention group, 65% participated in all 4 intervention sessions, 12% attended 3 sessions, and 23% attended fewer than three sessions.

At the 12-month follow-up, 52% of patients in the intervention group and 31% of the patients in the control group reported recovery ($p = 0.03$). There were no significant differences between the groups with respect to ratings of physical or mental distress, coping ability, and SMFA. The SF-36 results of the two groups were also similar.
(Figure 5). The mean duration of self-reported sick leave was 7.5 weeks (SD = 15.5) in the intervention group and 10.9 weeks (SD = 17.5) in the control group (p = 0.18).

Figure 5
The SF-36 subscores for the intervention group and for the control group at inclusion (upper, thin lines) and at the 12-month follow-up (lower, thick lines). The solid lines show the ratings of the intervention group, and the dotted lines the ratings of the control group. The X-axis presents the dimensions of the SF-36: Physical functioning (PF), Limitations in usual role activities due to physical health problems (RP), Bodily pain (BP), General health (GH), Vitality (VT), Social functioning (SF), Limitations in usual role activities due to emotional problems (RE), and Mental Health (MH).

Additional data
When comparing the patients predicted by the PPS to have a low risk of non-recovery and all others the difference in recovery rates were highly significant (p<0.001) (Table 1).

<table>
<thead>
<tr>
<th>Reporting recovery</th>
<th>All patients n = 210 %</th>
<th>Intervention group n= 65 %</th>
<th>Control group n = 62 %</th>
<th>Low risk group n = 83 %</th>
</tr>
</thead>
<tbody>
<tr>
<td>6 months</td>
<td>90/198 54</td>
<td>24/61 39</td>
<td>15/60 25</td>
<td>51/77 66</td>
</tr>
<tr>
<td>12 months</td>
<td>111/201 45</td>
<td>33/63 52</td>
<td>18/59 31</td>
<td>60/79 76</td>
</tr>
</tbody>
</table>
GENERAL DISCUSSION

This thesis, based on two prospective studies focusing on recovery among patients with traffic related minor and moderate musculoskeletal injuries, showed that these minor injuries were associated with rates of delayed recovery well in line with the rates observed among patients with WAD, suggesting that the phenomenon of seemingly disproportionate disability may not be specific for WAD. The results, further, indicate that the injury itself as well as social and emotional factors interacts in the recovery process. A novel instrument, the PPS questionnaire, was constructed and it was concluded that the PPS is helpful in identifying patients at risk of delayed recovery already at the time of the injury. Finally, in a randomized controlled trial it was shown that a simple multidisciplinary intervention focusing on somato-psycho-social support in the early phase after the injury seems to enhance the self-perceived recovery in selected patient groups.

THE RECOVERY PROCESS

Recovery after an injury is a complicated process and includes a series of events and decisions made both by the caregiver and the patient. This thesis aimed to highlight this process seen from the patients’ point of view by using a somato-psycho-social approach [75].

Despite the fact that 90% of the included patients had minor injuries about 60% reported non-recovery at 1 month (Paper I) and more than 40% reported non-recovery at 6 months (Papers I and II). At one month the injury itself had a major impact on the reported recovery rate while after 6 months educational level and working status were the strongest predictors for self-reported non-recovery. When using the duration of sick leave as an outcome measure, the injury type, educational level and working status were still the strongest predictors. Thus, the severity and the type of the injury does play a role early in the recovery process but other factors seem to alternate the outcome on a longer perspective.

In order to better understand why some individuals consider themselves as recovered while others do not, the single question “Do you feel recovered? –Yes/No” which has been proposed to be a useful measurement of health transitions [80] was related to measurement of functional health status according to SF-36. Proceeding from the theory proposed by Beaton et al. [18], who stated that “being better is reflected in the state of the disorder (resolution) but could also be an adjustment of life to work around the disorder (readjustment) or an adaptation to living with the disorder (redefinition)”. we first hypothesized that among patients with a self-perceived sense of recovery restitution of function (improvement of disabilities) would be reported at least as often as improvement of physical symptoms or impairments. Second, we hypothesized that social and mental factors would dominate over physical as determinants for self-perceived recovery after minor musculoskeletal injuries. Further, our own clinical experience suggests that the recovery process varies between different people and therefore we wanted to better understand the phenomena of recovery after an injury. Even if symptoms/impairments persist, self-
perceived recovery could be attained through an adjustment of life to work around the disorder or an adaptation to living with the disorder. Thus the shift from a role of being injured into a subjective sense of self-perceived recovery appears to involve an element of implicit decision. Therefore, research about this shift might gain insights about possibly modifiable mechanisms.

