Digital Comprehensive Summaries of Uppsala Dissertations from the Faculty of Medicine 639

Posttraumatic Stress and Cognitive Processes in Patients with Burns

JOSEFIN SVEEN
Dissertation presented at Uppsala University to be publicly examined in Enghoffsalen, Entrance 50, Uppsala University Hospital, Uppsala, Friday, March 11, 2011 at 13:15 for the degree of Doctor of Philosophy (Faculty of Medicine). The examination will be conducted in Swedish.

Abstract

A severe burn is one of the most traumatic injuries a person can experience. Posttraumatic stress disorder (PTSD) is relatively common after burns, and can be devastating for the individual’s possibilities for recovery. The principal aims were to gain knowledge regarding posttraumatic stress symptoms and cognitive processes after burn and to evaluate methods for assessing symptoms of PTSD up to one year after burn.

The psychometric properties of a Swedish version of the Impact of Event Scale-Revised (IES-R) were examined. The results indicate that the IES-R is a valid screening instrument for measuring PTSD symptoms in patients with burns and it can be used during hospitalisation to identify resilient individuals.

The pattern of PTSD symptoms over time was also investigated. Four distinct trajectories of PTSD symptoms were identified, i.e. four groups of patients with significantly different onsets and courses. The trajectories differed in the expected direction regarding several risk factors associated with PTSD symptoms.

Several previously known risk factors for PTSD symptoms were also identified including burn severity, psychiatric history, previous life events, early psychological symptoms, neuroticism-related personality traits, avoidant coping and low social support. The risk factors correspond well with those reported in the international trauma literature, which strengthens the findings in this thesis.

Finally, using the emotional Stroop task at one year post burn it was found that burn-specific attentional bias was common and associated with more previous life events, more perceived life threat, larger burns and higher levels of PTSD symptoms.

In summary, there are individual differences in the development and course of PTSD symptoms after burn and attentional bias is a common cognitive phenomenon related to these symptoms. The findings also support the use of the IES-R as a screening instrument for PTSD symptoms in patients with burns.

Keywords: Burn, Posttraumatic stress disorder, Outcome Assessment, Injuries, Trauma, Psychological distress, Psychiatric Disorders

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ISSN 1651-6206
ISBN 978-91-554-7993-0
urn:nbn:se:uu:diva-143169 (http://urn.kb.se/resolve?urn=urn:nbn:se:uu:diva-143169)
To my grandmother Brita
List of Papers

This thesis is based on the following papers, which are referred to in the text by their Roman numerals.


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<td>Analysis of Variance</td>
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<td>COWAT</td>
<td>Controlled Oral Word Association Test</td>
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<td>DA</td>
<td>Discriminant Ability</td>
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<td>DSM</td>
<td>Diagnostic and Statistical Manual of Mental Disorders</td>
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<td>KSP</td>
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<td>LOS</td>
<td>Length Of Stay in the Burn Center</td>
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<td>LR</td>
<td>Likelihood Ratio</td>
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<td>LTE-Q</td>
<td>List of Threatening Experiences-Questionnaire</td>
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<td>MIIC</td>
<td>Mean Inter-item Correlations</td>
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<td>OE</td>
<td>Overall Efficiency</td>
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<td>PTSD</td>
<td>Post Traumatic Stress Disorder</td>
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<td>SCID-I</td>
<td>Structured Clinical Interview for DSM-IV Axis I disorders</td>
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<td>SCID-II</td>
<td>Structured Clinical Interview for DSM-IV Axis II disorders</td>
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<td>Standard Deviation</td>
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<td>SSP</td>
<td>Swedish universities Scales of Personality</td>
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<td>SSQ-6</td>
<td>Social Support Questionnaire-short form</td>
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<tr>
<td>TBSA</td>
<td>Total Body Surface Area burned</td>
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Introduction

A severe burn is a life threatening state that challenges all of the main integrating systems in the body. Survival rates after severe burns have increased in recent decades as surgical techniques and treatments have improved [84]. As more burn patients survive, the potential psychological morbidity has also increased. Although many patients with burns recover well and have a satisfying quality of life after the trauma [98], some patients experience persistent psychological symptoms.

Burn injury

Epidemiology

In a global perspective, burn injuries are one of the leading causes of death, and a major cause of years lived with disability [101]. The incidence is much higher in developing countries, where open fires in households are more common than in developed countries. The most common cause of burn in children in the Western world is scalds, while in adults the main cause is flame.

The number of burned patients admitted to hospitals in Sweden is relatively low compared to other European countries. In the UK the incidence rate is about 21/100 000 [106] and in Italy it is 31/100 000 [10]. In Sweden the yearly number of burned patients is around 1100, an incidence of about 11/100 000 inhabitants [109].

Far more men than women are burned, and young children and elderly persons constitute other risk groups [74]. Children aged 0–4 years account for almost a third of all burns in Sweden [154]. Socioeconomically disadvantaged persons [47], the disabled [74], and individuals intoxicated by alcohol and drugs [73] are other risk groups.

Premorbid psychopathology

There is a higher incidence of premorbid psychopathology (e.g. depression, anxiety, alcohol- and substance abuse) in the burn population compared to the general population [55, 115, 116]. A Swedish study [46] found that two thirds of burn survivors had a history of lifetime psychiatric disorders, and in a re-
cent Finnish study [114] it was found that almost one fourth of acute burn patients had a personality disorder. The presence of psychiatric problems can affect adjustment after the burn injury. For example, patients with a mood or anxiety disorder prior to the burn injury have been shown to adjust less well after discharge compared to patients without those disorders [55].

Burn care and rehabilitation

A burn injury is damage of the skin caused by thermal energy, although electrical, chemical and radiation energy cause similar damage. Thermal injuries are most common and are caused by heat exposure in the form of hot fluids, fire, or direct contact with some other heat source. The severity of the burn depends on the extent of the burn, defined as percentage of the Total Body Surface Area (TBSA) burned and the depth of the burn. The depth of the burn depends on the extent to which the layers of the skin are damaged and is commonly described as epidermal, dermal, deep dermal, or full-thickness. The skin is one of the largest organs in the body and it protects the body from fluid loss, regulates body temperature and protects against bacteria. Hence severe burns are life threatening. Thirty years ago 50 % of young adults with 40 % of body surface area burned survived. Today a survival rate of 50 % is expected for a young adult with 80 % of body surface area burned [140].

Acute burn care is characterised by intensive care procedures, wound care, and surgical treatment. The first challenge after a burn injury is to prevent fluid loss and to prevent or control infection. Wound care involves early excision and skin grafting of deep-dermal and full thickness burn wounds. Patients with burns often have a long and painful course of in-hospital treatment that is associated with pain-related anxiety [30] and reactions such as anxiety, depression, psychosis, delirium, and behavioural problems [115]. One of the main challenges in burn care is the management of pain and anxiety, and an essential goal is to reduce the pain as much as possible [74, 130].

The rehabilitation phase starts on the day of injury, with active wound care, as well as early physiotherapy and occupational therapy to minimise complications such as skin contractures, and to increase function and mobility. For patients with severe burns, rehabilitation continues long after the patient leaves the intensive care unit. Reconstructive surgery may be necessary to improve function and appearance [52]. Pruritus [67], pain and paresthetic sensations [92] are common problems for many individuals after the healing of a severe burn.
Trauma

The term “trauma” is actually Greek, and it means “wound” or “injury”. It is used in different contexts with different meanings. One common meaning is that of a physical injury, and in medicine “Trauma Centre” commonly refers to a hospital unit focusing on the handling of severe physical injuries and their complications.

In another context, the term refers to a “psychological trauma”, defined as an event occurring in shocking and emotionally overwhelming situations. It is natural for people who experience a traumatic event to experience many psychological reactions such as intense fear, horror, emotional numbness and helplessness [79].

Some traumatic events involve both physical and psychological aspects. Survival following a severe physical trauma such as severe burn requires physical and psychological adaptation in order to recover. The experience of being burned is often a traumatic event in itself, and exposure to physical and psychological trauma continues during the long treatment in hospital. The treatment involves a number of repetitive painful procedures over which the patient has little or no control. The injury is often associated with more or less permanent losses of function, and insight regarding this situation is in itself traumatic.

The psychological impact of physical trauma can range from transient emotional distress to a wide variety of more severe psychological problems.

Psychopathology after burns

Following a burn injury several psychological problems can arise, including generalised anxiety, depression, and posttraumatic stress disorder (PTSD) [139]. Symptoms of depression and PTSD are the most common after burn injury. A Swedish study [46] showed that one year post burn, 17 % of the patients were diagnosed with depression. Other research has shown that up to 50 % develop symptoms of depression after burn injury [145] and over 30 % have symptoms of general anxiety at one year post burn [139]. According to a comprehensive literature review, between 20 % and 45 % of patients with burns develop PTSD one year after burn injury as assessed with validated structured clinical interviews [52]. Prevalence rates vary a great deal, and a recent prospective study of consecutively admitted patients in Sweden, which also used a structured clinical interview, found a 9 % prevalence rate of PTSD one year post burn [46].

