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**Deliberate Self-Harm Patients
in the Emergency Department:**
Clinical and Epidemiological Studies

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Institutet**

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Munch, Edvard, The scream, 1893

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TO MY FAMILY

ABSTRACT

Each year approximately ten million people deliberately harm themselves and one million people commit suicide across the world. Deliberate self-harm (DSH) is a major cause of individual suffering and a burden on the healthcare system. An attendance at an emergency department (ED) due to DSH increases the risk for subsequent suicide with 50 to 100 times compared to the general population. Repetition of DSH is very common (15–25%) and often occurs within a short period of time.

The aim of this thesis was to gain a better knowledge of DSH patients in the somatic ED and to find ways of reducing the high repetition rate among this group of patients.

The aims of the studies were to investigate risk factors associated with repeated DSH and suicide, to stratify a DSH population according to the risk of repetition, to develop and validate clinical decision rules that predict repetition of DSH and to investigate follow-up care for DSH patients and its impact on repeated DSH.

Study I: In this study risk factors associated with repeated DSH among 1524 patients attending the ED due to DSH were identified and the patients were stratified into risk categories. New DSH or suicide was identified via national registers. A model for risk stratification for repeated DSH describing groups of low-risk (18%), median-risk (28% to 32%) and high-risk (47% to 72%) was presented.

Study II: The aim was to develop a clinical decision rule, the Södersjukhuset Self-harm Rule (SoS-4), based on factors found to be associated with repeated DSH in Study I and also to validate an existing clinical tool for assessing risk after DSH, i.e., the Manchester Self-Harm Rule (MSHR). The SoS-4 uses five clinical correlates: gender, antidepressant treatment, history of self-harm, admission to a psychiatric clinic and current psychiatric treatment. The MSHR uses four clinical correlates: history of self-harm, previous psychiatric treatment, self-poisoning with benzodiazepines and current psychiatric treatment. The SoS-4 yielded a sensitivity of 90% and a specificity of 18% when applied to the DSH population in Study I and application of the MSHR yielded a sensitivity of 89% and a specificity of 21%.

Study III: The aim was to prospectively validate the ability of the two clinical decision rules, SoS-4 and MSHR, to predict repetition of DSH in a new population and new setting. Included were 325 DSH patients in the EDs of Södersjukhuset and Karolinska University Hospital Huddinge who were followed for six months. Application of the SoS-4, to this new DSH population, yielded a sensitivity of 89% and a specificity of 12% and application of the MSHR a sensitivity of 95% and a specificity of 18%.

Study IV: The aim was to investigate follow-up care of DSH patients and its impact on repetition, which was done in the same study population as in Study III. A visit to a psychiatric consultant within 10 days was registered as an early follow-up. When adjusting for risk factors known to be associated with repetition there was an indication of early followed-up patients being less inclined to repeat their DSH actions.

Conclusions: This thesis, focusing on DSH patients in a somatic ED, demonstrated that there are risk factors associated with repeated DSH that can be used to identify DSH patients at risk for repetition and that both clinical decision rules, the SoS-4 and the MSHR, can be useful in the clinical assessment of DSH patients in conjunction with psychiatric assessment. This thesis also demonstrated that there was an indication of early followed-up patients being less inclined to repeat their DSH actions after adjusting for risk factors known to be associated with repeated DSH.

LIST OF PUBLICATIONS

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

- I. **Bilén K**, Ottosson C, Castrén M, Ponzer S, Ursing C, Ranta P, Ekdahl K, Pettersson H
Deliberate self-harm patients in the emergency department: factors associated with repeated self-harm among 1524 patients
Emergency Medicine Journal 2011; 28(12): 1019-25
- II. **Bilén K**, Ponzer S, Ottosson C, Castrén M, Pettersson H
Deliberate self-harm patients in the emergency department: who will repeat and who will not? Validation and development of clinical decision rules
Emergency Medicine Journal Epub 2012/09/11
- III. **Bilén K**, Ponzer S, Ottosson C, Castrén M, Owe-Larsson B, Ekdahl K, Pettersson H
Can repetition of deliberate self-harm be predicted?
A prospective multicenter study validating clinical decision rules
Journal of Affective Disorders Epub 2013/02/28
- IV. **Bilén K**, Pettersson H, Owe-Larsson B, Ekdahl K, Ottosson C, Castrén M, Ponzer S
Can early follow-up after deliberate self-harm reduce repetition?
A prospective multicenter study of 325 patients
Submitted

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LIST OF ABBREVIATIONS

AUC	Area under the curve
CBT	Cognitive behavioural therapy
CHAID	Chi-squared automatic interaction detection
CI	Confidence Interval
DBT	Dialectical behavioural therapy
DSH	Deliberate self-harm
ED	Emergency department
HR	Hazard ratio
HPA	Hypothalamic-pituitary-adrenal axis
ICD-10	International Classification of Diseases (version 10)
MSHR	Manchester Self-Harm Rule
OR	Odds ratio
ROC	Receiver operating curve
SoS-4	Södersjukhuset Self-harm Rule
UK	United Kingdom
WHO	World Health Organization

INTRODUCTION

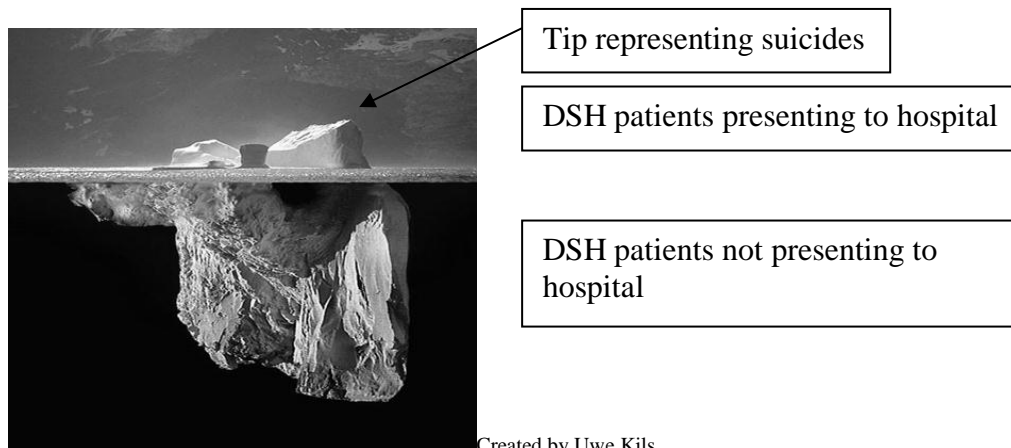
DELIBERATE SELF-HARM AND SUICIDE

The wish to live is essential to human beings. Deliberate self-harm is to be considered a disturbance of this essential wish and when people deliberately harm themselves it must be taken seriously and as an alert that an individual is not managing his or her situation or a certain period in his or her life.

Each year about one million people die by suicide and the estimated number of people deliberately harming themselves is 10-20 times higher.¹ Suicide and DSH are major public health problems in many parts of the world. The estimated annual suicide mortality rate is 14.5 deaths per 100.000 people, corresponding to one death every 40 seconds.² DSH is the strongest clinical predictor of subsequent suicide where the risk of suicide increases 50 to 100 times within the year after an episode of DSH compared to the general population.^{3,4}

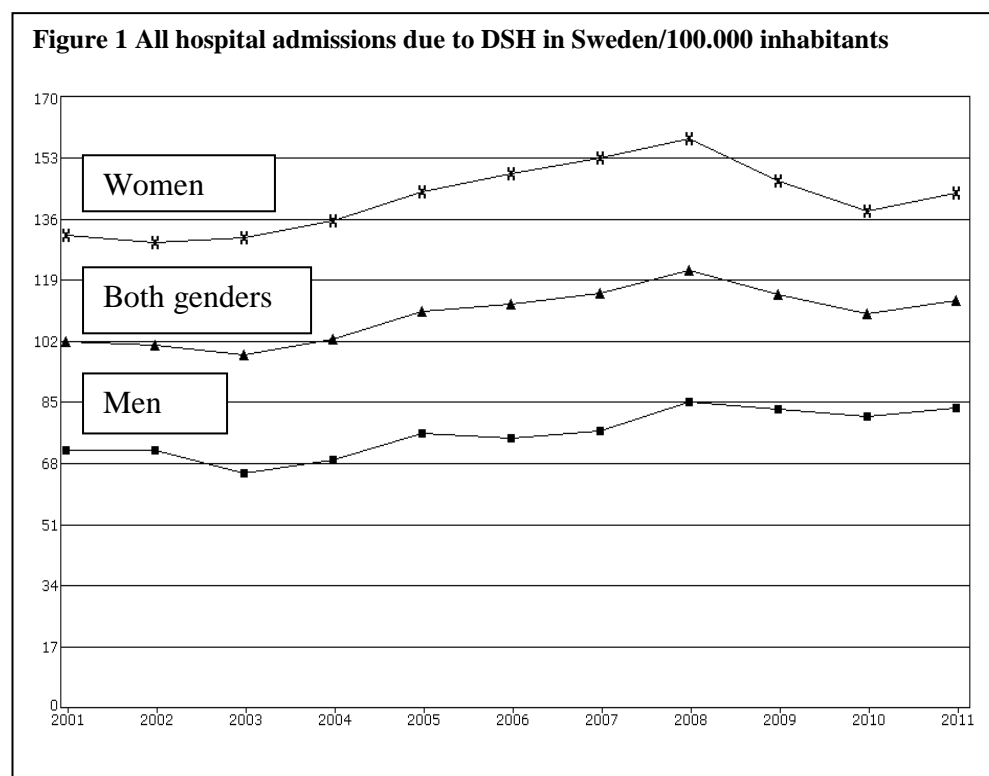
In somatic emergency departments (EDs) a large number of patients attending are patients who have deliberately harmed themselves and the frequency of repeated visits due to deliberate self-harm is high, up to 25%.⁵ ED visits due to DSH are increasing in many countries and these patients have persistent and elevated risks of suicidal behaviour and repeated ED visits.^{6,7} Repetition of DSH is frequent both immediately after a DSH episode and within the first year thereafter which results in individual suffering as well as a pronounced strain on EDs and health care services and could also be regarded as a failure to provide adequate care for these patients.⁸⁻¹⁰

In the developed world, the majority of life-threatening and medically severe DSH patients are treated in somatic EDs but also the less medically severe DSH patients and those who present with suicidal ideation attend somatic EDs. The ED is an increasingly important site for DSH patients to come into contact with the healthcare system and thus provides an opportunity to reach these patients and offer them adequate care and follow-up.¹¹ DSH is far more frequent than suicide but the estimation of DSH is not an easy task as the registers of clinical services and hospital admission often are not entirely complete and there is, most importantly, a large number of DSH patients who do not present at clinical services. One way of illustrating the problem is by means of an iceberg model of DSH and suicide:



Worldwide, suicide is one of the three leading causes of death among those in the most economically productive age group (15–44 years) and the second leading cause of death in the 15–19-year-old age group.¹² The incidence of suicide varies between countries; in general, the highest rates are in Eastern Europe (Lithuania, the Russian Federation, Belarus and, to a lesser extent, Hungary and Latvia) and the lowest rates in countries that follow Islamic traditions.² In all the Nordic countries, there is a trend towards declining suicide rates although Finland consistently presents the highest rates and also the highest male-to-female ratio (3:1), all Nordic countries present higher suicide rates among men than among women.¹³

In Sweden about 1500 people die by suicide each year and 10 000 people are admitted to hospital due to DSH.¹⁴ The number of suicides in Sweden has been slowly decreasing during the last 30 years, whereas there has been an increasing number of young people admitted to hospital due to DSH, among both young men and young women although the trend seems to have levelled out over the past 2–3 years.¹⁵ The numbers of hospital admissions due to DSH during the last ten years published by the Swedish National Board of Health and Welfare are presented below in Figure 1.