The single question on recovery in preference to a more objective measure can be justified by the postulation that the transition from the sick role may not coincide with objective medical healing [28]. Hence, the patient himself or herself is the best judge if he or she has recovered or not (independently of whether the injury has fully healed). We gained evidence to support this reasoning since the results showed that a return to pre-injury SF-36 levels was not necessary for a patient to report recovery. The SF-36 subscores that had the highest proportion of individuals among the recovered patients who reached their baseline line values were: “Role limitation due to physical function”, “Role limitation due to emotional problems”, and “Social functioning”. None of these subscores, however, reached the 100% level. When comparing the SF-36 scores reported by the recovered patients with the scores reported by those who still felt non-recovered, it became clear that physical aspects of functional health status were more strongly correlated with recovery than emotional or social aspects. Several previous studies have emphasised the importance of psychosocial factors as predictors of recovery and our findings do not necessary contradict these results since psychosocial factors could have effects on coping and re-adaptation and perhaps also on biological restitution, possibly affecting the pace of recuperation.

PREDICTING RECOVERY

The Prediction of Prolonged Self-perceived recovery after musculoskeletal injuries questionnaire, the PPS, is a novel instrument designed by our group. As far as we know this is the first effort to construct a clinically applicable predictor and also to validate it in a new group of patients.

The aim was to develop an instrument that would be possible to use in an acute care setting by regular staff. Therefore the PPS is deliberately short and includes only 4 questions to be answered by the patient and a crude injury rating done by the staff. The variables in the prediction model, namely, initial pain and mental distress, educational level, working status and the injury itself have also shown to predictive for delayed recovery by others [23, 25, 43, 84]. It is, however, likely that some additional factors such as level of social support, the perceived legitimacy for the sick-role, and personal aspects such as motivation, pre-existing psychiatric health problems and personal resources could have increased the accuracy of the prediction if included in the model. We found it somewhat surprising that gender did not have any influence on the prediction since previous studies have shown that women are at risk of poorer outcome after musculoskeletal injuries [43]even if later studies have not confirmed these results [85].

As might be expected the PPS performed less good in the validation set than in the model building set. The overall percentage of correct predictions in the model building set was 77% and 67% in the validation set and included a shift from a sensitive to a specific test. This seemingly paradoxical shift from a sensitive to a specific test may to
some extent be due to differences in patient mix in the model building and validation sets. Clearly, the prognosis was, on average, worse in the model building set, as evidenced by an observed non-recovery rate of 69%, compared to 42% in the validation set. Since the proportion with major injuries (mostly fractures) was much greater in the model building set, and patients with such injuries were at higher risk of non-recovery, the PPS assigned considerable weight to the presence of major injuries. It is conceivable that further development of the instrument may lead to separate sets of predictors for different injury spectra. Still, the admittedly imperfect prediction was sufficiently robust to increase the proportion with genuinely poorer prognosis more than two-fold in the group predicted to have high risk, despite the differences in patient mix, and the instrument performed significantly better than predictions based on the injury type alone (which was just as good as chance), both in the model building set and in the validation set.

Previously published studies in this research area have focused exclusively on predicting the outcome among patients with WAD. In a prospective study by Hartling et al. [42] a simple clinical prediction rule for the early identification of patients at risk for long-term WAD was developed. They identified age, number of initial physical symptoms, and early development of some symptoms (upper back pain, upper extremity numbness or weakness, or disturbances in vision) as potential risk factors for persistent symptoms among the 353 included patients. They used regression trees to develop the clinical prediction rule for the identification of patients at high and low risk for persistent WAD and concluded that in this way they would have identified the 118 cases of persistent WAD with a sensitivity of 91.5% and a specificity of 51.4%. However, their prediction rule still needs to be validated in a new group of patients.