History of posttraumatic stress

Historically, problems after exposure to stress and trauma have been observed in all time periods. Nevertheless, whether the cause of symptoms is
organic or psychological is a matter of debate. It was thought for centuries that the cause of symptoms was organic, e.g. spinal or brain damage. One of the first studies of traumatic events was conducted by a surgeon, J. E. Erichsen [51], and focused on severely injured patients after railway accidents. He suggested that the psychological problems observed, including memory loss, sleep problems and nightmares, the so-called “railroad spine syndrome”, were due to spinal cord and brain damage. Moreover, the neurologist Oppenheim [111] used the term “traumatic neurosis” to describe functional problems, which he believed were produced by subtle molecular changes in the central nervous system. It was not until the end of the 19th century that the first approaches to traumatic neurosis as a psychiatric symptom emerged.

During World War I, the term often used for severe psychological reactions was “shell shock”, and it was initially thought to be a result of physical injury in combat. However, as these symptoms were observed in soldiers not exposed to warfare, it was suggested that the cause was psychological rather than organic [103, 104]. It was often viewed as a coward’s reaction to fighting. However, during World War II these severe psychological reactions were accepted as part of warfare. After World War II, psychiatrists conducted more detailed studies of combat veterans in Europe who were suffering from what was then called “combat fatigue” [137].

One of the first studies on trauma in a non-clinical population was conducted by Stierlin [129] and concerned the Messina earthquake in 1907. He observed that 25% of the survivors suffered from sleep disturbances including nightmares. Stierlin concluded that violent emotions are the main etiological characteristics of posttraumatic neurosis and that no psychopathological predisposition was required.

Another early study of psychological stress reactions in civilians was conducted by Adler [2] and concerned the victims of the Cocoanut Grove nightclub fire disaster in Boston in 1942. It was reported that about one third of the victims had “psychiatric complications”, which were either symptoms of “general nervousness” or “anxiety neuroses”, after the trauma. These symptoms persisted and were still present at follow-up nine months later.

Kardiner [80] can be considered the founder of the biopsychosocial approach to trauma, as he argued that trauma responses such as the startle response had both psychological and physiological mechanisms. Furthermore, he was one of the first to identify behavioural and cognitive disturbances that occur as a consequence of traumatisation. In addition, in 1941 Kardiner described many of the PTSD symptoms included almost 40 years later in the DSM-III.

In recent decades, with extensive experience from the Vietnam War, knowledge about the effect of trauma has increased considerably. In 1980, when there was no diagnosis for chronic or delayed psychological problems after a traumatic event, PTSD was included in the DSM-III. The definition of traumatic stress was revised and was made broader in the DSM-IV [3].
Definition and prevalence of PTSD

For a PTSD diagnosis to be made according to the DSM-IV, six criteria have to be fulfilled: the experience or witnessing of an event that involved actual or threatened death or serious injury, or another threat to the physical integrity of oneself or others (criterion A1), and a response of intense fear, helplessness, or horror (criterion A2). The person reports recurrent reexperiencing of the traumatic event (criterion B), persistent avoidance of trauma-related stimuli and emotional numbing (criterion C), and persistent symptoms of hyperarousal (criterion D). The symptoms must be present for at least one month (criterion E), and they should cause impaired functioning in daily life (criterion F) [3]. The DSM-IV requires at least one symptom of Intrusion, three symptoms of Avoidance, and two symptoms of Hyperarousal for a diagnosis of PTSD.

It has been suggested that there are possible subgroups of patients with PTSD symptoms. The DSM-IV categorises PTSD according to the duration and onset of symptoms: acute (last less than three months), chronic (last three months or longer), and with delayed onset (at least six months post trauma). Bonanno [17] has suggested that there are four prototypical outcome trajectories following loss or trauma: resilience, recovery, delayed and chronic. According to Bonanno, resilience refers to the ability of the person “to maintain relatively stable, healthy levels of psychological and physical functioning” although temporary symptoms may arise and last for a few weeks. Recovery represents a pattern of temporary disruption of normal life functioning and distress (PTSD symptoms) that gradually returns to baseline over a period of some months. The delayed trajectory refers to moderate levels of symptoms initially, followed by an increase in symptom levels, and finally the chronic trajectory is characterised by elevated symptoms over time.

The prevalence rates for PTSD vary between trauma groups; however, around 25 % of those exposed to a severe traumatic event develop PTSD [21]. Thus, most individuals who are exposed to traumatic events do not develop PTSD. The lifetime prevalence rate of PTSD in the US is 6.8 % [82] and in Sweden it is 5.6 % [64]. Many individuals do not meet the criteria for a full PTSD diagnosis, but develop symptoms of PTSD that meet the criteria for subsyndromal PTSD [105]. According to Mylle and Maes [105], subsyndromal PTSD includes at least one symptom from each criterion including impaired functioning.

Assessment of PTSD

There are two main types of measures for assessing PTSD, structured clinical interviews and self-report instruments for PTSD symptomatology.
Structured clinical interviews

There are several structured interviews for the assessment of PTSD including the Structured Clinical Interview for DSM-IV Axis I disorders PTSD module (SCID-PTSD module; [59]), the Clinician Administered PTSD Scale [15], the PTSD module of the anxiety disorders interview schedule [44], the PTSD interview [141], the PTSD symptom scale-interview version [62] and the PTSD module of the Diagnostic Interview Schedule [119]. All of the above-mentioned interviews adhere to the DSM-III or DSM-IV criteria for PTSD.

The Structured Clinical Interview for DSM-IV Axis I disorders (SCID-I) [59] is one of the most widely used and thoroughly researched clinical psychiatric interviews. It is a semi-structured interview assessing most major psychiatric disorders and it is considered a “gold standard” interview [152]. In addition, it is often used for the diagnosis of PTSD and assesses the presence of each of the 17 DSM diagnostic criteria for PTSD. The SCID-PTSD module takes about 20-30 minutes to administer and is considered psychometrically sound (e.g. Refs [81, 86, 94]). In accordance with the DSM-IV, PTSD is registered as absent or present.

Self-report instruments

There are many different self-report instruments for assessing symptoms of PTSD. They are often more time- and cost-efficient than structured interviews and can be useful as screening tools for PTSD. Examples include the Davidson Trauma Scale [40], the PTSD Checklist [143], the PTSD symptom scale [62] and the Impact of Event Scale-Revised [144]. Most self-report measures of PTSD have good psychometric qualities.

One of the most widely used self-report measures for assessing PTSD symptoms is the Impact of Event Scale, IES [77], and its revised version - the Impact of Event Scale-Revised, IES-R [144]. The IES was developed to investigate traumatic distress and contains 15 items reflecting symptoms of intrusion and avoidance. In the IES-R, seven items were added, six to tap hyperarousal and one intrusion item to tap “flashbacks”, and hence it consists of 22 items that cover all three major symptom clusters of PTSD according to the DSM-IV. Although the IES-R provides a dimensional assessment of symptoms of PTSD, it is not constructed for categorical use as in a DSM-IV diagnosis of PTSD.

Although it is a well used instrument in general trauma research, studies examining the factor structure of the IES-R are inconsistent, as they report different factor solutions varying from one to four factors [8, 11, 12, 38]. To date, no study has evaluated the psychometric properties of the IES-R in the field of burn trauma. Nevertheless, the IES and the IES-R have been utilised in several studies investigating symptoms of PTSD in patients with burns.
Psychometric principles

Reliability and validity are the two main concepts within psychometrics, and they are used to evaluate psychological instruments. The diagnostic utility of an instrument can also be evaluated.

Reliability

Reliability refers to the consistency of a measurement. Reliability estimates are often based on calculations of correlations. There are several ways to estimate reliability: Internal consistency, e.g. Cronbach’s alpha values and mean inter-item correlations (MIIC), assesses the consistency across items within a test. Test-retest is used to assess the consistency of a measure from one time to another, and inter-rater reliability assesses the concordance between different raters.

Validity

The validity of an instrument stems from the accumulated evidence supporting its interpretation and uses – that is, how well an instrument measures what it was intended to measure. Thus, validity is a matter of degree rather than an all-or-none determination. There are different aspects of validity.

*Content validity* concerns the extent to which items comprising a measure adequately reflect the construct that is being measured, e.g. is the IES-R measuring the same symptoms as in the DSM-IV. *Criterion-related validity* refers to the extent to which the instrument correlates with some “gold standard” for assessing the same construct (i.e. concurrent validity) or predictor (i.e. predictive validity). In the field of PTSD, the “gold standard” criterion has often been structured clinical interviews, e.g. the SCID-PTSD module. *Construct validity* refers to evidence that the instrument measures the theoretical construct of interest, e.g. PTSD. *Construct validity* can be divided into *convergent* and *discriminant validity*. *Convergent validity* refers to the extent to which the instrument correlates with other known measures of the same construct, while *discriminant validity* refers to when the instrument correlates poorly with factors that it should not be correlated with.

Diagnostic utility

Instruments can also be evaluated in terms of factors that contribute to their diagnostic utility. One issue relevant to evaluating the clinical utility of an instrument is its capacity to accurately discriminate individuals with and without the disorder in question (i.e. discriminative validity).