DSH is the most important risk factor for subsequent suicide.^{3 16} Hawton et al conducted a follow-up study of 11583 DSH patients in England between 1979 and 1997 and showed that the risk of subsequent suicide among DSH patients was 66 times higher than for the general population.¹⁷ Among individuals who die by suicide, 20-25% have presented at a general hospital due to DSH in the year before committing suicide.¹⁸ The increased risk of suicide after DSH has been demonstrated by several other studies which confirm the strong association.^{4 5 19 20}

DSH is not only strongly associated with suicide, patients engaging in deliberate self-harm also have an overall higher mortality than the general population. Physical health and life expectancy have been shown to be severely compromised in individuals who self-harm compared with the general population.^{21 22}

Runeson et al. showed that patients attempting suicide by use of a more violent method such as hanging, strangulation or suffocation had the highest risk of subsequent suicide. Within the group using more violent methods, 54% of the men and 57% of the women committed suicide during the follow-up period.²³ Also the study by Bergen et al., including a large cohort of DSH patients, showed that individuals using a more dangerous method of DSH (hanging, carbon monoxide/other gases) were at higher risk of subsequent suicide.²⁴

The most frequently used method of DSH is self-poising with up to 80% of patients attending hospital due to DSH having used self-poisoning as method. The drugs used vary between different DSH populations but paracetamol, antidepressants and tranquilisers are among the most frequently used drugs.²⁵⁻²⁷ There is a wide variation in the methods used all over the world owing to different access to suicide means, in the USA for example the use of firearms is more common and in Southeast Asia the use of pesticides.^{28 29}

Definitions

Despite suicide researchers' attempts for half a century to find a uniform term for the entire range of suicidal behaviours there are still different terms used in different countries and by different research groups.

Deliberate self-harm is the term used throughout this thesis to describe an intentional act of non-fatal, self-inflicted harms and includes all methods of self-harm. It denotes any act by an individual with the intention of harming him- or herself physically and which may result in some degree of harm. The patients' motivations for DSH vary and are often difficult to investigate and the term DSH includes all DSH acts regardless of intention.³⁰⁻³² Thus it includes DSH acts with high suicidal intent as well as acts where little or no suicidal intent is involved. An act of DSH is not necessarily even an indicator of suicide and it can sometimes be a form of self-preservation. Nevertheless, the term covers a wide spectrum of behaviour, with harmful physical effects.^{33 34}

Other terms used in the literature are as presented in the review by Skegg³³ ;

- Attempted suicide: used widely (especially in North America) for episodes where there was at least some suicidal intent.
- Para-suicide: Any non-fatal, serious, deliberate self-harm with or without suicide intent.
- Self-harm: same definition as deliberate self-harm. There is a trend towards the use of self-harm and not including the word deliberate.
- Self-poisoning or self-injury: deliberate self-harm by these methods regardless of suicidal intent.¹⁷
- Self-mutilation: serious bodily mutilation without suicidal intent, also known as self-injurious behaviour or self-wounding.

Methods of deliberate self-harm:

Various different methods are used by patients who deliberately harm themselves, among which self-poisoning is the most common method used and is defined as the intentional self-administration of more than a prescribed dose of any drug or substance, whether or not there is evidence that the act was intended to result in death. Self-injury can result from very superficial cutting to injuries requiring a surgical procedure in an operating theatre and is defined as any injury which has been deliberately self-inflicted regardless of intention. Other methods of DSH include attempted hanging, jumping from heights, use of firearms, attempted gas poisoning and attempted suffocation.

Gender paradox in suicide and deliberate self-harm

Suicide

A consistent finding in the research regarding DSH and suicide is that men commit suicide more often while there are more women who deliberately harm themselves which has been referred to as the gender paradox of suicidal behaviour.³⁵ Reasons for this paradox have been discussed and explanations have been presented such as for example that men use more violent DSH methods than women and that there is a higher prevalence of substance use among men than among women, substance use being a risk factor for suicide.³⁶⁻³⁸

The global suicide rate is nearly four times higher among men than among women. Although there are regional exceptions where higher ratios have been observed in the more developed, mostly European countries, and lower ratios in developing, mostly Asian countries and for example China has a higher suicide rate among women than among men.^{2 39}

Risk factors for suicide vary between men and women with, for example, unemployment, retirement and being single, having been shown to be risk factors for suicide in men. In women, being the parent of young children has been shown to be a protective factor for suicide. However adjusting for different risk factors do not eliminate the gender difference in suicide risk.⁴⁰ A study by Isometsä et al. showed that more men than women die in their first suicide attempt (62% among the men and 38% among the women) underlining the importance of early recognition of suicide risk especially among men.⁴¹ A recent DSH episode prior to suicide was more common among women in the same study.

Deliberate self-harm

There are considerable gender differences in suicidal behaviour overall with rates of DSH usually being higher in females although the gender differences vary between countries and regions, just as for suicide, with Asian countries having lower female-to-male ratios of DSH than many of the European countries.⁴² DSH is most common among women aged 15–24 and fewer men than woman are admitted to hospital due to DSH. There has though been an increase in young men (aged 15-24) admitted to hospital due to DSH in Sweden and in the year 2011 more young men were admitted to hospital due to DSH than due to injuries caused by violence.¹⁴

The gender ratio for DSH presentations to hospital is often quoted as being approximately 1.5:1 (female:male). A study by Hawton and Harris confirmed this gender ratio but they also found important changes in the ratio across the life cycle. In patients of younger age the gender ratio was shown to be 1.5:1(female:male) as expected but from the age 50 years and onwards the pattern of the gender ratio was more similar to that for suicide, 0.8:1 (female:male).⁴³

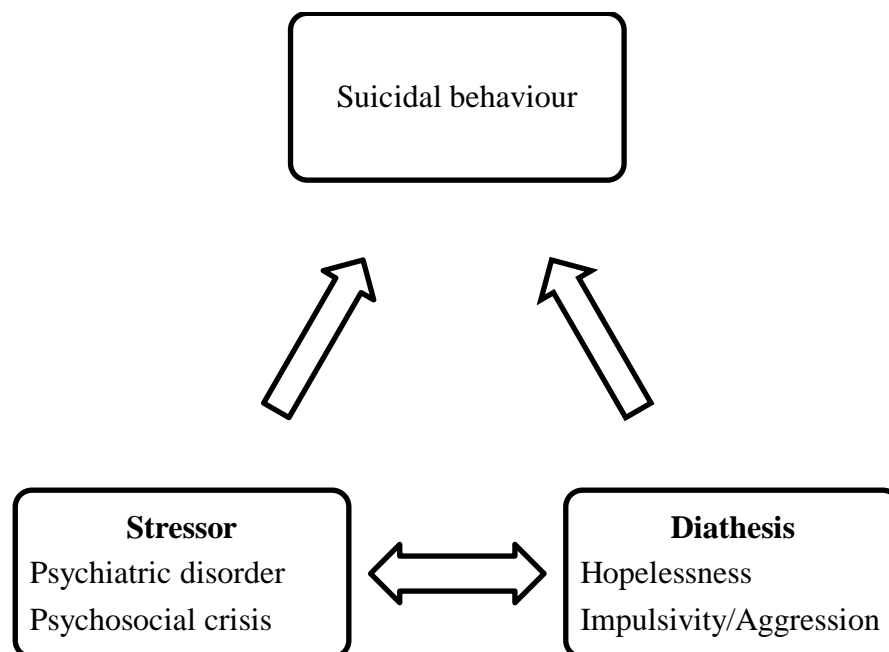
The study by Hawton and Harris indicates that the gender paradox of suicidal behaviour is not a stable pattern but changes over the life cycle. The differences in gender ratios, both in suicide and DSH, between countries also indicate a dependence on the cultural environment.³⁹

RISK FACTORS FOR DELIBERATE SELF-HARM AND REPETITION

The reasons for individuals engaging in DSH are multifactorial and there are different models for explaining their behaviour with a general consensus in suicide research and clinical psychiatry that stress-diathesis models are one appropriate way of attempting to explain the behaviour. The stress-diathesis models aims to explain how biological or genetic characters (diatheses) interact with environmental influences (stressors) to produce disorders. The stress-diathesis models emphasize that if the combination of the predisposition and the stress exceeds a threshold, the person in question will develop a disorder. The diathesis reflects a vulnerability to developing a disorder but requires other potentiating factors (stressors) to become pathogenic. The models include both predisposition and external stressors.⁴⁴

Figure 2 is an example of the stress-diathesis model of suicidal behaviour.

Figure 2



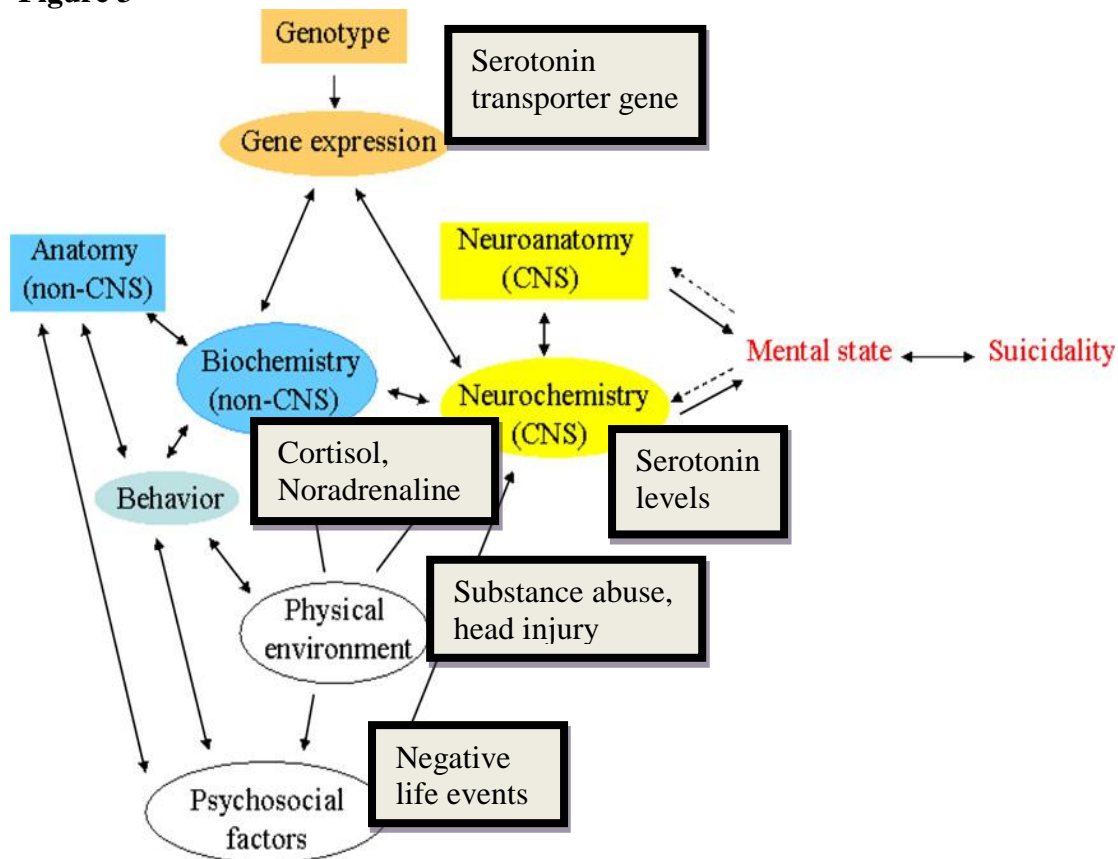
Adapted from Mann 2003.⁴⁵

The stress component may include psychosocial crises and psychiatric disorders and these are not always separable (psychiatric disorders can lead to unemployment, social isolation or relationship problems and these psychosocial factors have all been associated with higher suicide risk).