The main incitement for a clinician to use a prediction instrument would be the early identification of patients at increased risk for non-recovery (i.e. risk of a complicated course and/or behaviors that might jeopardize the results of medical and surgical treatment). It is common that patients, or their physicians, regardless of the severity of the injury, do not recognize the need of extra support before it is obvious that the rehabilitation does not progress as expected. Therefore the PPS should be used in the same manner as other algorithms for patient treatment. For example, a high PPS score would need to call for attention in the same way as a high blood sugar level. A test as PPS also has the advantage of being “objective” instead of just the physicians feeling of “trouble”, which could minimize the risk of the patients feeling of being a “psychiatric” case and could enhance the willingness to take part in an appropriate support program.

**TO PROMOTE RECOVERY THROUGH INTERVENTION**

The multidisciplinary intervention program for patients with acute traffic related minor musculoskeletal injuries is the first clinical trial in this field (Paper IV). The previously published studies using a multidisciplinary approach have focused on patients with chronic symptoms and especially those with a persisting WAD. For example Vendrig et al. [77] showed that a multidisciplinary treatment for chronic WAD patients significantly reduced pain and increased physical activity after 4 weeks. However, their study was not randomized and included only 26 patients, but
even so, their results indicated that a multimodal treatment program has the potential to be effective.

An important aspect of our study design was targeting the right patients. We used the PPS questionnaire (that was validated on the same group of patients) for this purpose. While perfect prediction is probably unattainable, the realistic goal is to improve the selection of patients who are likely to benefit from special rehabilitation efforts. Since unnecessary treatment might augment patients’ feeling of not being well and result in unmotivated costs, it is more important that patients who are selected for rehabilitation really have the needs, rather than making sure that every single patient with these needs are identified. Hence, in routine care it is more important to “rule in” patients with such needs than to rule them out among those whose predictions indicate a quick recovery. The PPS’s specificity was considerably higher than its sensitivity in this patient population, suggesting that we rather “ruled in” than “ruled out” patients in the intervention study. The patients that were excluded from the intervention (i.e. those with a low risk of non-recovery according to the PPS, see additional data) had a significantly higher recovery rate at 12 months compared both to those who participated in the intervention and those who formed the control group (and who had the lowest recovery rate of all). This finding might also support the PPS ability to select the patients that could benefit the most of additional support.

Our intervention program was based on well-known principles [77, 82, 83] but modified for an acute care setting. It should be possible for others to replicate our intervention which focused on helping the patient to appreciate the healthy parts of their injured body and mind, and stressed the importance of physical activity during the early phase of the rehabilitation. Besides the content of the sessions the participation itself probably promoted the patients’ physical activity level and the discussions during the sessions were most likely of importance as means of applying a certain degree of social pressure, inter-participant support and encouragement. Another important feature of our intervention program was the possibility for continuous contact with the study personnel, an important factor in any medical treatment.

The intervention was shown to be effective in terms of patient-reported recovery (which was the primary outcome measure); patients in the intervention group reported that they had recovered significantly more often than patients in the control group did at the 12 month follow-up.

However, the secondary outcome measures were not affected by the intervention which is most likely related to lack of power. It is also possible that the intervention changed the attitudes of the patients towards more acceptance of residual symptoms, impairments or disabilities, even if this effect could not be measured in terms of functional outcomes or HRQoL.

LIMITATIONS OF THE STUDIES

The design of both studies in this thesis required that all consecutive patients meeting the predefined criteria were included. However, a non-negligible part of the eligible patients in both studies were missed. The patients included thus may not be fully representative of the category to which we intend to generalize the results. Moreover, if factors linked to the willingness to participate are effect-modifiers of the correlations
that are to be studied, the internal validity might be at risk. However, many of the eligible patients who did not participate failed to do so as a result of administrative errors (an initial failure to record the injury as traffic-related, for example) and not as a result of personal characteristics. On the other hand the dropout rate among included patients was acceptable, but it may also have introduced some bias. However, we believe that most of the early drop-outs in both studies were patients who had suffered minimal injuries, who felt fully recovered and did not feel motivated to participate in the follow-up. Another limitation is that there could be other unrecorded factors related to self-perceived non-recovery such as general complications, involvement in litigation or pre-existing psychiatric health problems that were not fully considered.