The diagnostic utility of an instrument can be measured with *sensitivity*, *specificity* and *discriminant ability* (DA). An instrument should be *sensitive*, i.e. be able to detect all the true cases of the disorder identified by the criterion instrument (true positives), and *specific*, i.e. identify the true non-cases
Risk factors for PTSD

In general, one of the major risk factors for PTSD is the type of trauma involved. The risk for developing PTSD is higher after exposure to a trauma involving interpersonal violence, such as rape or armed robbery, than after a trauma caused by accidents or natural disasters [21]. Several other trauma-related risk factors for PTSD have been found both in burns and in the general trauma literature, e.g. perceived life threat during the trauma [112, 128, 148], injury severity [16, 138, 148], and, in burns, the location of the burn [138, 149]. A factor that appears to play a role is gender, as PTSD is more common among women than among men [136, 138]. A history of psychiatric morbidity [22, 46] and avoidant coping [66, 124, 148] are also known risk factors. Furthermore, in the general trauma literature, low level of education [22], a history of traumatic experiences [112] and prior stressful life events [22, 153] have been found to be risk factors. In contrast, social support has been found to be an important protective factor that may reduce the risk of developing PTSD [22, 117].

Personality traits

According to the World Health Organisation, personality is defined as “the ingrained pattern of thought, feeling, and behaviour characterising an individual’s unique lifestyle and mode of adaptation, and resulting from constitutional factors, development, and social experience” (WHO). Studies show a high degree of stability in personality traits during adulthood [37, 93].

There are different personality “paradigms”, such as Costa and McCrae’s five-factor model of Neuroticism, Extraversion, Openness to experience, Agreeableness, and Conscientiousness, which is an empirical and lexical approach [36]. Eysenck’s three-factor model of Extraversion, Neuroticism, and Psychoticism constitutes a biological approach [54]. Personality theories with a biological approach view personality as a dimensional and hierarchical structure.
Based on Sjöbring’s biological theory and several other biologically based theories, Schalling and colleagues developed the Karolinska Scales of Personality (KSP) [125], which was revised and renamed the Swedish universities Scales of Personality (SSP) [70]. It was developed to measure vulnerability for psychiatric illness and not to cover the “the whole personality”. A factor analysis of the SSP revealed a three-factor solution, reflecting Neuroticism, Aggressiveness, and Extraversion [70].

Personality traits have been associated with differences in exposure to traumatic stress [20]. In accordance with results from studies in other traumatised groups, certain personality characteristics appear to be risk factors for PTSD in patients with burns. For instance, high levels of Neuroticism have been associated with increased risk for PTSD [56, 88], while high levels of Extroversion appeared to lower the risk for PTSD [56].

A Cognitive model of PTSD

In addition to the medical, psychiatric definition of PTSD briefly reviewed above, there are also psychological models of the disorder. These models tend to focus more on the experience and function of the symptoms, and possible psychological processes that trigger or maintain the symptoms, rather than on diagnostic criteria [39]. Ehlers and Clark’s [49] cognitive model of PTSD recognises the role of the traumatic event in the development and maintenance of PTSD symptoms, as well as the importance of individual differences. They suggest that there are numerous background factors that are likely to influence cognitive processing during the trauma: the nature of trauma memory and appraisals of trauma and its sequela, as well as the behavioural and cognitive strategies used. For example, characteristics of the trauma such as trauma severity and perceived life-threat during trauma can influence cognitive processing during the event. Another example is that previous experiences such as prior trauma and coping styles (e.g. avoidant coping) are also likely to influence cognitive processing.

According to the model, negative appraisals of the traumatic event and/or its sequela lead to a perception of current threat. For example, individuals may overgeneralise from the event and as a result perceive a range of non-dangerous activities as dangerous. Such appraisals can lead to avoidance, which maintains the overgeneralised fear. Other people’s reactions after the trauma can influence the individual’s appraisals. For example, if the individual perceives a lack of social support, appraisals such as “No one cares about me” can arise. The role of negative appraisals in PTSD has been supported by several studies (e.g. Refs [5, 48, 128]).

Moreover, memory concerning the traumatic event may lead to a sense of current threat. The trauma memory is poorly elaborated and inadequately integrated into its context in time, place, new and prior information, and
other autobiographical memories, which makes it difficult to retrieve. Instead, the individual experiences frequent involuntary intrusive memories of parts of the event. Ehlers and Clark [49] propose that these memory difficulties are due to the way the trauma is encoded into the autobiographical memory. Studies have shown that the degree of disorganised trauma memory predicts later PTSD [27, 72, 102] and is related to development of PTSD [68, 102], thereby supporting the model.

Furthermore, it is assumed in the model that delayed onset PTSD occurs either because a later incident gives the trauma a more threatening meaning or because strong reminders of the trauma were not present until some time after the event. An example of the latter is that individuals hospitalised for severe injuries after a traumatic event may not encounter reminders of the trauma while in hospital. Moreover, they may be focusing on their physical state and medical procedures rather than on the event itself.

According to the model, the perception of current threat maintains PTSD in two ways. First, it produces negative emotions, e.g. fear, anxiety, sadness and anger. Second, it motivates the individual to engage in different cognitive and behavioural strategies, which are intended to reduce perceived threat and distress but instead have the effect of preventing cognitive change. An example of a cognitive process is selective attention to threat-related stimuli, also called attentional bias.

Attentional bias
Subsequent to the trauma, it has been observed that patients with PTSD symptoms display attentional bias towards trauma-specific stimuli [26, 61, 96]. When someone selectively attends to certain information that is important to that person, this is attentional bias; for example, a pregnant woman tends to selectively attend to other pregnant women. A common approach for measuring attentional bias is the use of a modified colour-naming task, the emotional Stroop task. In this task, participants are asked to name the colours in which words are printed. For patients with PTSD symptoms, it takes longer to name the colour of trauma-related words, e.g. the word “bodybags” for Vietnam veterans, versus general threat words or neutral words. It seems that the specific meaning of the word attracts attentional resources and thereby delays colour-naming [95]. Attentional bias identified by the emotional Stroop task has been demonstrated for a number of clinical psychiatric conditions, including general anxiety disorder, phobias, obsessive-compulsive disorder and depressive disorder, but it is generally larger for PTSD than for any other disorder [150]. Studies have shown that individuals with PTSD have longer response times for threat-related words compared to participants without PTSD [26, 61, 96]. The attentional bias is suggested to play a role in maintaining PTSD by constantly activating and reinforcing cognitive representations of threat [49]. The delay in colour-naming
is not caused by conscious strategies [29] and thus represents an involuntary presentation of cognitive processing.

There is only one previous study of attentional bias in relation to burns. On a group level, former patients with burns who were injured 5-19 years previously displayed an attentional bias towards burn-specific words, while a control group did not [147]. In that study, burn-specific attentional bias was not associated with PTSD symptoms. However, attentional bias has not been investigated in patients with a more recent burn, and there are no related prospective studies.
Background and aims

This thesis is part of a larger multidisciplinary research project concerning different aspects of burn trauma focusing on adaptation and recovery after severe burn injuries. The project is based on the concept that psychiatric history, personality traits, coping strategies, cognitive functions and processes as well as environmental factors and genetic disposition, affect the adaptation process after the trauma (Figure 1).

Figure 1. Proposed interactions affecting recovery/adaptation after burn.
The main aim of this thesis was to gain knowledge regarding cognitive processes and psychological symptoms after burn, with focus on posttraumatic stress symptoms, and to evaluate methods for assessing the above-mentioned problems.

The specific aims were:

- to evaluate the psychometric properties of the IES-R by examining its factor structure, aspects of validity and reliability, and its discriminative ability (papers I & II)
- to investigate the pattern of PTSD symptoms over time and possible subgroups after burn injury (paper III)
- to identify risk factors for PTSD symptoms (papers I & III)
- to assess burn-specific attentional bias in patients with burn injury and its association with PTSD symptoms and risk factors (paper IV)
Methodology

Participants and procedures

The participants were consecutive patients admitted for treatment of burns at the Uppsala Burn Center (papers I–IV) and at the Linköping Burn Center (paper I). The inclusion criteria for the Uppsala sample were (1) an age of 18 years or above, (2) proficiency in the Swedish language, (3) absence of cognitive dysfunction, and (4) either burns of greater than 5 % TBSA or length of stay at the hospital of more than one day. An additional criterion in paper IV was absence of colour blindness. At the Linköping Burn Center the inclusion criteria were (1) an age of 16 years or above, (2) proficiency in the Swedish language, and (3) either burns of 10 % TBSA or greater or length of stay at the Burn Center of seven days or more. A summary of the study samples in papers I–IV is shown in Table 1.

In paper I, data were collected between 2000 and 2008 at the Uppsala Burn Center and between 2002 and 2008 at the Linköping Burn Center. Patients were sent self-report questionnaires 12 months following their burn injury assessing personality traits and perceived psychological symptoms.

In paper II, data were collected between 2000 and 2008. At 12 months after injury participants were sent a questionnaire containing the Impact of Event Scale-Revised (IES-R), followed by an appointment at the outpatient clinic that included a SCID-I interview to assess for the presence of PTSD. In order to achieve an overlap in time frames for symptom assessment between the IES-R and the SCID, individuals whose assessments did not overlap were excluded (n = 24).

In paper III, data were collected between 2000 and 2009. During the initial treatment for the burn the patients were interviewed regarding psychiatric morbidity and perceived life threat during trauma, and self-report questionnaires were used to assess perceived psychological symptoms. At three, six, and 12 months after the burn the patients again filled in the IES-R.