The diathesis reflects a person's vulnerability to develop a disorder and may be due to genetic and epigenetic effects and childhood difficulties and is reflected by a distinct biological, psychological or clinical profile. Both impulsivity or aggression and hopelessness have been shown to be more common in individuals engaging in suicidal behaviour even after controlling for psychiatric disorders.⁴⁶

The complex network of gene–environment interactions is demonstrated in this next model for suicidality adapted from Wasserman 2007 (Figure 3).⁴⁷ Relatively stable and constant parameters are boxed, whereas dynamic and acute parameters are encircled. Solid arrows show well-established interactions, whereas dotted arrows show hypothesized interactions.

Figure 3



The boxes with black frames have been added as examples of gene expression (serotonin transporter gene), neurochemistry (serotonin levels), biochemistry (cortisol and noradrenaline levels), physical environment (substance abuse, head injury) and psychosocial factors (negative life events).

As indicated in Figure 3 the reasons for suicidality are characterized by heterogeneous and complex causes. Environmental factors such as negative life events may often act as a significant contributor to suicidal behaviour. However, in many cases the exposure to the same environmental stress does not result in increased suicidality. Biological systems have been shown to be involved in suicidal behaviour: hyperactivity in the Hypothalamic-pituitary-adrenal axis (HPA-axis) influencing cortisol levels, increased activity in the noradrenergic system and dysfunction of the serotonergic system.

The HPA axis and noradrenergic systems are involved in response to stress. The serotonergic system is involved in for example mood regulation. It is an established fact that there is also a substantial genetic and biological contribution to suicidal behaviour.^{45 47}

Factors associated with deliberate self-harm

A risk factor increases the probability of an event to occur and an individual under the influence of a risk factor is more likely to experience the outcome than someone selected at random from the general population.

There are many well known risk factors associated with DSH with psychiatric disorders such as mood disorders, substance use disorders and adult personality disorders being among the most consistently reported risk factors for DHS.⁴⁸ Demographic and socio-economic factors are also associated with DSH and the main demographic risk factors for DSH include female gender, younger age, being single or divorced or having a lower educational level.⁴⁹

Risk factors found to be associated with DSH in different studies are listed in Table 1.

Table 1

Study	Study population	Risk factors for DSH
Alaghehbandan et al. 2005⁵⁰	978 DSH patients	Female gender, single, younger age, low educational level
Beautrais 2001⁵¹	275 DSH patients (serious attempt)	Psychiatric disorders, low income, low education, stressful life event
Gratz et al. 2002⁵²	159 students, 18% reported DSH	Insecure attachment, childhood separation, sexual abuse
Haw et al. 2007⁵³	4391 DSH patients	Relationship, employment, alcohol and financial problems
Hawton et al. 2007⁵⁴	7344 DSH patients	Female gender, younger age,
Landstedt et al. 2012⁵⁵	1663 students, 17.1% reported DSH	Psychological distress, violence, school-related factors
Lilley et al. 2008¹⁰	7344 DSH patients	Current or previous mental health contact
Mahadevan et al. 2008⁵⁶	261 students presenting at hospital due to DSH	Academic and relationship problems, eating disorders
Nixon et al. 2008⁵⁷	96 youth reporting DSH	Female gender, depressive mood, attention problems
Perry et al. 2012²⁵	48.000 DSH patients	Younger age, female gender
Souminen et al. 1996⁴⁸	114 DSH patients	Depression, alcohol abuse, comorbid mental disorders
Welch 2001⁵⁸	Review of 20 studies	Female gender, younger age, single, divorced, unemployed, mental disorder
Yip et al. 2011⁵⁹	92 DSH patients	Female gender, younger age, unemployed

Factors associated with repeated deliberate self-harm

A previous episode of DSH is the strongest predictor of repeated DSH (Table 2) but also other factors have been shown to be associated with repeated DSH. Listed in Table 2 below are risk factors found to be associated with repeated DSH in different studies.

Table 2

Study	Population, follow-up, repetition rate	Risk factors for repeated DSH
Chung et al. 2012⁶⁰	39875 DSH patients, follow-up 3 months-8years, 8% repeated	Female gender, psychiatric disorder
Colman et al. 2004⁶¹	369 DSH patients, follow-up 1–2 years, 24.9% repeated	Previous DSH, history of depression or schizophrenia, poor physical health
Cooper et al. 2006⁶²	6933 DSH patients, follow-up 6 months, 16.7% repeated	Previous DSH, prior psychiatric treatment, benzodiazepine, current psychiatric contact
Harris et al. 2005⁶³	2489 DSH patients, follow-up 1 year, 15-18 % repeated	Low suicide intent score among men
Haukka et al. 2008⁸	18199 DSH patients, follow-up 8 years, risk of repetition 30%	Mental disorder, alcohol abuse, female gender, 30–40 years of age
Haw et al. 2007⁵	4167 DSH patients, follow-up 6 years, 24.5% repeated	Previous DSH, personality disorder
Howson et al. 2008⁶⁴	754 DSH patients, follow-up 1 year, 18% repeated	Female gender
Kapur et al. 2006⁶⁵	9213 DSH patients, follow-up 12 months, 13.6% repeated	Previous DSH, psychiatric treatment, unemployed, alcohol abuse, self-injury, suicidal plans
Kapur et al. 2004⁶⁶	658 DSH patients, follow-up 6 months, 14.6% repeated	Previous DSH, psychiatric contact, male, young age, alcohol/drug abuse
Oh et al. 2011⁶⁷	967 DSH patients, follow-up 9 years, 21% repeated	Female gender, living alone, history of psychiatric treatment, antidepressant treatment
Owens et al. 1994⁶⁸	992 DSH patients, follow-up 1 year, 12% repeated	Previous DSH, prior psychiatric treatment, unemployment, more than 1 drug used
Sinclair et al. 2010⁶⁹	101 DSH patients, follow-up 6 years, 57.4% repeated	Alcohol abuse, unemployment, divorce
Yip et al. 2011⁵⁹	90 DSH patients, follow-up 6 months, 16.7% repeated	Previous DSH, single, subject to violence, personal problems, childhood abuse

Some of the studies include both psychiatric and sociodemographic factors to evaluate risk of repetition which is of importance due to the multifactorial reasons for DSH acts.

Two of the studies (Colman et al., Haukka et al.) include specific psychiatric diagnosis when evaluating the risk of repetition while the other studies use the more unspecific factor psychiatric disorder to evaluate risk of repetition. Only one of the studies has used the factors found to be associated with repetition to classify patients according to risk of repetition (Cooper et al.). None of these studies were conducted in a Swedish population.

Clinical decision rules

A clinical decision rule is defined as a decision making tool derived from original research and has been developed to help physicians with diagnostic and therapeutic decision when handling different conditions. The development of clinical decision rules includes investigating the need for a rule, continuation according to methodological standards, prospective validation and refinement, implementation in clinical practise and the rules' cost-effectiveness.⁷⁰

There are different clinical tools for assessing suicide intent such as for example Beck's Suicide Intent Scale which studies have shown to be a valuable tool in clinical suicide risk assessment.^{71 72} Also a scale developed by Jokinen et al., the Karolinska Interpersonal Violence Scale correctly identified suicide attempters who subsequently committed suicide.⁷³ It is however difficult to predict subsequent suicide after DSH, in part due to the rarity of the event, even though several studies have demonstrated predictive values of DSH patients characteristics which indicate a higher risk of subsequent suicide.^{74 75}

Owing to the high repetition frequency of DSH there is an indication for clinical decision rules to help identify patients at higher risk of repetition in order to be able to allocate the right resources for these patients.^{76 77}

Only a few studies have used risk factors found to be associated with repeated DSH to develop clinical tools to facilitate assessment in the ED. Cooper et al. in the UK have developed a clinical decision rule for assessing risk after self-harm, the Manchester Self-Harm Rule (MSHR), for use by ED clinical staff to identify patients at a high risk of repeating DSH within 6 months.⁶² The MSHR uses four clinical correlates to identify DSH patients at higher risk of repetition and focuses on high sensitivity as often must be the case in emergency medicine settings. Also a modified version of this clinical decision rule, the ReACT Self-Harm Rule has been developed in the UK to identify patients at higher risk of repeated DSH and was derived from a multicenter study including both DSH patients receiving psychosocial assessments and those not receiving psychosocial assessments.⁷⁷

PREVENTING DELIBERATE SELF-HARM

One model for suicidal behaviour prevention is to divide preventive measures into *universal*, *selected* and *indicated* prevention. Universal preventions are directed at a population base, selective preventions are directed at individuals at greater risk for suicidal behaviour and indicated preventions are aimed at individuals who have already deliberately harmed themselves.⁷⁸ In preventing DSH, various approaches are needed owing to the complexity of suicidal behaviour.^{79 80}

There are *universal* preventive measures that have been shown to be effective:

- Withdrawal of the method by deregistration of, for example, co-proxamol (paracetamol and dextropropoxyphene).⁸¹
- Reducing the availability of the method by, for example, restricting the amount of paracetamol and salicylate tablets sold in non-pharmacy outlets.⁸²
- Reducing ease of access to the method by, for example, building safety barriers on bridges and removal of potential rope points on in-patient wards.⁸³
- Training of general practitioners to recognize and treat mental disorders.⁸⁰

There are *selective* preventive measures that have been shown to be effective:

- Antidepressant treatment to decrease the risk of suicidal behaviour among depressed patients.⁸⁴
- Lithium treatment to decrease the risk of suicidal behaviour among patients with bipolar disorders.⁸⁵
- Clozapine treatment to decrease the risk of suicidal behaviour among patients with schizophrenia.⁸⁶

Indicated prevention

Only a minority of patients attending hospital due to DSH receive adequate care, although facilitation of follow-up care after DSH has been suggested as a promising strategy for preventing repeated DSH and suicide.⁸⁰

The results are, however, inconsistent regarding follow-up care after DSH and its influence on reduced repeated DSH rates or subsequent suicide:

- A systematic review by Crawford et al. of psychosocial interventions following DSH did not provide evidence for any effect on subsequent suicide.⁸⁷
- A randomized controlled trial of assertive outreach by Morthorst et al. after DSH could not show a significant positive effect on the rate of repeated DSH either.⁸⁸
- A review by Daigle et al. of treatments to prevent repetition of DSH showed positive effects with reduced repetition rates of DSH among patients receiving cognitive behavioural therapy (CBT) and psychoanalytically oriented treatments in 8 out of 16 studies and there were also, in a few studies, positive effects of phone contact or outreach programmes on repeated DSH.⁸⁹