SUMMARY

Most researcher dealing with outcomes after injuries are aware of that differences in long-term results relate to the injury but also to the characteristics of the patient and his/her environment. There is a range of external (economic, social) as well as internal factors (physical and psychological) that might affect this decision (Figure 6). Some of these factors are unchangeable and their identification may only serve to target individuals in need of additional services. Other factors, however, can be altered, and studies investigating their role in the recovery process can lead to the identification of effective strategies for intervention.

The shift from the role of being an injured person into the subjective sense of being recovered seems to involve an element of implicit decision. The injury itself and its treatment can lead to permanent impairment and disability. However, this health state might for one person mean a handicap for life while another person might accept the current state and feel actually recovered. It is likely that different people use different coping strategies for this shift. Another way of understanding the shift from being ill to being better can be reflected in the state of the disorder (resolution) but could also be an adjustment of life to work around the disorder (redefinition) or an adaptation to living with the disorder (redefinition) [28]. Further studies are needed to better understand the complex process of recovery.
CONCLUSIONS

- Delayed recovery, with more than 6 months of self-perceived residual illness, is commonly observed in a mixed emergency room population with traffic-related, mostly minor musculoskeletal injuries.

- Physical, psychological and social factors interact in the recovery process after traffic related musculoskeletal injuries.

- Physical as well as social factors are important predictors of outcome.

- The abolition of pain is important for self-perceived recovery, but it is neither a sufficient nor a necessary condition. Physical aspects of functional health status are more strongly correlated to recovery than are emotional or social aspects.

- The Prediction of Prolonged Self-perceived recovery after musculoskeletal injuries questionnaire - the PPS - can be used to identify patients at risk of delayed recovery after trauma but further research is needed to verify the results.

- A multidisciplinary group intervention can promote self-perceived recovery in selected patient groups but the clinical significance of the treatment benefit remains to be determined.
IMPLICATIONS FOR FUTURE RESEARCH

Patients injured in traffic or during other stressful events should be treated with “open eyes”, seeing the individual and her or his present situation more than just seeing the injury as such. It is my dream to be able to better target the patients who need extra help as early as at the emergency room, and to be able to tailor both the medical treatment and the psychological treatment suitable for the individual.

Therefore, there is a need for

- Further development and validation of the PPS questionnaire
- Evaluation of the PPS instrument for other groups of injured patients
- Confirmation of the results from the multidisciplinary treatment with other outcome instruments, such as pain-oriented instruments
SAMMANFATTNING


Avhandlingen är baserad på två prospektiva studier där patienter med akuta skador i rörelseapparaten efter en trafikolycka undersöcktes. I den första studien inkluderades 318 patienter (Delarbeten I och II). Alla patienter behandlades enligt sjukhusets rutiner. Information om bakgrundsfaktorer och skador inhämtades och patienterna ombads att skriva sitt hälsotillstånd innan olyckan enligt SF-36 (retrospektiv skattning). Patienterna följdes upp brevlade efter 1 månad och efter 6 månader och tillfrågades om de kände sig återställda; om och hur länge de varit sjukskrivna, de ombads också skriva sitt hälsotillstånd enligt SF-36. I den andra studien (Delarbeten III och IV) inkluderades 387 patienter. Samtliga patienter fyllde i PPS frågeformuläret och de som predicerades att ha en hög risk för att inte bli återställda randomiserades till en behandlingsgrupp (n=65) eller till en kontrollgrupp (n=62). Behandlingsprogrammet bestod av fyra gruppträffar och fokuserade på information om skador och smärtsamt behandling samt betonade vikten av självhjälp och fysisk aktivitet. Alla patienter följdes upp vid 6 månader (Delarbete III) och vid 12 månader (Delarbete IV).