In paper IV, data were collected between 2000 and 2005. The inclusion criteria were the same as outlined above with the additional criterion of absence of colour blindness as reported by the patient. During the initial treatment for the burn the patients were interviewed regarding psychiatric morbidity, and self-report questionnaires were used to assess perceived psychological symptoms. At three, six, and 12 months after the burn the patients were sent self-report questionnaires. In addition, at 12 months the patients
were interviewed to assess for PTSD, and they performed two cognitive
tests, one targeting attentional bias and one targeting verbal fluency.

Table 1. Sociodemographic characteristics of the participants in papers I–IV.

<table>
<thead>
<tr>
<th>Paper</th>
<th>N</th>
<th>Response rate (%)</th>
<th>M/F</th>
<th>Age at injury</th>
<th>TBSA (%)</th>
<th>TBSA-FT (%)</th>
<th>LOS</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>147</td>
<td>60</td>
<td>108/39</td>
<td>45.3 (16.4)</td>
<td>24.0 (19.4)</td>
<td>12.9 (16.3)</td>
<td>28 (35)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>16.0–89.5</td>
<td>0.5–80.0</td>
<td>0–65.0</td>
<td>0–301</td>
</tr>
<tr>
<td>I</td>
<td>60</td>
<td>50</td>
<td>48/12</td>
<td>43.2 (15.8)</td>
<td>26.0 (21.1)</td>
<td>12.4 (16.1)</td>
<td>29 (35)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>20.0–81.9</td>
<td>0.5–80.0</td>
<td>0–63.5</td>
<td>2–183</td>
</tr>
<tr>
<td>III</td>
<td>95</td>
<td>67</td>
<td>72/23</td>
<td>44.7 (15.5)</td>
<td>23.4 (19.4)</td>
<td>10.9 (14.5)</td>
<td>27 (37)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>19.0–89.0</td>
<td>0.5–80.0</td>
<td>0–63.5</td>
<td>1–277</td>
</tr>
<tr>
<td>IV</td>
<td>38</td>
<td>48</td>
<td>30/8</td>
<td>43.9 (13.8)</td>
<td>23.3 (22.4)</td>
<td>9.5 (15.0)</td>
<td>27 (38)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>19.3–76.4</td>
<td>0.5–80.0</td>
<td>0–63.5</td>
<td>1–230</td>
</tr>
</tbody>
</table>

Values are means (SDs) and range. M/F = males/females, TBSA = total body surface area burned, TBSA-FT = total body surface area full-thickness burns, LOS = length of stay at the Burn Center in days

Assessments and measures

The Impact of Event Scale-Revised (IES-R)
In papers I–IV, a Swedish version of the IES-R was used to assess traumatic
distress after burn. This version of the IES-R was adapted from two psycho-
metrically evaluated self-report scales, the original IES [77, 131] and the
IES-R [12, 38]. The present version contains 22 items that correspond to the
IES-R and are rated on the same scale as in the original IES: 0, 1, 3, and 5,
where 0= “not at all” and 5= “often”.

The Hospital Anxiety and Depression Scale (HADS)
In papers I–IV, the HADS was used to assess symptoms of general anxiety
and depression. Each of the two subscales, Anxiety and Depression, consists
of seven items. Each item is rated on a scale of 0 to 3, where 0= “no symp-
tom” and 3= “a severe symptom”. The HADS is used extensively in health
care and has been evaluated in several clinical populations with satisfactory
results [14].
The Structured Clinical Interview for DSM-IV Axis I and II disorders (SCID I & II)
The SCID-I interview [59] covers DSM-IV axis I disorders, i.e. clinical disorders, and the SCID-II interview [60] covers axis II disorders, i.e. personality disorders. The SCID-I was used in papers II–IV, including the PTSD module of the SCID-I. Subsyndromal PTSD was assessed according to the criteria suggested by Mylle and Maes [105]. According to their recommendations, subsyndromal PTSD includes at least one symptom from each criterion including impaired functioning. The SCID-II was used in paper III.

The List of Threatening Experiences-Questionnaire (LTE-Q)
The LTE-Q was administered during the initial treatment of the burn to assess the number of stressful experiences during the year prior to the burn injury and during the patient’s lifetime. The LTE-Q is composed of 12 events and covers illnesses, accidents, losses, interpersonal problems, unemployment, financial crises and legal problems [25]. The LTE-Q was used in papers III and IV.

Perceived life threat
Perceived life threat was assessed in a semi-structured interview during the initial treatment in the Burn Center. The interview focused on the event when the burn injury occurred up until the arrival of medical assistance. Perceived life threat was used in papers III and IV.

The Swedish universities Scales of Personality (SSP)
The SSP [70] is an inventory designed to measure personality traits that are associated with vulnerability for psychopathology. It comprises 13 subscales, each of which contains seven items for a total of 91 items: (1) Somatic Trait Anxiety, (2) Psychic Trait Anxiety, (3) Stress Susceptibility, (4) Lack of Assertiveness, (5) Detachment, (6) Embitterment, (7) Mistrust, (8) Trait Irritability, (9) Impulsiveness, (10) Adventure Seeking, (11) Social Desirability, (12) Verbal Trait Aggression and (13) Physical Trait Aggression. Each item is presented as a statement and is rated on a scale from 1= “Does not apply at all” to 4= “Applies completely”. The SSP has been standardised in a Swedish age- and sex-stratified non-patient sample. In factor analysis of results for patients with burns, the SSP has been found to cover three broad domains of personality: Neuroticism (subscales 1–8), Sensation Seeking (9–10), and Aggressiveness (11–13) [146]. The SSP was used in papers I and III.

The Social Support Questionnaire (SSQ-6)
In paper III, the SSQ-6 [123] was used to assess perceived social support. It contains six items and each item has two parts. The first part assesses the
number of available others the individual feels he or she can turn to in times of need in various situations. The second part of each item measures the individual's degree of satisfaction with the perceived support available in that particular situation. The SSQ-6 yields two scores, the Number score for the perceived number of social supports with a possible range of 0–9 for each item, and the Satisfaction score for satisfaction with the social support that is available. On the latter, participants are instructed to indicate how satisfied they are on a six-point Likert scale, from “very dissatisfied” to “very satisfied”.

Avoidant coping
Avoidant coping style was assessed with one subscale from the Coping with Trauma Interview administered during the initial treatment. The interview concerns coping style in general, and thus the patients were instructed to report how they usually cope with life events, not counting the recent burn [148]. The subscale consists of seven items rated on a scale of 1 = “does not apply/not used” to 4 = “used a great deal”. Avoidant coping was used in paper III.

The modified emotional Stroop task
In paper IV, the modified emotional Stroop task was used to assess attentional bias one year after the burn. The Stroop task was originally programmed by Lundh et al [91]. Two experimental word types were used; 12 burn words and 12 general anxiety words. For each experimental word there was a neutral control word that was matched for part of speech, number of syllables and frequency in the Swedish language. The 48 words appeared singly on the screen four different times, in different colours (red, green, blue and yellow), and in random order. The total number of trials was 192. There were two breaks of one minute each at equal time intervals. The participants were instructed verbally and on the screen to name the correct colour as fast as possible. Response latencies were registered when the participant pressed the space bar on the computer.

The Controlled Oral Word Association Test (COWAT)
In paper IV the COWAT was used to assess verbal fluency at one year after the burn. The task in this test is to say as many words as possible, other than proper nouns, beginning with a specified letter (F, A, and S). Total scores were adjusted for differences in age, education and gender [89].

Burn-specific and demographic information
In papers I–IV, data regarding age, gender and injury severity were extracted from medical records. Injury severity was assessed by percentage of the Total Body Surface Area that was burned (TBSA burned), percentage of the Total Body Surface Area with Full-Thickness burns (TBSA-FT), Length of
Stay in the Burn Center (LOS), and days on a ventilator. Further, information regarding level of education (papers I, III–IV), marital (papers I, IV) and working status (papers I–II, IV) was obtained by means of questionnaires.

Data analysis

All data analysis was performed using SPSS Software (SSP Inc.).

In paper I, a principal component analysis with oblique rotation was performed to examine the factor structure of the IES-R. Internal consistency of the IES-R subscales was assessed with MIIC and Cronbach's alpha coefficients. Validity was assessed with Pearson correlations and independent sample t-tests. Chi square and Fischer’s Exact Test were used to analyse associations between categorical variables.

In paper II, both the full diagnosis of PTSD and subsyndromal PTSD were interpreted as positive tests for PTSD. The discriminative values’ sensitivity, specificity, discriminant ability (DA), positive and negative likelihood ratios (LR+ and LR-, respectively) and overall efficiency (OE) were calculated for the IES and the IES-R in order to examine the efficacy of the IES and IES-R in identifying PTSD cases. In a first step, the sensitivity was set to 1.0 as that would allow identification of all participants with a positive diagnosis of PTSD and no case would be missed. In a second step, the best DA was sought without having a fixed limit for sensitivity. Demographic data were compared using t-tests, Chi-Square and Fischer’s Exact Test.

In paper III, a cluster analysis was conducted on the IES-R total scores assessed at three, six and 12 months post injury to classify participants into subgroups. Two different cluster analyses were performed in order to verify the results, a hierarchical (Wards) and a non-hierarchical analysis (K-means), using squared Euclidean distances to form the distance matrix. In order to explore cluster differences for relevant risk factors for PTSD, Kruskal-Wallis non-parametric ANOVA and Mann-Whitney U tests, Chi-square and Fischer’s Exact Test were used.