- Hawton et al. reviewed the efficacy of psychosocial and pharmacological treatments in preventing repetition of DSH and found significantly reduced rates of repeated DSH for flupenthixol versus placebo and for dialectical behaviour therapy (DBT), although they requested further large trials of treatment.⁹⁰
- A randomized controlled trial of brief psychological intervention after DSH (self-poisoning used as the method) showed a significant reduction in suicidal ideation and self-reported DSH in the intervention group.⁹¹ Also other studies on social and psychological treatments have demonstrated a positive impact on DSH repetition rates.^{92 93}
- Behavioural therapies, CBT and DBT have been shown to be effective in reducing repetition rate of DSH.^{94 95} The randomized controlled trial by Slee et al., in which a short CBT intervention supplemented the usual care was compared with only the usual care, showed that additional CBT was effective as a tool to reduce repetition of DSH.⁹⁶

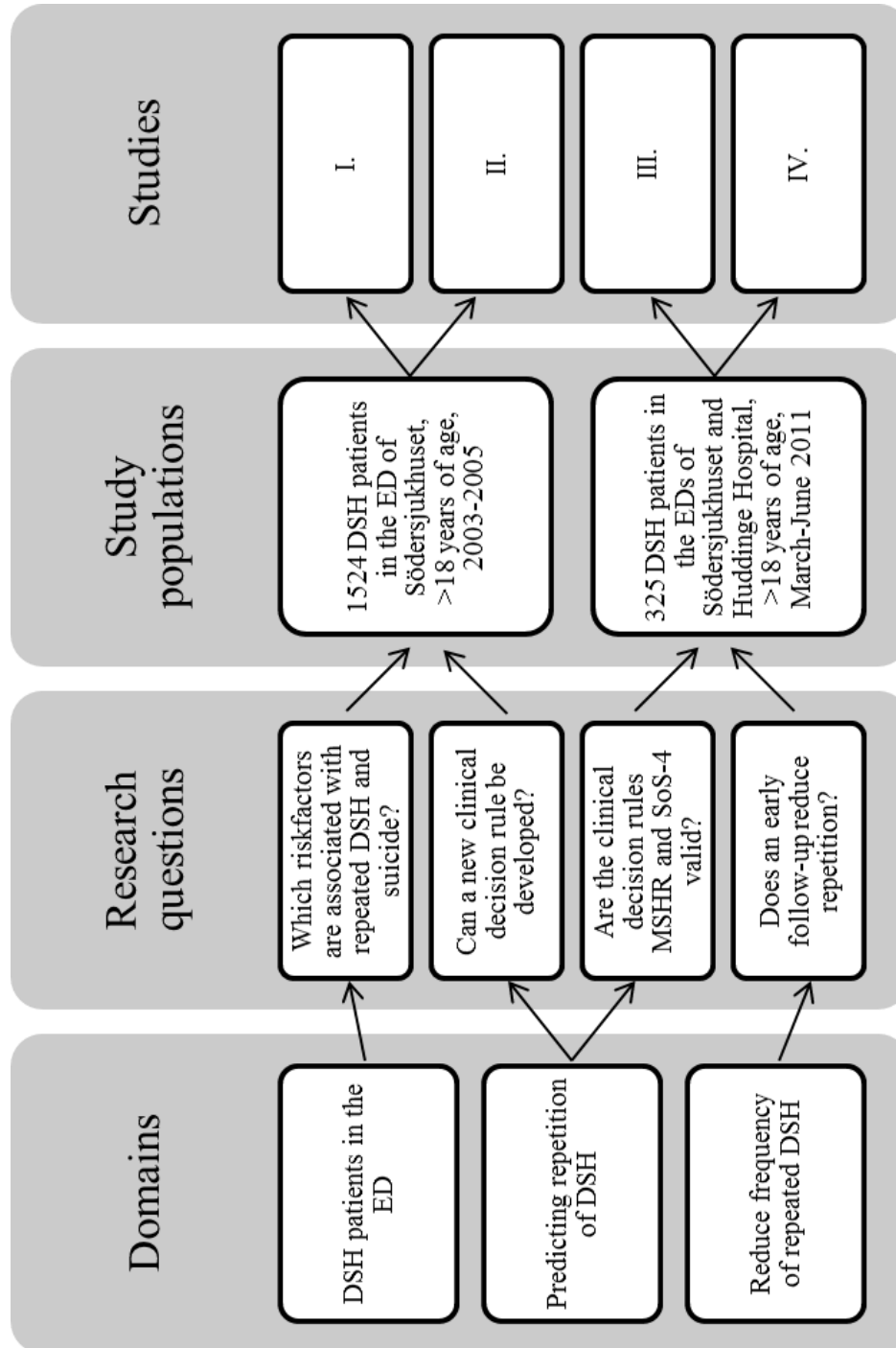
Indicated preventive measures, even low-intensive ones, may be effective for reducing the risk of repeated DSH, but there is still a need for a stronger evidence base regarding indicated prevention of suicidal behaviour.⁹⁷

AIMS OF THE THESIS

This thesis focused on DSH patients in a somatic emergency department and aimed at gaining better knowledge of DSH patients and finding ways of reducing the high repetition rate among this group of patients.

The specific aims of the studies were to:

- Investigate risk factors associated with repeated DSH among patients attending the emergency department due to DSH, stratify these patients into risk categories for repeated DSH, and estimate the proportion of repeated DSH.
- Develop a novel clinical decision rule based on factors associated with repeated DSH in a Swedish population, the Södersjukhuset Self-Harm Rule, and validate an existing clinical decision rule for assessing risk after DSH, the Manchester Self-Harm Rule.
- Prospectively validate the ability of the clinical decision rules, the Södersjukhuset Self-Harm Rule and the Manchester Self-Harm Rule, to predict repetition of DSH.
- Investigate whether an early follow-up of DSH patients could reduce the high frequency of repeated DSH.



Overview of the research questions and overall research framework.

MATERIAL AND METHODS

NATIONAL REGISTERS

In the studies information from the National Inpatient Register, the National Outpatient Register and the Causes of Death register maintained by the National Board of Health and Welfare in Sweden was used. Information regarding sociodemographic factors from Statistics Sweden, specifically from the Register of the Total Population (RTB) and labour statistics (RAMS) was also used in the studies.

Swedish Population Register

All residents of Sweden are included in the Swedish Population Register under a unique personal identification number allocated at birth or on receiving a residence permit. Each visit to an ED, admission to hospital or out-patient contact is recorded with the patient's personal identification number, thereby enabling automatic and accurate record linkages. The registers of Statistics Sweden and the National Board of Health and Welfare are linked by personal identification numbers.

National Board of Health and Welfare

The National Board of Health and Welfare in Sweden is a government agency under the Ministry of Health and Social Affairs, with many different duties within the fields of social services, health and medical services, environmental health, communicable disease prevention and epidemiology. The National Board of Health and Welfare undertake official duties such as maintaining health data registers and official statistics. The National Inpatient Register, covering all somatic and psychiatric hospital discharges with diagnoses coded according to the International Classification of Diseases (ICD), and also the National Outpatient Register are maintained by the National Board of Health and Welfare. The National Inpatient Register has an almost 100% coverage and has high validity for many (although not all) diagnoses.⁹⁸ The National Board of Health and Welfare also maintain the Causes of Death Register.

Statistics Sweden

Statistics Sweden is an administrative agency with the task of supplying customers with statistics for decision making, debate and research. Statistics Sweden is mainly assigned these tasks by the government and different agencies, but also by customers in the private sector and researchers. Besides producing and communicating statistical data, Statistics Sweden support and coordinate the Swedish system for official statistics and participate in international statistical collaborations. The Register of the Total Population is an extraction from the Swedish Population Register which is maintained by the Swedish Tax Agency and is mainly used as a base register to produce statistics regarding population size and composition and for statistics regarding for example migrations, births, deaths, marriages and divorces. Labour statistics from administrative sources (RAMS) offer annual information on employment, commuters, employees and industrial structures and also illustrate occurrences and flows on the labour market.

International Classification of Diseases

The International Classification of Diseases (ICD) is the standard diagnostic tool for epidemiology, health management and clinical purposes. It is used to monitor the incidence and prevalence of diseases and other health problems. In addition to enabling the storage and retrieval of diagnostic information for clinical, epidemiological and quality purposes, these records also provide the basis for the compilation of national mortality and morbidity statistics by WHO member states. The International Classification of Diseases 10 (ICD-10) is used by both somatic and psychiatric care units and the ICD-10 codes X60-X84 describe intentional self-harm and intentional self-poisoning.

STUDY SETTINGS

Södersjukhuset (Stockholm South General Hospital) is situated in the city central part of the capital of Sweden and is one of Scandinavia's largest EDs with over 110.000 visits per year and the hospital serves over 600.000 people in the region. Karolinska University Hospital Huddinge is situated further out from the city and has about 80.000 ED visits per year and has a base catchment area of about 250 000 people. Both hospitals are university level hospitals. At Södersjukhuset there is a psychiatric emergency consult team available at all hours but the hospital has no psychiatric inpatient wards. At Karolinska University Hospital Huddinge there is a psychiatric emergency department open all hours and there are also psychiatric inpatient wards.

STUDIES I AND II

Studies I and II were based on ED register complemented with a review of somatic and psychiatric hospital records and national registers, with a nationwide follow-up via the Swedish National Board of Health and Welfare registers. All patients over 18 years of age treated at the ED of Södersjukhuset due to DSH during the time period from 1 January 2003 to 31 December 2005 were included. The index episode (inclusion of the patient) was defined as the first DSH attendance that led to a psychiatric assessment (registered by the psychiatric consultant) during the period (2003–2005) or, if a psychiatric assessment was not made, the first DSH attendance of an individual during the study period. Patients were included by searching the register of the psychiatric emergency consult team and by searching the ED register which includes the patient's main reason for attending the ED ensuring inclusion of all DSH patients if the main reason for attending the ED was DSH.

Baseline data

A structured protocol to collect data regarding explanatory factors from the hospital charts (medical and psychiatric history and examination) was used. The protocol included method of DSH, if the self-injury required a surgical procedure i.e. general anaesthesia or admission for surgery, the substance used for self-poisoning, current and previous psychiatric treatment, current antidepressant treatment, influence of alcohol at the time of self-harm (serum ethanol, ‰ or whether it was clearly mentioned in hospital charts that the patient was under the influence of alcohol), precipitant events before the DSH episode, suicidal intention, discharge information and psychiatric diagnosis listed by group by the psychiatric consultant at Södersjukhuset.

Additional data regarding explanatory factors were also collected from Statistics Sweden including sociodemographic factors such as age, gender, marital status, housing status, employment, educational level and early retirement pension.

The explanatory factors collected were based on a substantive literature review of DSH and specifically on factors associated with repeated DSH.

In Study II the variables, among the explanatory factors, that could be used in an ED setting by clinical staff without psychiatric expertise were selected in order to develop a useful clinical tool for any ED with or without psychiatric consultants. This meant that in Study II the psychiatric diagnosis listed by group by the psychiatric consultant were not included.

Data on episodes of DSH before index registered at any healthcare unit in Sweden were collected from the Swedish National Board of Health and Welfare records. The use of the ICD-10 by both somatic and psychiatric care units made it possible to identify episodes of DSH before index (2002–2005) from the National Inpatient Register and the National Outpatient Register.