Efter en månad rapporterade ca 60 % av patienterna att de kände sig återställda och motsvarande andel vid 6 månader var ca 40 %. Skadetype, om man var i arbete eller inte vid skadetillfället och utbildningsnivå var associerade till självrapporterad återställning vid 1 månad, men vid 6 månader var det endast om man var i arbete eller ej och utbildningsgrad som var associerade till självraperad återställning (Delarbete I). Patienter som rapporterade att de var återställda hade signifikant bättre SF-36 värden jämfört med dem som rapporterade att de inte var återställda. Att återfå samma SF-36 värden som före skadan var inte nödvändigt för att känna sig återställd. SF-36:s hälsomätt som återspeglar fysisk hälsa var starkast associerade till självraperad återställning. (Delarbete II). PPS frågeformuläret identifierade patienterna med hög risk för att inte vara återställda efter 6 månader bättre än en prediktion baserad enbart på skadan (Delarbete III). En signifikant högre andel av patienterna i behandlingsgruppen jämfört med kontroll gruppen rapporterade återställning vid 12 månader (Delarbete IV).

Somatiska, sociala och emotionella faktorer samverkar i tillrisknandeprocessen efter en skada. PPS frågeformuläret kan vara till hjälp vid identifiering av patienter med risk för fördjupad självraperad återställning. Stödprogram för selekterade patientgrupper förefaller förbättra återhämtningen efter lindriga trafikskador.
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in the intervention group did not participate in all of the four sessions which might have diluted the effect of the intervention in terms of functional outcome. Fourth, we were able to get complete follow-up data, i.e. the secondary outcome measures, only for about 70% of all patients. On the other hand, the intervention group had a non-significant tendency towards shorter sick leave duration compared to the control group, implying that this type of intervention in the early stage after an injury might have long term effects also in terms of working capability.

The intervention program was only offered to patients at increased risk of non-recovery as predicted by the PPS Questionnaire (Ottoisson et al; A novel instrument for predicting delayed recovery after trauma, submitted). The rationale for this approach was supported by earlier findings indicating that many patients seem to be able to cope with any injury without specific support and that unnecessary treatment might augment their feeling of not being well 31. We have previously shown that the PPS can predict an unfavorable outcome with a better accuracy than predictions based exclusively on information about the injury. Even if the PPS has only fair sensitivity and specificity it is the first step towards targeting the patients in need of extra support.

A major limitation of this study was that we were able to include only about one fourth of the eligible patients. The reasons for non-participation in the majority, however, were of administrative nature since we could not get in contact with about half of the patients entering the emergency room. Only one fourth of the non-participants actively declined participation. Even if there is a risk of bias it is reasonable to assume that less than all patients with minor injuries would be interested in any rehabilitation and some might be persons out of reach for any intervention as suggested by Cutler et al 32 implying that self-selection may have enriched our study of patients who were more motivated than average. It is, however, reasonable to assume that the same self-selection will occur also if this intervention will be deployed in routine care.

The intervention was aimed to be clinically applicable and was therefore short and gave the patients flexibility to choose dates for their participation. Over 75% participated in at least 3 of the 4 possible sessions indicating that this goal was mainly reached. The intervention was based on well-known principles and uncontroversial per se. Besides the content of the sessions the participation itself probably promoted the patients' physical activity level and the discussions during the sessions were most likely of importance as means of applying a certain degree of social pressure, inter-participant support and encouragement. Another important feature of our intervention program was the possibility for continuous contact with the study personnel, an important factor in any medical treatment. Even if this is the first clinical study investigating the effects of a multidisciplinary intervention for acutely injured traffic related victims, some similar studies focusing on patients with WAD have been reported previously. Ferraro et al 33 were unable to confirm any benefit from an educational pamphlet on outcome 33. On the other hand Brison et al 34 used an educational video as intervention and found a trend toward less severe WAD symptoms. Further, in a study by Veldrig et al 35 it was shown that a multidisciplinary treatment for chronic WAD patients significantly reduced pain and increased physical activity after 4 weeks of daily interactions.
In conclusion, this study provides some evidence that among selected injured patients with constellations of factors that are indicative of a high risk of a slow return to self-perceived health, a simple group intervention can stimulate recovery. Our intervention, focused on helping the patient appreciate the healthy parts of their injured body and mind and stressing the importance of physical activities already during the early phase of the rehabilitation, should be possible to replicate by others. There is still a need for further studies, especially regarding the clinical significance and cost effectiveness of this intervention.
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