In paper IV, response latencies for each word type in the Stroop task were compared using paired t-tests. Difference scores were calculated for each of the two word types (i.e. Burn words-Control words, and Anxiety words-Control words). Correlation and group analyses were performed with non-parametric Spearman’s rank correlations and Mann-Whitney U Tests. Chi square and Fischer’s Exact Test were used to analyse associations between categorical variables.
Ethics

The studies were performed according to the principles of the Helsinki Declaration and were approved by the Uppsala University Ethics Committee and the Linköping University Hospital Ethics Committee.
Results

Psychometric properties of the Impact of Event Scale-Revised in patients one year after burn injury (Paper I)

Factor analysis
The factor analysis of the IES-R revealed a three-factor solution including a strong single factor accounting for 47.0 % of the variance, while factors two and three explained 7.8 % and 7.3 % of the total variance, respectively. Thus, in total 62.2 % of the variance was explained. The limit for factor loadings was set at 0.40. Apart from five items, the factor structure was in agreement with the three subscales proposed by Weiss and Marmar [144].

Reliability
The MIIC were 0.48 for intrusion, 0.52 for avoidance, 0.50 for hyperarousal and 0.44 for the total scale, and Cronbach’s alpha values were 0.88, 0.90, 0.85 and 0.95, respectively, which is considered high internal consistency [71].

Validity
The subscale intercorrelations were high, ranging between 0.71 and 0.77. This indicates that the subscales tap into a similar construct, but are not interchangeable. There were significant correlations between the IES-R subscales and concurrent symptoms of anxiety and depression, as measured with the HADS subscales (range of \( r = 0.49–0.78 \)). All the SSP subscales within the broader domain Neuroticism correlated positively with the IES-R subscales (range of \( r = 0.24–0.64 \)). In addition, the IES-R scores were positively related to TBSA-FT, LOS, and days on a ventilator, indicating overall that the more severe the burn the higher the IES-R scores. There were no associations between the IES-R and age or education. Women had more symptoms of intrusion than men \( (t_{145} = 2.3, p < 0.05) \), but there were no gender differences on the other IES-R subscales.
Validation of a Swedish version of the Impact of Event Scale-Revised (IES-R) in patients with burns (Paper II)

Presence of PTSD

According to the SCID-I interview, three participants (5%) had a full PTSD diagnosis and subsyndromal PTSD was found in eight cases (13%); thus, 11 participants in total (18%) had a positive diagnosis of PTSD.

Validity of the IES and the IES-R

Participants with a positive PTSD diagnosis (i.e. full or subsyndromal PTSD) had higher scores on each of the IES-R subscales, and on the total IES and IES-R, than those without a diagnosis. The lowest score for an individual who fulfilled the criteria for a positive diagnosis of PTSD was 25 on the IES and 40 on the IES-R (Table 2).

Table 2. Cut-off scores and discriminant ability of the IES, the IES-R and the IES-R subscales in distinguishing between participants with and without PTSD, as assessed with the SCID-I.

<table>
<thead>
<tr>
<th>Scale</th>
<th>Cut-off score</th>
<th>Sensitivity</th>
<th>Specificity</th>
<th>DA</th>
<th>LR(+)</th>
<th>OE</th>
</tr>
</thead>
<tbody>
<tr>
<td>IES</td>
<td>≥25</td>
<td>1.00</td>
<td>0.65</td>
<td>0.83</td>
<td>2.88</td>
<td>0.72</td>
</tr>
<tr>
<td>IES-R</td>
<td>≥40</td>
<td>1.00</td>
<td>0.78</td>
<td>0.89</td>
<td>4.45</td>
<td>0.82</td>
</tr>
<tr>
<td>IES-R subscales:</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Intrusion</td>
<td>≥15</td>
<td>1.00</td>
<td>0.65</td>
<td>0.83</td>
<td>2.88</td>
<td>0.72</td>
</tr>
<tr>
<td>Avoidance</td>
<td>≥8</td>
<td>1.00</td>
<td>0.55</td>
<td>0.78</td>
<td>2.23</td>
<td>0.63</td>
</tr>
<tr>
<td>Hyperarousal</td>
<td>≥10</td>
<td>1.00</td>
<td>0.69</td>
<td>0.85</td>
<td>3.27</td>
<td>0.75</td>
</tr>
</tbody>
</table>

DA = discriminant ability, LR = positive likelihood ratio, OE = Overall efficiency

Note: Negative likelihood ratios were not reported, since at a sensitivity of 1.0 the negative likelihood ratios are zero.

Discriminative ability

To determine whether the IES and the IES-R could distinguish between participants with and without a PTSD diagnosis, analysis of discriminative ability was conducted. When sensitivity was set to 1.0, the best performance was found for the IES-R, which had a specificity of 0.78, a DA of 0.89, an LR+ of 4.5, and classified 82% of the individuals correctly (i.e. overall effi-
ciency). The second best performance was shown for the Hyperarousal sub-scale alone, which had a specificity of 0.69, a DA of 0.85, an LR+ of 3.3, and an overall efficiency of 0.75. Both were overly inclusive at their optimal cut-off levels; the IES-R total score with an optimal cut-off at ≥40 was associated with 50 % true positive results. As the sensitivity was 1.0, there were no false negatives. The Hyperarousal subscale, with an optimal cut-off score of ≥10, was associated with 42 % true positive results. The IES-R Intrusion and Avoidance subscales and the IES total score were less able to correctly identify individuals with PTSD (Table 2).

When the cut-off yielding the best possible DA was sought, it was at the same cut-off levels as when the sensitivity was set to 1.0, suggesting that the cut-off at a sensitivity of 1.0 yields the best performance of the IES-R and its subscales.

**A prospective longitudinal study of PTSD symptom trajectories after burn injury (Paper III)**

For the total sample of 95 participants, the mean IES-R total scores at baseline, three, six and 12 months did not change over time. As each of the three subscales showed the same pattern as the total scores, the total scores were chosen as the basis for clustering.

**Identification of PTSD symptom trajectories**

Four distinct patterns of PTSD symptom trajectories were identified using cluster analysis: *resilient* (low and initially decreasing IES-R scores), *recovery* (decreasing scores over time), *delayed* (increasing scores over time) and *chronic* (high scores at all time-points). The trajectories are presented in Figure 2. There were significant differences in IES-R total scores between all trajectories at each time-point, except for the *recovery* and *delayed* trajectories at six months.

Within each trajectory, the three subscales had the same general pattern as the IES-R total score over time (all within-cluster comparisons were ns, data not shown). This suggests that the trajectories are not determined by any specific symptom as measured with the IES-R (see Figure 2 in paper III).
Validation of PTSD symptom trajectories

Among the four trajectories, the resilient and chronic trajectories differed the most regarding risk factors. Compared with the chronic trajectory, the resilient symptom trajectory patients had perceived less life threat, had lower levels of symptoms of PTSD, general anxiety and depression during hospitalisation, had more people to support them, lower levels of neuroticism-related personality traits and avoidant coping style, fewer stressful life events, and less prior psychiatric morbidity. The recovery trajectory was similar to the resilient trajectory, except that patients had more days in hospital and higher symptom levels on the IES-R and the HADS during hospitalisation than those in the resilient trajectory. In the delayed trajectory patients had more years of education, more stressful life events, more neuroticism-related personality traits, more previous affective disorders, perceived more life threat during the trauma and scored higher on anxiety and depression during hospitalisation than those in the resilient trajectory. Almost half of those in the delayed trajectory and more than half of the chronic trajectory fulfilled the symptom criteria for a personality disorder.
Attentional bias and symptoms of post-traumatic stress disorder one year after burn injury (Paper IV)

Burn-Specific Attentional bias
At a total group level 12 months post burn, burn-specific attentional bias was indicated, as the response latencies were significantly longer for burn-related words than for control words. However, the difference scores were not associated with symptoms of PTSD or its proposed risk factors.

Using a categorical analysis, dividing the sample into those with positive difference scores and those without positive difference scores, 29 participants displayed burn-specific attentional bias while nine did not. The group with burn-specific attentional bias reported more threatening life events ($z = 2.3$, $p < 0.05$) during the year before the injury, they were more likely to have perceived a life threat during the burn trauma ($\chi^2 = 5.4$, $p < 0.01$), and they had more severe injuries (TBSA: $z = 2.0$, $p < 0.05$) than the group without attentional bias.

Symptoms and diagnosis of PTSD
The group with burn-specific attentional bias had higher scores on the IES-R subscales at two time-points (Table 3). There were no differences regarding symptoms of anxiety and depression according to the HADS at any of the time-points. According to the SCID interview at 12 months after the burn, none of the participants had a PTSD diagnosis, whereas seven fulfilled criteria for subsyndromal PTSD. All of them also showed burn-specific attentional bias, although the association was not significant.