Follow-up

Data on repeated DSH or death by suicide (2003–2006) were collected from the registers of the Swedish National Board of Health and Welfare, providing a nationwide follow-up. Use of the ICD-10 codes X60-X84 made it possible to identify repeated DSH and suicide from the National Inpatient Register, the National Outpatient Register and the Causes of Death Register.

STUDIES III AND IV

In Studies III and IV all patients over the age of 18 years attending the ED of Södersjukhuset and the ED of Karolinska University Hospital Huddinge due to DSH during the time period of 22 March 2011 to 30 June 2011 were included. Each patient's first attendance to the EDs due to DSH during the study period was defined as the index episode. A clinical decision rule sheet was attached to the clinical record by the triage nurse. The clinical decision rule sheet was also available in all sections of the ED and it was filled in by the physician treating the patient in the ED.

Baseline data

It was recorded whether or not the patients were seen at a follow-up visit to a consultant at any psychiatric care unit within ten days by searching data hospital records. In Stockholm, Sweden the majority of the hospitals and open care units use computerized hospital records that are connected which made it possible to identify follow-up visits not only at the hospital where the patient was treated at the index episode but with-in health care units of the Stockholm region.

To be clear about any differences between the patients attending Södersjukhuset and Karolinska University Hospital Huddinge and between early followed-up and not early followed-up patients, additional information regarding sociodemographic factors, admission to somatic care, and admission to psychiatric care, psychiatric diagnosis and severity of the deliberate self-harm act from hospital charts (medical and psychiatric history and examination) was collected by using a structured study protocol.

Severity of the DSH act was classified as low if the patient had taken less than 10 tablets or had a very superficial self-injury, as moderate if more than 10 tablets but less than 100 tablets had been taken or if the self-injury was handled only in the ED and as high if more than 100 tablets or a lethal drug had been taken or if the self-injury required an operation in an operating theatre. For example, warfarin and insulin was defined as lethal drugs.

Data on episodes of DSH before index registered at any healthcare unit in Sweden were collected from the Swedish National Board of Health and Welfare records. The use of the ICD-10 by both somatic and psychiatric care units made it possible to identify episodes of DSH before index from the National Inpatient Register and the National Outpatient Register.

Clinical decision rules

The clinical decision rule Södersjukhuset Self-Harm Rule (SoS-4) was developed in Study II using multivariable logistic regression to predict repetition of DSH. The SoS-4 uses five clinical correlates: gender, antidepressant treatment, history of DSH, admission to a psychiatric clinic and current psychiatric treatment. Based on this model, the estimated risk for a patient to repeat DSH within six months can be calculated and categorized to a moderate/high risk group or to a low risk group.

The Manchester Self-harm Rule (MSHR) was validated in Study II and uses four clinical correlates: history of self-harm, previous psychiatric treatment, self-poisoning with benzodiazepines, and current psychiatric treatment. Patients who have any of the above clinical correlates are classified as belonging to a moderate/high risk group and only the patients without any of the four clinical correlates are classified as belonging to a low risk group regarding the risk of repeated DSH within six months.

The clinical decision rule sheet, filled in by the physician treating the DSH patient in the ED, included the factors used in the SoS-4 and the MSHR.

Follow-up

Data on repeated DSH within six months after the index episode were collected from the registers of the Swedish National Board of Health and Welfare, providing a nationwide follow-up. Use of the ICD-10 codes X60-X84 made it possible to identify repeated DSH from the National Inpatient Register and the National Outpatient Register.

STATISTICAL METHODS

Cox proportional hazard models

Cox proportional hazard models were used to evaluate the influence of different factors on the risk of repetition and to account for differences in the length of follow-up. Risk time (person-days) was accumulated from the index episode of DSH up to the first repetition or suicide or censoring for death from other causes or at the end of follow-up, whichever occurred first. The unadjusted association between repetition and each separate factor was studied in univariable models. The adjusted association was studied in multivariable models developed by including factors that showed an association (p value <0.05) with repetition. Hazard ratios (HRs) with their corresponding 95% CIs were reported. All variables were tested by the two-sided Wald χ^2 test.

Logistic regression

Binary logistic regression was used to evaluate the influence of different individual factors on the risk of repetition. The unadjusted association between repetition and each factor was studied in univariable models. The adjusted association was studied with inclusion of factors that showed an association (p value <0.05) with repetition in multivariable models. Odds ratios (ORs) with their corresponding 95% CIs were reported. All variables were tested using the two sided Wald χ^2 test. The Hosmer-Lemeshow goodness-of-fit test was used to examine whether the multivariable models were adequate for the data, with a p -value larger than 0.5 indicating that the goodness-of-fit was accurate.⁹⁹

Classification trees

Classification trees were used to stratify the patients into groups according to the risk of repetition after DSH. The χ^2 automatic interaction detection (CHAID) algorithm to build the tree was used. A CHAID analysis starts with all patients in one group. Each possible split on each factor is considered to find the split that leads to the strongest association with the dependent variable: repetition of self-harm after an index episode of self-harm (yes/no). The resulting groups were split until one of the following stop criteria were reached: tree depth was limited to three levels, no group with less than 50 patients was formed and no split with a Bonferroni adjustment of less than 0.05 was executed.

Receiver operating curve

To evaluate the performance of individual factors and different classification models and to discriminate between repeaters and non-repeaters, the area under the receiver operating curve (ROC: trapezoid rule) was calculated. An area under the curve (AUC) equal to 0.5 suggests no discrimination, 0.7 to <0.8 is acceptable, 0.8–0.9 is excellent and >0.9 is outstanding discrimination.⁹⁹

Sensitivity and specificity

To describe the decision rules' ability to classify patients according to the risk of repetition correctly, the sensitivity (true repeater, i.e. the proportion of patients predicted to repeat according to the decision rules among those who did repeat) and specificity (true non-repeaters, i.e. the proportion of patients predicted not to repeat according to the decision rules among those who did not repeat) was calculated. In an ideal model, both sensitivity and specificity should be high.

The Open Epi Program with the score method (corrected for continuity) was used to calculate the 95% confidence intervals (CI) for the sensitivity and specificity. This method is suitable for situations where the proportions are large, as is typically the case with measures of sensitivity and specificity.¹⁰⁰

Comparing groups

To compare differences in baseline characteristics between the two hospitals and between early follow-up or no early follow-up, Fisher's exact test and Pearson's chi-squared (χ^2) test was used with the statistical significance set at $p < 0.05$.

A summary of the different statistical methods chosen for the different studies is presented below in Table 3.

Table 3 Statistical analyses used in the thesis

	Study I	Study II	Study III	Study IV
Comparisons between two groups: Fischer's exact test Pearson's chi-squared (χ^2) test			X	X
Associations between variables and adjustment for confounders: Cox proportional hazard models Logistic regression	X	X		X
Stratification into groups according to different risks: Classification trees	X	X		
Evaluation of the predictive ability of individual factors and different models: Receiver operating curve		X	X	
Description of different models ability of correct classification according to risk: Sensitivity and specificity		X	X	

The statistical analyses were performed using SPSS, versions 17, 18, 20.

ETHICAL CONSIDERATIONS

All four studies were approved by the Regional Ethics Committee at Karolinska Institutet, Stockholm, Sweden. Reference numbers 2006/1049-31, 2011/238-31/1 and supplement 2011/1880 32.

All studies were conducted in accordance with the Helsinki declaration.

After receiving data from the registers of the Swedish National Board of Health and Welfare and Statistics Sweden there were no longer any personal identification number connected to any of the data used in the four studies but instead a serial number and the key to the number was kept by the Swedish National Board of Health and Welfare. This meant that all the data was anonymized and all analyses were performed in anonymized datasets. Risk of perception of breaches of privacy for individuals who unknowingly participates in a study is always present even though only including a systematization of previously collected information through hospital charts and registers. On the other hand, this type of studies give a possibility to gain new and enhanced knowledge regarding this group of patients in order to be able to provide adequate care and offer a better treatment for future patients.

RESULTS

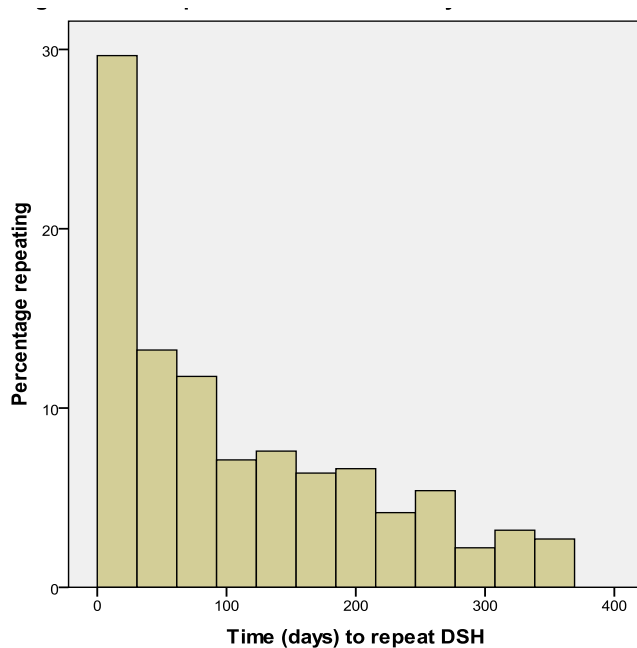
STUDY I

During the study period, 1679 patients were identified with an episode of DSH. Exclusion criteria were: death at the index episode (n=16), patient leaving the ED before a somatic or psychiatric assessment (n=8), hospital chart not available (n=41), incorrect classification in the register i.e. not a DSH according to the hospital chart (n=39), and a missing or inaccurate personal identification number (n=51). After exclusion criteria were met the study population consisted of 1524 patients.

Risk factors found to be associated with repeated DSH included episode of DSH before index, female gender, self-injury as a method for DSH, self-injury requiring a surgical procedure, current psychiatric or antidepressant treatment and if the patient suffered from a substance use disorder or adult personality disorder or did not have children under the age of six.

Within the first year after the index episode, 408 patients (26.8% [95% CI: 24.6–29.0]) repeated DSH and 75% of these repeated DSH episodes occurred within six months and 10.5% within the first few days after the index episode (Figure 4).

Figure 4 Time to repeated DSH within the first year after the index episode (n=408)



In total 484 patients (31.8% [95% CI: 29.4–34.1]) repeated their DSH actions after the index episode within the whole time period (2003–2006). The follow-up period differed between the patients depending on the date of the index episode but all patients had a follow-up period of at least one year. Among the patients who repeated DSH, 26% attended another hospital than the one attended at the index episode. In total, the repeating DSH patients attended 31 different hospitals in Sweden during the time period.

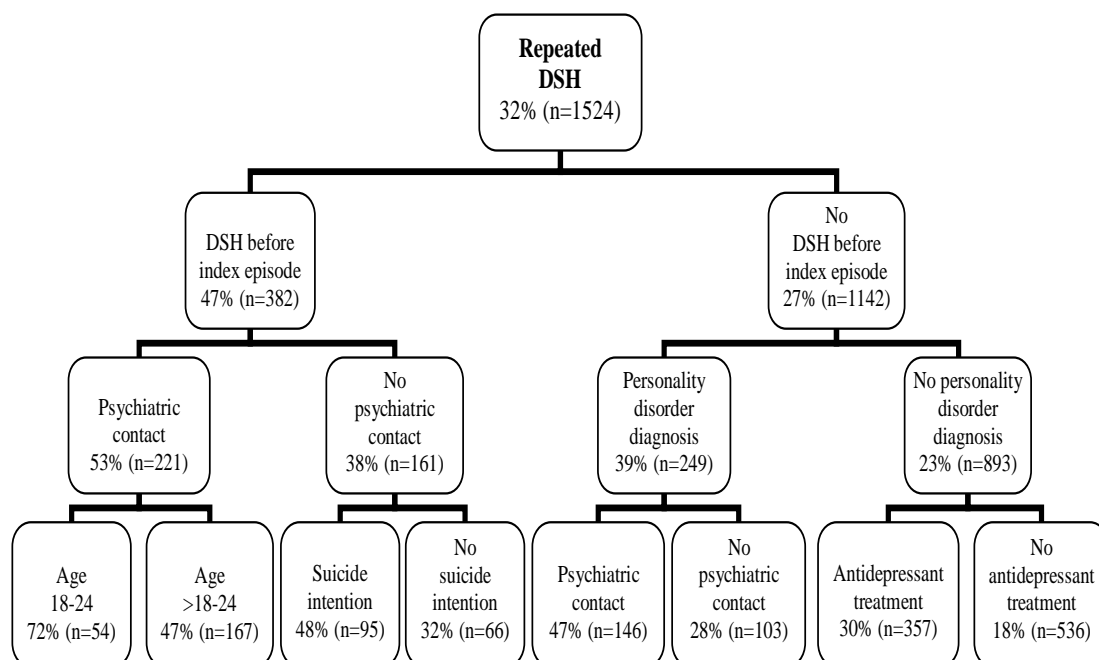
Six per cent (96/1524) of the patients were deceased on 31 December 2006, including 35 patients (2.3%) who had subsequently committed suicide. Among the patients who committed suicide, 63% were men and 46% were over the age of 45.

The stratification according to the classification tree analysis showed that the occurrence of repeated DSH or suicide by patients attending the ED due to DSH ranged between 18% and 72% within different groups (Figure 5).

The patients with the highest risk (47%–72%) of repetition had an episode of DSH before index and a current psychiatric contact. Alternatively, they had an episode of DSH before index without a psychiatric contact but a suicidal intention (48%). Another group with a high risk of repetition (47%) was patients without an episode of DSH before index with an adult personality disorder diagnosis and a psychiatric contact.

In contrast, the group with the lowest occurrence of repetition, 18%, consisted of patients with no episode of DSH before index, no adult personality disorder diagnosis, and without antidepressant medication.

Figure 5 Classification tree showing the factors which, **at each step**, had the strongest association with repeated DSH among patients attending the emergency department due to DSH (n = 1524) during the whole study period (2003-2006). The percentage of repeated DSH is based on the total number of patients in each node (n).



STUDY II

The study population consisted of the same 1524 DSH patients described in Study I. To be able to compare the MSHR and also for a more clinical useful approach, repeated DSH or suicide within six months was chosen as outcome measure. The cumulative incidence for patients repeating their deliberate self-harm acts within six months was 20.3% (95% CI: 18.0–22.0). Of the 309 patients who repeated within six months, 3.8% (12/309) repeated by committing suicide. Among the 309 patients who repeated, 70% were women, the mean age was 39.5 years (18 to 91 years), and 26% were under 25 years of age.

The unadjusted factors found in the Swedish material to be statistically significant ($p < 0.05$) associated with repetition within six months using logistic regression were gender, parent with young children, unemployment, disability pension, current psychiatric treatment (subgroup admitted to psychiatric clinic), previous psychiatric treatment, episode of DSH before index, antidepressant treatment, self-injury requiring a surgical procedure, and a precipitant event.

In the adjusted model the following factors were statistically significant ($p < 0.05$): gender, parent with young children, current psychiatric treatment, previous psychiatric treatment, episode of DSH before index, antidepressant treatment, and self-injury requiring a surgical procedure. In addition marital status and housing status showed a statistically significant ($p < 0.05$) predictive ability when AUC was calculated for each individual factor.

The classification tree analysis indicated that the four factors associated with repetition within six months were gender, antidepressant treatment, episode of DSH before index and current psychiatric treatment (subgroup admitted to psychiatric clinic).

In order to evaluate the ability of different models to predict repetition within six months, ROC was used and AUC for the different models was compared:

Use of all nine factors, in the adjusted model and when calculating AUC for each factor, found to be statistically significant ($p < 0.05$) associated with repetition within six months (Södersjukhuset Self-Harm Rule: SoS-9) yielded an AUC of 0.67, while use of the four factors (Södersjukhuset Self-Harm Rule: SoS-4) from the classification tree analysis yielded an AUC of 0.64.

In comparison, the Manchester Self-Harm Rule yielded an AUC of 0.55 when applied to this material. When a low cut-off point (0.14 or lower) was chosen, the sensitivity for repetition was similar for all models while the Manchester Self-Harm Rule had a lower sensitivity and specificity when higher cut-off points were chosen. The models with nine and four factors were similar with respect to AUC and sensitivity and specificity (Figure 6).

The sensitivity and specificity for SoS-4 at different cut-offs when applied to the 1524 DSH patients are shown in Table 4 and the sensitivity and specificity for MSHR in Table 5.

Table 4 Södersjukhuset Self-Harm Rule (SoS-4)* as applied to 1524 DSH patients according to different cut-off points.

Södersjukhuset Self-Harm Rule	Cut-off point 0.14			Cut-off point 0.33		
	Repeater	Nonrepeater	Total	Repeater	Nonrepeater	Total
Moderate/high risk	279	993	1272	51	79	130
Low risk	30	222	252	258	1136	1394
Total cases	309	1215	1524	309	1215	1524
Sensitivity	90%			17%		
Specificity	18%			93%		
Positive predictive values	22%			39%		
Negative predictive values	88%			81%		
Proportion repeater	20%			20%		

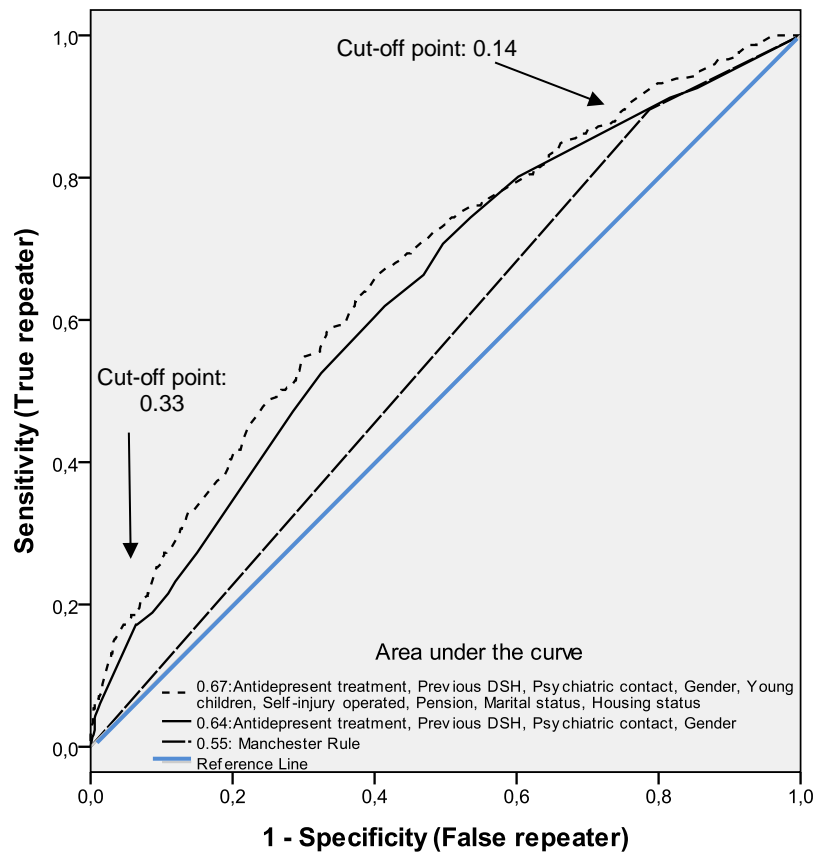
* The Södersjukhuset Self-Harm Rule includes the variables: gender, history of DSH, current psychiatric treatment (subgroup admitted to psychiatric clinic) and antidepressant treatment. Individuals with an estimated risk above the cut-off point are predicted to have a moderate/high risk of repetition.

Table 5 Manchester Self-Harm Rule (MSHR)* as applied to 1524 DSH patients.

Manchester Self-Harm Rule	Repeater	Nonrepeater	Total
Moderate/high risk	275	955	1230
Low risk	34	260	294
Total cases	309	1215	1524
Sensitivity	89%		
Specificity	21%		
Positive predictive values	22%		
Negative predictive values	88%		
Proportion repeater	20%		

* The Manchester Self-Harm Rule includes the variables: history of self-harm, previous psychiatric treatment, self-poisoning with benzodiazepines and current psychiatric treatment.

Figure 6 Evaluation of the ability to predict repeated deliberate self-harm (DSH) within six months in 1524 patients attending the emergency department due to DSH for different models. Results expressed by the ROC.



STUDY III

After exclusion criteria were met, i.e. not being > 18 years of age (n=2) and not having a valid personal identification number (n=1), the total study population consisted of 325 patients. Of these 325 patients, 222 were included at Södersjukhuset and 103 at Karolinska University Hospital Huddinge.

Regarding baseline data there were two statistical significant differences between the two hospitals: first admission to a psychiatric clinic after DSH; 31.5% of the DSH patients at Södersjukhuset were admitted to a psychiatric clinic after DSH compared to 43.7% of the DSH patients at Karolinska University Hospital Huddinge and, second, self-injury, was more common at Karolinska University Hospital Huddinge (14.6%) than at Södersjukhuset (6.8%).

The majority of the patients were admitted to a somatic clinic (72.1% of the patients at Södersjukhuset and 70.9% of those at Karolinska University Hospital Huddinge) but the length of stay in hospital was very short, the majority of the patients were only admitted for one day (200/233). The short length of stay (one day) was similar between the two hospitals.