Anxiety-related Attentional bias
There was no difference in response latencies between general anxiety words and control words, and the difference scores were not associated with symptoms of PTSD or its proposed risk factors. Furthermore, using a categorical analysis, those with attentional bias for anxiety words did not differ from those without anxiety-related bias regarding the presence of subsyndromal PTSD, PTSD symptoms or proposed risk factors for PTSD.
<table>
<thead>
<tr>
<th>Time-point (n/n)&lt;sup&gt;a&lt;/sup&gt;</th>
<th>IES-R scores</th>
<th>Burn-specific bias Median (IQR)&lt;sup&gt;b&lt;/sup&gt;</th>
<th>No burn-specific bias Median (IQR)&lt;sup&gt;b&lt;/sup&gt;</th>
<th>z-score</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Baseline (29/9)</td>
<td>Intrusion</td>
<td>11.0 (4.5–20.0)</td>
<td>6.0 (4.5–11.0)</td>
<td>1.1</td>
<td>0.29</td>
</tr>
<tr>
<td></td>
<td>Avoidance</td>
<td>8.0 (0.0–20.0)</td>
<td>7.0 (1.0–11.0)</td>
<td>1.0</td>
<td>0.34</td>
</tr>
<tr>
<td></td>
<td>Hyperarousal</td>
<td>3.0 (0.0–11.0)</td>
<td>1.0 (0.0–1.5)</td>
<td>1.7</td>
<td>0.10</td>
</tr>
<tr>
<td>3 months (27/9)</td>
<td>Intrusion</td>
<td>12.0 (7.0–23.0)</td>
<td>9.0 (1.0–15.0)</td>
<td>1.4</td>
<td>0.18</td>
</tr>
<tr>
<td></td>
<td>Avoidance</td>
<td>7.0 (3.0–18.0)</td>
<td>4.0 (0.0–11.5)</td>
<td>1.2</td>
<td>0.22</td>
</tr>
<tr>
<td></td>
<td>Hyperarousal</td>
<td>9.0 (3.0–16.0)</td>
<td>2.0 (0.0–14.0)</td>
<td>1.5</td>
<td>0.15</td>
</tr>
<tr>
<td>6 months (29/9)</td>
<td>Intrusion</td>
<td>20.0 (9.5–22.0)</td>
<td>7.0 (3.5–12.0)</td>
<td>2.9</td>
<td>0.003</td>
</tr>
<tr>
<td></td>
<td>Avoidance</td>
<td>13.0 (2.5–18.5)</td>
<td>1.0 (1.0–7.0)</td>
<td>2.2</td>
<td>0.03</td>
</tr>
<tr>
<td></td>
<td>Hyperarousal</td>
<td>10.0 (6.0–16.0)</td>
<td>3.0 (0.0–10.5)</td>
<td>2.2</td>
<td>0.03</td>
</tr>
<tr>
<td>12 months (28/9)</td>
<td>Intrusion</td>
<td>18.0 (9.5–22.0)</td>
<td>5.0 (0.5–7.5)</td>
<td>3.1</td>
<td>0.001</td>
</tr>
<tr>
<td></td>
<td>Avoidance</td>
<td>11.0 (2.3–22.0)</td>
<td>4.0 (0.5–6.0)</td>
<td>1.8</td>
<td>0.08</td>
</tr>
<tr>
<td></td>
<td>Hyperarousal</td>
<td>9.5 (4.5–13.8)</td>
<td>6.0 (0.5–8.5)</td>
<td>2.1</td>
<td>0.03</td>
</tr>
</tbody>
</table>

<sup>a</sup> = (Burn-specific bias/no burn-specific bias) group size for each time-point, <sup>b</sup> = Interquartile range.
Discussion

The main aims of this thesis were to gain knowledge regarding PTSD symptoms and cognitive processes after burn, and to evaluate a screening tool for measuring symptoms of PTSD up to one year after burn.

Psychometric properties of IES-R

The psychometric properties of the Swedish version of the IES-R were examined in papers I and II. These studies are the first validations of the IES-R, one of the most frequently used self-report scales for symptoms of post-traumatic stress, for use as a screening instrument for full or subsyndromal PTSD in patients with burns.

In paper I, a factor analysis was performed on the Swedish version of the IES-R and the results largely supported the three-factor structure of the IES-R proposed by Weiss and Marmar [144]. In conjunction with the analyses of reliability and validity, the results indicated that the IES-R has satisfactory psychometric properties when used in the present population of patients with burns.

Although a recent Norwegian study of the IES-R found support for the three-factor structure of the IES-R in a non-clinical sample [50], other studies have reported varying numbers of factors ranging from one- to five-factor solutions [8, 11, 12, 38, 65, 100]. Direct comparisons between different studies can be difficult due to methodological issues such as different factor analyses, different trauma exposure and symptom severity across different samples, and differing lengths of time since trauma. Furthermore, studies of measures of PTSD other than the IES-R have also found inconsistent numbers of factors [6, 7, 28, 63, 97, 113, 134]. Hence, the inconsistency might be due to difficulties in assessing PTSD rather than to the psychometric properties of the IES-R. Moreover, there is controversy regarding the number of symptom clusters in the diagnosis of PTSD [6, 83].

In paper II, the diagnostic utility of the IES and the IES-R was examined by validating the instruments against a clinically assessed PTSD diagnosis. The IES-R total scale, with a cut-off score at 40, had the best properties as a screening tool for the diagnosis of PTSD in patients with burns as compared to the IES and the IES-R subscales. In this study the sensitivity was set to 1.0 (i.e. identifying all cases), as it can be argued that a psychological screening
tool should be overly inclusive since the consequence of an “unnecessary” clinical interview has a less serious effect than missing a diagnosis [34, 127].

There are several studies that have validated the IES-R using structured interviews [1, 8, 12, 38, 90, 118, 132]. Only one of these used the SCID-I for the clinical assessment [8], and the results were similar to those in paper II; with a sensitivity set to 1.0, the specificity was 0.80 and the overall efficiency was 0.85. The other studies used the Clinician Administered PTSD Scale for the clinical assessment; for example, in a recent study [90] that validated the Korean version of the IES-R, a high diagnostic efficiency was found with a sensitivity of 0.95 and a specificity of 0.80.

There are many screening instruments for measuring PTSD, which makes it difficult to compare findings across studies (see Refs [1, 23]), and some of the instruments are trauma specific (e.g. the Mississippi Scale for Combat-related PTSD). To date there is not enough empirical evidence to demonstrate which instrument is the most psychometrically sound screening tool for PTSD. However, a study [1] comparing seven self-report measures of PTSD in a non-clinical sample found that the IES-R had the best discriminant validity, and together with the Posttraumatic Diagnostic Scale and the PTSD checklist it demonstrated the best diagnostic utility.

**PTSD symptom trajectories**

As compared to studies on the prevalence of PTSD, there is less research concerning the onset and course of PTSD symptoms. Some suggest that early symptoms predict later PTSD while low or no symptoms do not lead to PTSD (e.g. Ref [108]), whereas other studies have reported a more complex pattern with four trajectories also including a delayed and a recovery trajectory [17, 41, 43]. To date, paper III is the first study using the IES-R for the purpose of investigating symptom trajectories with a cluster analysis approach and it is also the first study to investigate patterns of PTSD symptoms over time in a population of patients with burns.

Four distinct patterns of PTSD symptoms over time were identified. The majority of patients (40 %) belonged to the resilient trajectory with low and decreasing symptoms of PTSD over time. A small number of patients (10 %) reported initially high levels of symptoms of PTSD that declined over time, i.e. the recovery trajectory. A relatively large number of patients (32 %) initially reported moderate levels of PTSD that increased over time, i.e. the delayed trajectory. Finally, 18 % of the patients belonged to the chronic trajectory with high levels of symptoms of PTSD at each assessment.

The findings correspond with several previous studies following other forms of trauma regarding the number of trajectories and the course of PTSD symptoms [17, 19, 41, 69, 107], as well as the finding that the resilient tra-
trajectory was the most common (e.g. Refs [19, 41, 69]). However, the delayed trajectory was larger than previously found in other studies.

It was recently suggested that two additional trajectories should be considered in response to stress; resistance referring to those who consistently display no or very low levels of symptoms, and remitting/relapsing referring to a cyclical pattern of symptoms [107]. However, the present study did not find support for either of those proposed trajectories.

It was expected that known risk factors for PTSD symptoms would be negatively associated with the resilient trajectory and positively associated with the trajectories characterised by such symptoms. Accordingly, in comparison with other trajectories, individuals in the resilient trajectory had less prior psychiatric morbidity, perceived less life threat, had fewer symptoms of anxiety and depression during hospitalisation, fewer days in hospital, more people to support them, lower levels of neuroticism and avoidant coping style, and fewer stressful life events. These findings are consistent with previous research on risk factors for PTSD symptoms. Moreover, this generally healthier profile of the individuals in the resilient trajectory is consistent with other research investigating resilience following trauma [18, 43].

The trajectories were also compared with regard to PTSD symptoms during hospitalisation. Previous studies have shown that psychological symptoms during hospitalisation predict later symptoms [87, 148]. In this study (paper III), the resilient group reported lower PTSD symptom levels during hospitalisation than individuals in the other three trajectories. No differences were detected between the other three trajectories. This implies that individuals in the resilient trajectory are expressing less distress after the trauma, while the other three trajectories could not be distinguished during hospitalisation. Thus, the IES-R alone cannot predict whether borderline scores will decline, persist or increase. Additional assessments are needed for individuals scoring moderately on the IES-R. For instance, a structured interview regarding other risk factors for PTSD such as previous psychiatric morbidity and life events might help in identifying individuals at risk for delayed or chronic elevations of PTSD symptoms.