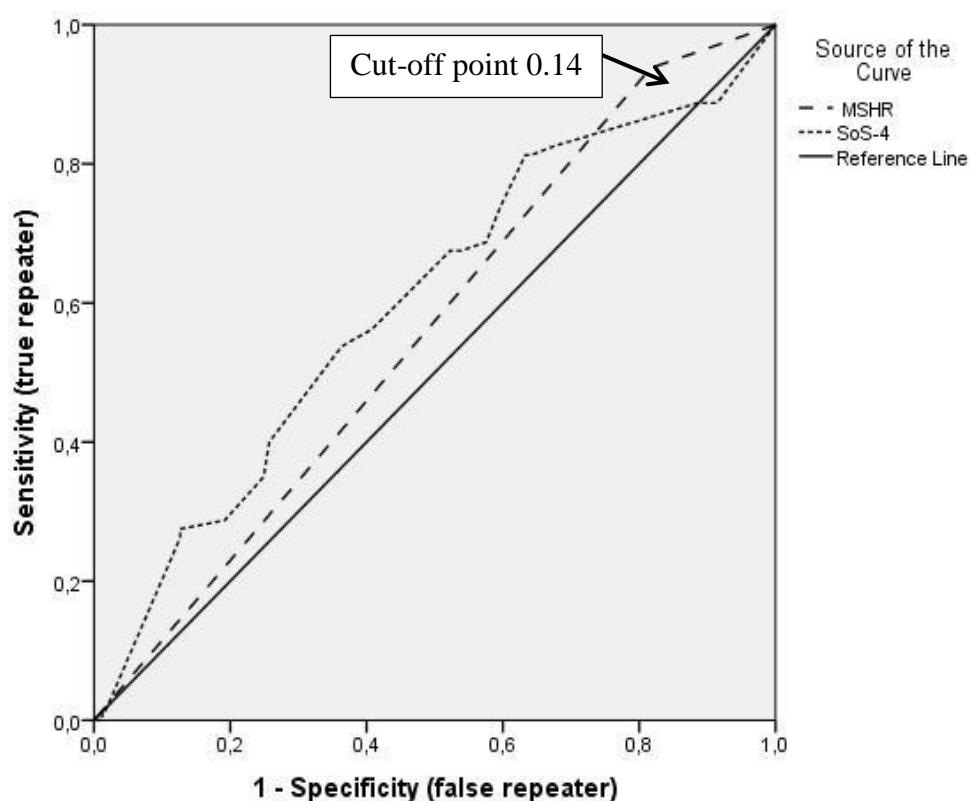
The cumulative incidence for patients repeating their deliberate self-harm acts within six months was 24.6% (95% CI: 19.9–29.3). Of the 80 patients who repeated within six months, 62.5% were women, the mean age was 28 years (18 to 94 years), and 24% were under 25 years of age. Among the men, 30% repeated their DSH acts compared to 22% among the women.

To evaluate the ability of the two models (SoS-4 and MSHR) to predict repetition the area under the ROC curve was used and AUC for the two models was compared. SoS-4 yielded an AUC of 0.60 (95% CI: 0.53–0.67). In comparison MSHR yielded an AUC of 0.56 (95% CI: 0.49–0.63). Both parameters are shown in Figure 7.

The ROC shows possible combinations of sensitivity and specificity for the estimated risk of repeated DSH at different cut-off points for the different models (Figure 7).

Application of the SoS-4 to this new prospective material yielded a sensitivity of 89% and a specificity of 12% when a cut-off point of 0.14 was chosen, while application of the MSHR yielded a sensitivity of 95% and a specificity of 18%.

Figure 7 Evaluation of the ability to predict repeated DSH. Results expressed by ROC.



STUDY IV

The study population consisted of 92 patients in the group with an early follow-up visit within 10 days and 233 patients in the group without an early follow-up visit within 10 days.

At the six months follow-up 22 of 92 patients (24%) with an early follow-up had repeated their DSH acts compared to 58 of 233 patients (25%) without an early follow-up (Table 6).

The unadjusted analysis showed no significant association between patients not receiving an early follow-up and repeated DSH within six months (OR 1.06 (95% CI: 0.60–1.85)). There were unadjusted associations between episode of DSH before index, previous psychiatric contact, having a psychiatric diagnosis, admission to psychiatric clinic after DSH and repetition. After adjustment for all factors, the association between patients not receiving an early follow-up and repeated DSH within six months became slightly stronger but still not statistically significant (OR 1.22 (95% CI: 0.62–2.38). After adjustment for factors that were statistically significant (either unadjusted or adjusted for all factors) the association between patients not receiving an early follow-up and repeated DSH was similar with OR 1.30 and OR 1.15.

Of the patients categorized as moderate/high risk patients according to SoS-4 31% (89/288) were seen at an early follow-up and of the patients categorized as low risk patients according to SoS-4 8% (3/37) were followed-up within 10 days.

Of the patients categorized as moderate/high risk patients according to MSHR 30% (82/275) were followed-up within 10 days and of the patients categorised as low risk patients according to MSHR 20% (10/50) were followed-up within 10 days.

In the group without an early follow-up 26 of the 233 patients (11%) were followed-up after more than 10 days. Among all patients, the mean time from the index DSH episode to follow-up was 7.6 days (95% CI 5.8–9.4).

Table 6 Follow-up within 10 days and repeated DSH within six months among 325 DSH patients in the ED.

	Follow-up within 10 days	No follow-up within 10 days	Total
Repeater	22 (24%)	58 (25%)	80
Nonrepeater	70 (76%)	175 (75%)	245
Total cases	92 (100%)	233 (100%)	325

DISCUSSION

This thesis, focusing on deliberate self-harm patients in the somatic emergency department, showed that there are factors associated with a higher risk of repeated DSH and that these risk factors can be used to stratify patients into different groups regarding moderate/high or low risk of repeating. This thesis also showed that the clinical decision rules SoS-4 and MSHR can be of use, in a clinical ED setting, to correctly identify patients at higher risk of repeated DSH and that there was an indication that DSH patients seen at an early follow-up visit within 10 days by a psychiatric consultant were less prone to repeat their DSH acts.

DELIBERATE SELF-HARM IN THE EMERGENCY DEPARTMENT

The repetition rate of DSH among patients attending an ED due to DSH has been reported to be as high as 25% but most commonly reported is a repetition rate of about 15%.^{49 101} The repetition rates in the studies were higher than commonly reported in previous studies which could be due to the national follow-up in which all new DSH episodes could be identified and not only repetition at the index episode hospital. Patients with history of DSH have a high risk of repeating their DSH acts and the study by Bergen et al showed an increasing risk with increasing DSH episodes.¹⁰² This might be another explanation to the higher repetition rate of DSH in Studies III and IV where a large number of the included patients had had episodes of DSH before the index episode. Patients who attend an ED due to DSH often repeated their DSH acts within a short period of time which also could be shown in Study I. In contrast to other studies, repeated DSH could be identified nationwide and it was demonstrated that the DSH patients (with an index episode at Södersjukhuset) had attended a large number of different hospitals with repeated episodes of DSH.

A history of DSH is the most frequently reported and clinical relevant predictor of suicide. Among DSH patients the risk of suicide is up to 100 times higher than in the general population. It has been estimated that about 10-15% of DSH patients eventually die by suicide and studies have shown that the risk of subsequent suicide is highest within the first year after an episode of DSH.¹⁰³ The study by Suominen et al., with a follow-up after DSH of 37 years, also showed that the risk remains high for a long period of time, even appearing to be an indicator of high risk for subsequent suicide throughout the whole adult lifetime.¹⁰⁴ In Study I about two percent of the included DSH patients committed suicide during the follow-up period of between one and four years which is in line with reviews of follow-up studies of one to five years (0.5–3%).⁴⁹ The finding of more men than women committing suicide and that the patients committing suicide were of older age is consistent from a global perspective.²

Higher female to male ratio among DSH patients and higher male to female ratio among patients committing suicide, referred to as the gender paradox of suicidal behaviour, showed to be consistent in the studies as well. There was a tendency of higher rate of repetition among men than among women in Studies III and IV which is in accordance with recent statistics from the Swedish National Board of Health and Welfare showing an increase in young men admitted to hospital due to DSH.¹⁴ Increase in admission to hospital due to DSH should be one alert of the importance and seriousness of DSH acts.

Risk factors shown in previous studies to be associated with repeated DSH, such as a history of DSH, female gender, psychiatric diagnoses of substance use disorder and adult personality disorder were also associated with repeated DSH in this Swedish population.⁶⁵

The association between self-injury requiring surgical procedure and repetition of DSH in Study I indicated a more severe DSH method and that the suicidal intention was high, which should alert clinical staff and other caretakers to make sure that this group of patients is provided with adequate resources, especially since previous studies have shown evidence of a strong association between severe DSH methods, higher suicide intent and subsequent suicide.¹⁰⁵⁻¹⁰⁷

The association between current antidepressant treatment and repeated DSH could indicate that these patients were at higher risk of repeating due to having a psychiatric disorder severe enough to be treated. It has been shown that the risk of suicidal behaviour among depressed patients treated with antidepressants is present during the first two weeks of treatment. If these patients had recently started their antidepressant treatment this might explain the association with repeated DSH as the patients often repeated within a short period of time.⁷⁹

When patients with young children attend an ED due to DSH other authorities are, owing to Swedish law, involved and other caretakers are quickly alerted, which is not the case with patients without young children and might explain the protective factor shown in our studies of having young children regarding risk of repeated DSH.

The risk stratification analysis indicated that within the group attending an ED due to DSH, there were patients with different risks of repetition and the stratification implied that in order to identify patients with high risk of DSH repetition, clinical staff should take special note of patients with a previous DSH episode who have a psychiatric contact or those without a psychiatric contact but with suicidal intention. Furthermore, among patients without a previous DSH episode, those with an adult personality disorder diagnosis and a psychiatric contact are at high risk of repeating.

PREDICTING REPEATED DELIBERATE SELF-HARM

Identifying patients at risk of subsequent suicidal behavior is of great importance to be able to provide adequate care to these patients. Due to the complex and multifactorial causes of suicidal behaviour, including both exposure to environmental stress and genetic and biological contribution, the prediction of repeated DSH is not an easy task. Also methodological difficulties contribute to the difficulty of predicting repeated DSH such as for example some factors being strongly associated with repeated DSH but not showing predictive capabilities due to low prevalence.

The Manchester Self-Harm Rule (MSHR) is a clinical decision rule developed and first validated in a UK population by Cooper et al.^{62 108} The MSHR uses four clinical correlates: history of self-harm, previous psychiatric treatment, benzodiazepine used as self-poisoning drug and current psychiatric treatment to predict repeated DSH within six months among patients attending an ED due to DSH. In Study II the MSHR was validated in a new setting and in a new population and correctly identified patients at higher risk of repeated DSH.

The clinical decision rule, Södersjukhuset Self-Harm Rule (SoS-4), was developed in Study II according to risk factors associated with repeated DSH within six months in a Swedish population. The clinical decision rule was developed to facilitate assessment in somatic EDs with or without psychiatric expertise. The SoS-4 uses 5 clinical correlates: gender, history of DSH, current psychiatric treatment, admitted to psychiatric clinic and antidepressant treatment to predict repeated DSH within six months among patients attending an ED due to DSH.

Compared to many other studies regarding factors associated with DSH and repetition, the analysis was taken one step further and evaluated the predictive capabilities of the factors associated with repetition.^{109 110} Although a factor is highly associated with repetition (has an OR significantly above or below 1), this is not equivalent to being a strong predictor of repetition. For example, although patients with a self-injury requiring a surgical procedure had five times higher odds of repeating DSH (Study II), this factor was not useful in predicting because the absolute number of patients in this group was small.

The prospective multicenter Study III showed that both the SoS-4 and the MSHR correctly identify patients with a higher risk of repeating their DSH acts within six months. The MSHR is easy to implement as all patients with any of the four clinical characteristics are defined as moderate/high risk patients. In comparison, the SoS-4 gives a more detailed estimated probability of repetition but require a calculation which can be easily carried out using a preprogrammed calculation sheet.

It is not without controversy to use clinical decision rules to identify patients at high risk of repetition and, for example, in the UK, the National Institute for Health and Clinical Excellence (NICE) guidelines do not recommend the use of risk assessment tools and scales to predict future suicide or repetition of self-harm.¹¹¹ Of course, the ideal would be to offer all DSH patients a psychological intervention that is specifically structured for people who self-harm, with the aim of reducing self-harm, but if that is not possible, due to a lack of availability or for other reasons, decision rules might be used as a preliminary guide for ED physicians to identify patients who are at higher risk of repetition and help prioritize for more urgent psychological intervention for these patients. Also the study by Cooper et al. showed that the clinical decision rule, MSHR, performed better than the global clinical assessment of ED clinicians and mental health specialists which would suggest improved accuracy of risk assessment when adding the use of a clinical decision rule.¹⁰⁸

REDUCING REPEATED DELIBERATE SELF-HARM

The high risk of subsequent suicide after DSH and also the high risk of repeating DSH indicate that patients treated due to DSH and especially those with characteristics indicating a higher risk should be targeted in prevention programs.¹¹²

Indicated preventive measures by simple contact-type interventions such as mailed postcards to DSH patients after discharge have in some studies been shown to influence the repetition rates of DSH.¹¹³⁻¹¹⁵ Also some studies investigating improved access to health care services, such as provision of emergency or crisis cards, have shown a decrease in repetition rates of DSH.^{116 117} There has though been proposed a need for further investigation of simple contact-type interventions to be able to show their effectiveness of reducing repeated DSH due to inconsistency of results.¹¹⁸

In Study IV it was investigated if an early follow-up (sort of simple contact-type intervention) could reduce the high repetition rate of DSH and it gave a slight indication of early followed-up patients being less inclined to repeat their DSH acts, although not with statistical significance. Previously known risk factors for repeated DSH were significantly associated with repetition within six months in this study as well and influenced the impact of the association between an early follow-up and repeated DSH.^{61 68}

It is of importance to provide adequate follow-up care to all DSH patients and especially those at high risk of repetition. Only 30% of patients at moderate/high risk of repeating their DSH acts, according to the clinical decision rules used in Study IV, received an early follow-up hence the majority of DSH patients with a higher risk of repeating their DSH actions did not receive an early follow-up at a psychiatric care unit. In all only about one fourth of the patients attending the ED due to DSH were seen at an early follow-up after the DSH episode. Previous studies have also shown that many DSH patients do not receive follow-up after a DSH episode.^{119 120}

Other studies have indicated the influence of problem solving therapy approaches and simple contact-type interventions on reducing repetition rates.^{90 121} It is also of importance to implement universal and selected preventive measures to prevent individuals from engaging in DSH since the repetition of DSH and also subsequent suicide is hard to fully prevent regardless of the strategies used.

Patients who deliberately harm themselves often report negative responses from staff in health services and especially in emergency departments which may be due to professionals' lack of understanding of DSH and may also be due to the lack of evidence base for treatments. Patients who deliberately harm themselves deserve the same standard care as those with other medical conditions such as myocardial infarction or acute asthma. Understanding and finding best ways of treating DSH patients is an essential part of effective suicide prevention.

LIMITATIONS

One limitation of the studies was that if data on the decision rule sheet or on the study protocol were missing it was not possible to investigate this further and in the statistical analysis missing data were classified as no. This would imply that the estimated risks might be underestimated.

One limitation of Studies I and II was that the patients were not prospectively assessed according to a study protocol. All information was obtained retrospectively from somatic and psychiatric hospital records. Some doctors wrote elaborate records while others were rather brief. To minimize the impact of heterogeneous information a strict protocol was used when extracting data from the medical and psychiatric records in order to achieve high data reliability. Omission of information played a more important role than incorrect information. If, for example, a psychiatric record stated that a patient had been sexually abused, he or she probably had been abused. If nothing about sexual abuse was found in the psychiatric records, the patient still might have been abused. There could have been an underestimation of the occurrence of risk factors based on information extracted from the medical and psychiatric records.

One limitation of Studies III and IV was the different strategies for identification of DSH patients at the two hospitals in cases where the ED physician who treated the patient had not filled in the form. To ensure inclusion of all DSH patients at the Karolinska University Hospital all referrals from the somatic clinic to the psychiatric clinic were examined and at Södersjukhuset all emergency records were examined which might have influenced the identification of DSH patients at the two different hospitals.

When developing the clinical decision rule SoS-4 some factors were strongly associated with repeated DSH such as for example self-injury requiring a surgical procedure but did not show good predictive ability due to the small number of patients in this group. The individual risk of the patients with self-injuries requiring a surgical procedure is of course high but not useful to predict repetition among a large group of DSH patients.

IMPLICATIONS FOR FUTURE RESEARCH

DSH is poorly understood in society and even among those who in their working lives encounter people who harm themselves such as nurses and doctors.¹²² People who harm themselves are subject to stigma and hostility. A positive effect of contact based interventions on staff attitudes and DSH patients, as well as reduced repetition rate, has been demonstrated.^{123 124} Further studies should include an evaluation of changes in staff attitudes towards DSH patients and DSH patient's opinions regarding follow-up care in addition to the outcome of repeated DSH.

Due to DSH patients often repeating their DSH acts within a short period of time, further studies on early intervention and its effect on repeated DSH is necessary in order to find ways of reducing the high repetition rates.

The clinical decision rule SoS-4 has not yet been evaluated in another setting than large university hospitals in Stockholm, Sweden. Further prospective studies are therefore needed to validate the rule in new settings and other populations.

There is evidence supporting the role of behavioural therapy in preventing suicidal behaviour in specific subgroups although its effect in a heterogeneous DSH population remains to be investigated. It is also of importance to implement and evaluate universal and selected prevention strategies to prevent individuals from engaging in DSH at all as the repetition of DSH as well as subsequent suicide is hard to fully prevent regardless of the strategies used.

CONCLUSION

Patients who harm themselves are often seen in somatic emergency departments and it is important for all healthcare personnel, and especially for ED physicians, to better understand how these patients should be assessed and treated.

- The risk of repetition is high among some DSH patients while it is lower among others in the heterogeneous group of patients seeking acute somatic care due to DSH. There are risk factors associated with repeated DSH, which means that DSH patients can be stratified according to different risks of repetition.
- The clinical decision rules, SoS-4 and MSHR, can identify, with high sensitivity, patients who will repeat their deliberate self-harm acts. Application of either of these rules can facilitate assessment in the ED and help focus right resources on patients at higher risk. All in all, it is difficult to predict repetition among DSH patients but previous deliberate self-harm and current psychiatric treatment are two important predictors.
- The group of DSH patients is heterogeneous and adequate strategies for reducing the high risk of repeated DSH are not easily applicable to different populations. There is an indication of early followed-up patients being less inclined to repeat their DSH acts after adjusting for well known risk factors associated with repeated DSH.

SAMMANFATTNING

Vi som arbetar på de somatiska sjukhusens akutmottagningar slås ofta av det stora antalet patienter som behöver vård till följd av avsiktliga självdestruktiva handlingar (självskador) och av att många av dessa patienter återkommer vid upprepade tillfällen till följd av nya självskador. Viljan att leva är grundläggande för alla människor och att någon skadar sig själv måste tas på allvar och vara en varning att en individ inte klarar av en viss situation eller period i livet.

Omkring tio miljoner människors skadar sig själva och en miljon människor begår självmord varje år över hela världen. Självskador är en betydande orsak till enskilda lidanden och är även en belastning för hälso- och sjukvården. Att ha skadat sig själv är den starkaste riskfaktorn för självmord, patienter som skadat sig själva har upp mot hundra gånger så hög risk att ta livet av sig jämfört med individer som inte har skadat sig själva. Mellan 15–25 % av patienterna som kommer till en akutmottagning på grund av en självskada, skadar sig själva igen och risken för en ny självskada är högst inom det första halvåret till året efter en självskada.

Syftet med denna avhandling var att studera vilka riskfaktorer det finns som kan kopplas till att återkomma med ny självskada, att utveckla och pröva ett verktyg för att kunna hitta patienter med högre risk för att återkomma med ny självskada och att undersöka om en tidig uppföljning med ett återbesök inom 10 dagar skulle kunna minska den höga andel patienter som återkommer med nya självskador.

Studie I: Under tre år sökte 1524 patienter Södersjukhusets akutmottagning till följd av självskada och kunde inkluderas i studien. Tidigare och nya självskador hos dessa patienter kunde upptäckas genom tillgång till nationella register. De riskfaktorer som kunde kopplas till att återkomma med ny självskada var följande: att ha skadat sig själv tidigare, kvinnligt kön, att skära sig och att skära sig så allvarligt att det krävdes en kirurgisk operation, att ha en pågående psykiatrisk eller antidepressiv behandling, att ha en beroendediagnos eller en personlighetsstörnings diagnos och att inte vara förälder till små barn. Patienterna kunde grupperas efter deras risk för ny självskada och det fanns grupper med låg risk (18 %) för ny självskada och hög risk (47-72%) för ny självskada.

Studie II: De riskfaktorer som var kopplade till att återkomma med ny självskada i Studie I användes i denna studie för att ta fram ett verktyg för att kunna identifiera patienter med högre risk att återkomma med ny självskada, Södersjukhuset Self-Harm Rule (SoS-4). Ett verktyg, från England, som också tagits fram för bedömning av risken för att återkomma med ny självskada, Manchester Self-Harm Rule (MSHR) utvärderades också i denna studie. När MSHR utvärderades på de 1524 patienterna i Studie I visade det en sensitivitet på 89 % och en specificitet på 21 %. Det nya verktyget, SoS-4, visade en sensitivitet på 90 % och en specificitet på 18 %.

Studie III: För att kunna utvärdera SoS-4 och MSHR förmågor att hitta patienter med högre risk att återkomma med ny självskada undersöktes 325 nya patienter som sökt Södersjukhusets och Karolinska Universitetssjukhuset Huddinges akutmottagningar till följd av självskada. Patienterna följdes under sex månader och genom tillgång till nationella register kunde nya självskador upptäckas. När SoS-4 utvärderades på denna nya grupp av patienter visade det en sensitivitet på 89 % och en specificitet på 12 % och motsvarande visade MSHR en sensitivitet på 95 % och en specificitet på 18 %.

Studie IV: Uppföljning av självskadepatienter och dess inverkan på att återkomma med ny självskada studerades i samma population som Studie III. Återbesök till en psykiatrisk klinik inom 10 dagar registrerades som ett tidigt återbesök. När hänsyn togs till kända riskfaktorer för att återkomma med ny självskada så uppvisade patienterna som erhöll ett tidigt återbesök en viss benägenhet att återkomma i mindre utsträckning. Studien visade också att en stor andel av patienter som skadar sig själva inte följs upp överhuvudtaget, inte ens de patienterna med högre risk att återkomma med ny självskada.

Slutsatser: Denna avhandling visade att det finns riskfaktorer som är kopplade till att återkomma med ny självskada och att dessa riskfaktorer kan användas för att hitta patienter med högre risk för att återkomma med nya självskador. Risken för att återkomma med ny självskada är högre hos vissa patienter och lägre hos andra. De båda kliniska verktygen MSHR och SoS-4 kan vara användbara, tillsammans med en klinisk bedömning av självskadepatienter, för att hitta patienter med högre risk att återkomma med ny självskada. Båda verktygen fokuserar på hög sensitivitet då det är av större vikt att hitta patienter med högre risk att återkomma än att korrekt avfärda de med lägre risk. Det är svårt att förutse vilka patienter som kommer att återkomma med ny självskada men att ha skadat sig själv tidigare och att ha en pågående psykiatrisk kontakt är två viktiga indikatorer på att risken är högre. Gruppen av patienter som skadar sig själva är heterogen och adekvat uppföljning är inte lätt att applicera på olika populationer. Det fanns en benägenhet hos patienter som erhållit ett tidigt återbesök att i mindre utsträckning återkomma med ny självskada när hänsyn togs till tidigare kända riskfaktorer kopplade till att återkomma med ny självskada.

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