Taken together, papers I–III demonstrate that the IES-R is a psychometrically sound instrument for measuring PTSD symptoms in patients with burns, with good measures of reliability, validity and diagnostic utility. A clinical implication is that the IES-R can be helpful as a screening tool during hospitalisation for identifying resilient individuals.

Risk factors for PTSD symptoms

In burns there are several identified risk factors for the development of PTSD symptoms including female gender, psychiatric history, neuroticism, avoidant coping, low social support, injury severity, life threat during the
trauma, and early psychological symptoms. Other risk factors found in the general trauma literature are prior stressful life events and low educational level. The results presented in this thesis largely correspond with these previous findings.

**Burn and sociodemographic characteristics**

Consistent with previous burn research [138], there was a positive association between measures of burn severity and PTSD symptoms. For example, individuals with high levels of symptoms of PTSD had longer hospital stays than those with low symptom levels.

Female gender [138] and younger age [22] have been found to be risk factors for PTSD in previous studies, but were not associated with PTSD symptoms in the present studies. However, it must be borne in mind that the female participants constituted only one quarter of the sample, which makes the gender analyses less certain. Individuals who were married and were working one year after the burn had lower PTSD symptom levels than those who were unmarried or not working. There was no straightforward association in this thesis between symptoms of PTSD and years of education. In most previous studies of PTSD, a high level of education is regarded as a protective factor [22], whereas others have found that a low level of education is not a risk factor for PTSD symptoms [18].

**Psychiatric history and stressful life events prior to injury**

In line with previous studies, those reporting high levels of PTSD symptoms had more prior psychiatric morbidity and had experienced more stressful life events than those with lower symptom levels.

**Symptoms of general anxiety and depression**

Symptoms of general anxiety and depression were positively correlated with PTSD symptoms. As expected, symptoms of anxiety were more strongly associated with PTSD than symptoms of depression. The association was strongest for the PTSD symptom of hyperarousal. Similar results have been shown in other studies using the IES-R [11, 12, 110]. This might be explained by the fact that symptoms of hyperarousal, such as disrupted sleep, concentration difficulties, etc., are also symptoms of general anxiety and depression. These findings suggest that hyperarousal in particular may be an indicator of general psychological distress.

**Personality traits, social support and avoidant coping**

Symptoms of PTSD were correlated with high levels of neuroticism-related personality traits, which is in agreement with previous studies after trauma in general [32, 33, 76, 78, 126] and in patients with burns [56, 88].

In a general trauma study, Bonanno et al [18] found an association between perceived social support and resilience, and similarly, individuals in
the present thesis (paper III) with constant high levels of PTSD symptoms had fewer people to support them than those with low symptom levels or delayed symptoms. However, there were no differences with regard to the degree of satisfaction with social support.

Individuals with low levels of symptoms of PTSD used less avoidant coping over time than individuals with high levels of symptoms. This concurs with a previous study [148] showing that avoidant coping predicted poorer psychological health after burn injury. Similar results have been found in other trauma populations. For example, Scarpa et al [124] found that avoidant coping and low perceived social support predicted PTSD symptoms after community violence.

In summary, this thesis has identified several of the known risk factors for the development of PTSD. The risk factors correspond well with the international trauma literature, which strengthens the findings in the thesis.

**Attentional bias**

In paper IV, the modified emotional Stroop task was used to investigate the existence of attentional bias toward burn-specific stimuli one year post burn. The main finding was that burn-specific attentional bias exists and that it is relatively common in patients one year after burn injury. The group with burn-specific attentional bias was more likely to have perceived a life threat during the burn trauma and had more severe injuries than the group without attentional bias. Also, in accordance with the hypotheses, burn-specific bias was associated with earlier and concurrent symptoms of PTSD, but not with symptoms of general anxiety or depression.

In the present study the analyses of attentional bias were performed in two modes, first using the difference scores as continuous variables, and second using a cut-off to divide the sample into those with and those without attentional bias. A limitation of the categorical condition is the loss of information that accompanies categorisation of continuous data. On the other hand, the categorical condition can be viewed as more clinically useful as it more directly evaluates whether or not the presence of attentional bias is associated with PTSD symptoms. In this study only the categorical condition rendered significant results in the analyses regarding risk factors and PTSD symptoms.

Although burn-specific attentional bias was associated with PTSD symptomatology, the bias was also present among some patients who did not report high symptomatology. This suggests that the experience of burn trauma may have a general impact on attentional processes. Many patients are constantly reminded of the burn, as they have been disfigured or suffer from persistent physical symptoms. These reminders may affect the patients’ at-
tentional processes. This is consistent with other studies showing that trauma-specific attentional bias can be found in individuals without PTSD [31] or symptoms of PTSD [147].

The finding that burn-specific bias was not exclusive to patients with high levels of PTSD symptomatology limits the clinical utility of the emotional Stroop task in its present form. Studies in other patient groups have indicated a possible clinical utility of the Stroop task as a tool to distinguish depression from dementia [45], and as an outcome measure after treatment for anorexia nervosa [9], and spider phobia [142]. In contrast, successful treatment after motor vehicle accident-related PTSD did not result in a decrease in attentional bias [42].

Nevertheless, the findings are largely in line with previous empirical studies showing that trauma-specific attentional bias is present among patients with PTSD [150]. In addition, the results are in line with Ehlers and Clark’s theoretical model of PTSD, which postulates that previous life events, perceived life threat and injury severity, among other factors, may influence cognitive processing.

More recently, this cognitive theory has gained support from studies involving brain imaging. It has been suggested that attentional bias towards threat-related stimuli probably is a reflection of alterations of fear-processing mechanisms in the brain, e.g. in the amygdala and the medial prefrontal cortex [13, 155]. It has been proposed that the emotional distress characterising PTSD arises as a hypoactive medial prefrontal cortex fails to inhibit activity in the amygdala when patients with PTSD are exposed to threat cues [53, 85]. Positive correlations have been found between amygdala activation and attentional biases [4, 13, 99]. This suggests that there are neural correlates between attentional bias and PTSD. The role of attentional bias is still not known; i.e. whether it is a contributing factor or merely a reflection of other processes.

Methodological considerations

Samples

The research participants include patients referred to the Uppsala Burn Center (papers I–IV) and the Linköping Burn Center (paper I), which are the two national burn centres in Sweden. The catchment areas for the two centres during the study period were approximately 3 and 3.3 million inhabitants, respectively, and covered the northern part of Sweden as well as parts of southern and central Sweden. The sample can therefore be considered to be representative for the Swedish population and populations of other countries.
with comparable social standards. A strength in paper I is that it includes patients from both burn centres, thus covering the greater part of Sweden.

The participants were included on a consecutive basis, which minimises the risk of selection bias. General limitations are that the samples were relatively small and partly overlapping. A reason for this is the low incidence of severe burns in Sweden, which may be due in part to high levels of household safety and work safety as well as a high social standard. The small sample size limits the statistical power in the studies, especially in papers II and IV.

The response rates in papers I and III were 60% and 67%, while the response rates in papers II and IV were somewhat lower. In paper II, the exclusion of 24 participants who did not meet study criteria because of non-overlapping assessments resulted in a 50% participation rate. In paper IV, the non-participants mainly consisted of those who declined participation or dropped out of the longitudinal study. The comparably short inclusion time renders a smaller total sample. In comparison with other burn research, the present studies have a low proportion of non-responders. Studies of burn patients have shown that those with sociodemographic risk factors [75] as well as minor burns [58] are less likely to complete follow-up studies. Overall, the non-participants in this thesis did not differ from the participants regarding known sociodemographic characteristics such as age and gender or intentional/unintentional injuries. However, the non-participants had somewhat smaller injuries (TBSA) (papers I–III) and fewer days on a ventilator (paper II).

Study Design, Methods and Procedures

A strength in this thesis is that all the studies had a prospective and longitudinal design. In paper III, a limitation is that the study included assessments only up to 12 months post trauma, even though symptom patterns may change after this period. In paper IV, the Stroop task was performed 12 months after the burn injury, although it might have been more ideal to assess attentional bias earlier or on repeated occasions. One reason for this design was practical, as several patients were not well enough to be able to perform cognitive tests during the initial admission. Also, as LOS varies a great deal, an early test would catch the patients at very different stages of recovery both physically and psychologically.

A limitation of paper I is the use of different methods for inclusion at the two participating burn centres. However, the two samples were compared with regard to burn-specific and sociodemographic characteristics and IES-R scores, and there were no differences except for days on a ventilator.

The data collection methods were self-report questionnaires and semi-structured interviews. A limitation with the use of self-report questionnaires is response biases, such as the tendency to avoid extreme values and to give
socially desirable answers [35]. However, these questionnaires are very time- and cost-efficient. A limitation with the use of structured interviews is the possible systematic bias of the interviewer and a recall bias of the interviewee. Nevertheless, the use of the established SCID-I and SCID-II interviews to assess previous psychiatric disorders and personality disorders is a definite strength. The SCID interview is considered a gold standard clinical interview for assessing the major Axis I and II disorders. For the assessment of PTSD, an alternative would have been to use the Clinician Administered PTSD Scale, as it also assesses severity and intensity of each symptom. However, it takes at least one hour to administer as compared to 20–30 minutes for the SCID. As assessments took place in a clinical setting, a brief assessment was preferred.

The reliability analysis of the IES-R was focused on internal consistency, and there was no other form of analysis such as test-retest. However, as PTSD symptoms can be expected to fluctuate over time, it would have been difficult to find an optimal test-retest time interval. For the reliability of the diagnostic assessment of PTSD an analysis of interrater reliability showed complete agreement on a diagnostic level (kappa 1.0). Regarding aspects of validity, criterion-related validity and construct validity of the IES-R were assessed in papers I and II. Content validity, which is a non-statistical subjective measure established by experts in the specified area, was not assessed as the IES-R is a previously well-used instrument.

A limitation of papers II and IV is the small number of individuals with full PTSD. The merging of full and subsyndromal PTSD affects the interpretation of the results. However, the diagnosis of subsyndromal PTSD requires that the criterion of impaired function is fulfilled, and the only difference between full PTSD and subsyndromal PTSD is a lower requirement regarding the number of symptoms [105]. Thus, individuals with subsyndromal PTSD still have problems in daily life due to their symptoms, and they may be in need of treatment and follow-up. Moreover, there is evidence that PTSD is a dimensional rather than a categorical construct [122]. Thus, it was judged as appropriate to merge full and subsyndromal PTSD in the analysis.

General discussion

This thesis has demonstrated that there are individual differences in the development and course of PTSD symptoms after burn injury, and that the identified trajectories differ regarding several risk factors associated with PTSD symptoms. This thesis has also established that the IES-R is a valid screening instrument that can be used during hospitalisation to identify those with a more favourable prognosis. Moreover, it was found that burn-specific attentional bias was common one year after burn injury and was associated with PTSD symptoms.
Detecting and managing psychopathology early during recovery is important not only for the injured individual, but also in order to further improve medical care. Recent research has shown an association between psychopathology and physical recovery after burn injury, and that psychological distress during hospitalisation could delay physical recovery [57, 133, 135, 151]. A recent study in burns [151] found that patients with psychological distress during hospitalisation, including posttraumatic stress symptoms, had longer hospital stays and required more surgical procedures than those expressing low psychological distress. Additionally, individuals with pre-existing psychiatric disorders also had longer hospital stays and required more surgical procedures than those without a psychiatric history. Poor adherence to treatment and delayed discharge were suggested to contribute to slowed recovery in these patients. Thus, identification and reduction of early psychological distress might accelerate both physical and psychological recovery of individuals with major burn injuries.

Although there is a vast amount of research in the field of PTSD, the psychological mechanisms behind PTSD are not fully understood. Moreover, the construct of PTSD has been up for debate for some time and the diagnosis has been found to have both conceptual and practical problems. The diagnosis has been criticised on several grounds such as that Criterion A events are neither necessary nor sufficient to produce PTSD, that symptoms overlap with other disorders, and that it pathologises normal stress reactions (e.g. Refs [24, 120, 121]). The next version of the DSM, the DSM-V, is due for publication in 2013, and the criteria for the diagnosis of PTSD will most probably be revised.

Broadly speaking, there are two main pathways for approaching PTSD: a medical perspective and a psychological perspective. The medical perspective of PTSD focuses on epidemiological and diagnostic issues and is largely categorical in nature; either an individual meets the criteria and has a PTSD diagnosis or the criteria are not met and the individual is not diagnosed with PTSD. The psychological perspective focuses more on experiences and functions of the symptoms, as well as cognitive processes that lead to or maintain the symptoms. This thesis has considered both perspectives when investigating PTSD in patients with burns. Recent neurobiological findings, e.g. that the medial frontal cortex and the amygdala play important roles in the development of PTSD, may provide a promising bridge between the two perspectives.

Future research and clinical implications

The approach to investigating the development of PTSD symptoms over time is relatively young and its implications need to be further explored, e.g. whether the treatment of PTSD should be different for the different trajecto-
ries. For example, individuals in the chronic trajectory may benefit from an extended, systematic treatment strategy taking social difficulties into account, while individuals in the recovery trajectory might benefit from brief counselling.

Identification of cognitive processes that may trigger or maintain PTSD symptoms needs to be further investigated in more detail and with more specific measures. Further investigation regarding both of these perspectives, i.e. PTSD symptom trajectories and underlying psychological processes, may have implications in theory as well as practice, as it would improve our understanding of PTSD and the recovery process.

Thirty years ago the primary concern in burn care was patient survival, while today, when most patients with severe burns survive, the aim has shifted to adaptation after the burn, including psychological adaptation. Research on psychological outcomes after burn has increased rapidly during the last 20 years. Implementation of this newly acquired knowledge in the clinical setting is necessary in order to achieve optimal patient benefit. One easily adopted routine, supported by this thesis, is utilisation of a concise and validated screening instrument for PTSD in all adult patients with burns. Identification of those who are resilient to psychopathology, already during hospitalisation, enables the staff to focus on those who are more likely to develop problems after burn injury. This would allow for an efficient utilisation of clinical psychology or psychiatry resources. Moreover, the validated instrument could be further utilised during rehabilitation in order to identify those with psychological symptoms, who are at risk of a poor recovery.
Conclusions

Posttraumatic stress disorder is relatively common after burns, and can be devastating regarding the individual’s possibilities for recovery. Symptoms of PTSD and its associations with personality traits, coping strategies, psychiatric history, sociodemographics, injury severity, social support, psychological symptoms, and cognitive processing have been investigated in this thesis. The main conclusions are

- The IES-R has good psychometric properties, including the factor structure, aspects of validity and reliability, as well as discriminative ability. Hence, it is a valid instrument for measuring PTSD symptoms in patients with burns and can be used during hospitalisation to identify resilient individuals.

- Four trajectories with different onsets and courses of PTSD symptoms were identified: the resilient trajectory, with low levels of PTSD symptoms that decreased over time; the recovery trajectory, with high levels of symptoms that gradually decreased; the delayed trajectory, with moderate symptoms that increased over time; and the chronic trajectory, with high levels of symptoms over time. In addition, the trajectories differed in the expected direction on a number of risk factors associated with PTSD symptoms.

- Several previously known risk factors for symptoms of PTSD were identified in the present studies including certain sociodemographic factors, burn severity, psychiatric history, previous life events, early psychological symptoms, neuroticism, avoidant coping and low social support. The risk factors correspond well with the trauma literature, which strengthens the findings in this thesis.

- Burn-specific attentional bias, as assessed with the emotional Stroop task, was common one year after burn injury. The individuals displaying burn-specific attentional bias had more previous life events, perceived more life threat, had larger burns and higher levels of PTSD symptoms.
Acknowledgements

This thesis is the result of collaboration between the Departments of Neuroscience, Psychiatry, and Surgical Sciences, Plastic Surgery at Uppsala University, and the Uppsala University Hospital Burn Center, as well as the Department of Clinical and Experimental Medicine at Linköping University and the Linköping University Hospital Burn Center. Support and encouragement from many people have made this thesis possible.

First and foremost I wish to thank Mimmie Willebrand, my supervisor, for her great enthusiasm and excellent supervision, and for giving me invaluable guidance and support. She has my deepest gratitude. I am also very grateful to my co-supervisor Bengt Gerdin for his great scientific expertise, never-ending enthusiasm and constructive support.

I also wish to thank Lisa Ekselius for sharing her wisdom and scientific knowledge, for her optimism and warmth, and for being an inspiration. Thanks to my fellow Ph.D. students Caisa Öster and Josefin Bäcklund for sharing this journey, and for their encouragement. I also want to thank Johan Dyster-Aas for co-authoring and for sharing his knowledge in psychiatry. Thanks also to the others in the research group, Björn Wikehult, Morten Kildal, Silvester von Bülow, Andreas Lindahl and Aili Low, for sharing their clinical knowledge in burn care.

I would like to thank Folke Sjöberg, Lottie Orwelius, and Fredrik Huss for their collaboration in data collection at the Linköping Burn Center and for co-authoring. Without their cooperation paper II would not have been possible.

I am indebted to Jane Wigertz for excellent linguistic help, and to Hans Arinell for statistical advice and computer support. Thanks to Lena Bohlin for invaluable practical help and comradeship.

I would like to express my gratitude to Lars von Knorring for support during the project and to all my colleagues and the staff at the Department of Neuroscience, Psychiatry.

I am very grateful to all the staff at the burn intensive care unit for sharing their knowledge concerning burn care, and to Anna Eriksson for helping with data collection, and to Emilie Gauffin, Eva Manfredsson and Carina Wärme for practical assistance.

Above all, I am indebted to all the burn patients for participating and making this thesis possible.
Finally, I wish to thank my family for their constant support. My late grandmother, who I know would be so proud and who is up there “drinking coffee in circles”. A very special thanks to my mother, Lena, for always believing in my ability and for being the greatest grandmother, taking care of Stellan so I could finish writing this thesis. Last and most important, thanks to my fiancé Per, whom I love so very much, for believing in me, for love and encouragement, and for always supporting me.

Financial support was provided by the Swedish Research Council, the Swedish Council for Working Life and Social Research, the Söderström-Königska Foundation, the Thuring Foundation, the Vårdal Foundation, the Nasvell Foundation and the County of Östergötland.
References


118. Rash CJ, Coffey SF, Baschnagel JS, Drobos DJ, Saladin ME. Psychometric properties of the IES-R in traumatized substance dependent individuals with and without PTSD. Addict Behav. 2008;33:1039-47.


Acta Universitatis Upsaliensis

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Editor: The Dean of the Faculty of Medicine

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